Title: Encyclopaedia Britannica, 11th Edition, "Logarithm" to "Lord Advocate"

Author: Various

Release date: March 15, 2013 [EBook #42342]

Language: English

Credits: Produced by Marius Masi, Don Kretz and the Online
Distributed Proofreading Team at http://www.pgdp.net

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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME XVI SLICE VIII

Logarithm to Lord Advocate

Articles in This Slice

LOGARITHM

(from Gr. λόγος, word, ratio, and ἀριθμός, number), in mathematics, a word invented by John Napier to denote a particular class of function discovered by him, and which may be defined as follows: if a, x, m are any three quantities satisfying the equation $a^x = m$, then a is called the base, and x is said to be the logarithm of m to the base a. This relation between x, a, m, may be expressed also by the equation $x = \log_a m$.

Properties.—The principal properties of logarithms are given by the equations

$$\log_a (mn) = \log_a m + \log_a n, \quad \log_a (m/n) = \log_a m - \log_a n,$$
$$\log_a m^r = r \log_a m, \quad \log_a \sqrt[r]{m} = (1/r) \log_a m,$$

which may be readily deduced from the definition of a logarithm. It follows from these equations that the logarithm of the product of any number of quantities is equal to the sum of the logarithms of the quantities, that the logarithm of the quotient of two quantities is equal to the logarithm of the numerator diminished by the logarithm of the denominator, that the logarithm of the rth power of a quantity is equal to r times the logarithm of the quantity, and that the logarithm of the rth root of a quantity is equal to (1/r)th of the logarithm of the quantity.

Logarithms were originally invented for the sake of abbreviating arithmetical calculations, as by their means the operations of multiplication and division may be replaced by those of addition and subtraction, and the operations of raising to powers and extraction of roots by those of multiplication and division. For the purpose of thus simplifying the operations of arithmetic, the base is taken to be 10, and use is made of tables of logarithms in which the values of x, the logarithm, corresponding to values of m, the number, are tabulated. The logarithm is also a function of frequent occurrence in analysis, being regarded as a known and recognized function like sin x or tan x; but in mathematical investigations the base generally employed is not 10, but a certain quantity usually denoted by the letter e, of value 2.71828 18284....

Thus in arithmetical calculations if the base is not expressed it is understood to be 10, so that log m denotes $\log_{10} m$; but in analytical formulae it is understood to be e.

The logarithms to base 10 of the first twelve numbers to 7 places of decimals are

log 1 = 0.0000000	log 5 = 0.6989700	log 9 = 0.9542425
log 2 = 0.3010300	log 6 = 0.7781513	log 10 = 1.0000000
log 3 = 0.4771213	log 7 = 0.8450980	log 11 = 1.0413927
log 4 = 0.6020600	log 8 = 0.9030900	log 12 = 1.0791812

The meaning of these results is that

$$1 = 10^0, \quad 2 = 10^{0.3010300}, \quad 3 = 10^{0.4771213}, \ldots$$
$$10 = 10^1, \quad 11 = 10^{1.0413927}, \quad 12 = 10^{1.0791812}.$$

The integral part of a logarithm is called the index or characteristic, and the fractional part the mantissa. When the base is 10, the logarithms of all numbers in which the digits are the same, no matter where the decimal point may be, have the same mantissa; thus, for example,

$$\log 2.5613 = 0.4084604, \quad \log 25.613 = 1.4084604, \quad \log 2561300 = 6.4084604, \text{ \&c.}$$

In the case of fractional numbers (*i.e.* numbers in which the integral part is 0) the mantissa is still kept positive, so that, for example,

$$\log .25613 = \overline{1}.4084604, \quad \log .0025613 = \overline{3}.4084604, \text{ \&c.}$$

the minus sign being usually written over the characteristic, and not before it, to indicate that the characteristic only, and not the whole expression, is negative; thus

$\overline{1}.4084604$ stands for $-1 + .4084604$.

The fact that when the base is 10 the mantissa of the logarithm is independent of the position of the decimal point in the number affords the chief reason for the choice of 10 as base. The explanation of this property of the base 10 is evident, for a change in the position of the decimal points amounts to multiplication or division by some power of 10, and this corresponds to the addition or subtraction of some integer in the case of the logarithm, the mantissa therefore remaining intact. It should be mentioned that in most tables of trigonometrical functions, the number 10 is added to all the logarithms in the table in order to avoid the use of negative characteristics, so that the characteristic 9 denotes in reality $\overline{1}$, 8 denotes $\overline{2}$, 10 denotes 0, &c. Logarithms thus increased are frequently referred to for the sake of distinction as *tabular logarithms*, so that the tabular logarithm = the true logarithm + 10.

In tables of logarithms of numbers to base 10 the mantissa only is in general tabulated, as the characteristic of the logarithm of a number can always be written down at sight, the rule being that, if the number is greater than unity, the characteristic is less by unity than the number of digits in the integral portion of it, and that if the number is less than unity the characteristic is negative, and is greater by unity than the number of ciphers between the decimal point and the first significant figure.

It follows very simply from the definition of a logarithm that

$$\log_a b \times \log_b a = 1, \quad \log_b m = \log_a m \times (1/\log_a b).$$

The second of these relations is an important one, as it shows that from a table of logarithms to base a, the corresponding table of logarithms to base b may be deduced by multiplying all the logarithms in the former by the constant multiplier $1/\log_a b$, which is called the *modulus* of the system whose base is b with respect to the system whose base is a.

The two systems of logarithms for which extensive tables have been calculated are the Napierian, or hyperbolic, or natural system, of which the base is e, and the Briggian, or decimal, or common system, of which the base is 10; and we see that the logarithms in the latter system may be deduced from those in the former by multiplication by the constant multiplier $1/\log_e 10$, which is called the modulus of the common system of logarithms. The numerical value of this modulus is 0.43429 44819 03251 82765 11289 ..., and the value of its reciprocal, $\log^e 10$ (by multiplication by which Briggian logarithms may be converted into Napierian logarithms) is 2.30258 50929 94045 68401 79914 ....

The quantity denoted by e is the series,

$$1 + \frac{1}{1} + \frac{1}{1\cdot2} + \frac{1}{1\cdot2\cdot3} + \frac{1}{1\cdot2\cdot3\cdot4} + \ldots$$

the numerical value of which is,

2.71828 18284 59045 23536 02874 ....

The logarithmic Function.—The mathematical function log x or $\log_e x$ is one of the small group of transcendental functions, consisting only of the circular functions (direct and inverse) sin x, cos x, &c., arc sin x or $\sin^{-1} x$,&c., log x and e^x which are universally treated in analysis as known functions. The notation log x is generally employed in English and American works, but on the continent of Europe writers usually denote the function by lx or lg x. The logarithmic function is most naturally introduced into analysis by the equation

$$\log x = \int_1^x \frac{dt}{t}, \ (x > 0).$$

This equation defines log x for positive values of x; if $x \leq 0$ the formula ceases to have any meaning. Thus log x is the integral function of 1/x, and it can be shown that log x is a genuinely new transcendent, not expressible in finite terms by means of functions such as algebraical or circular functions. A connexion with the circular functions, however, appears later when the definition of log x is extended to complex values of x.

A relation which is of historical interest connects the logarithmic function with the quadrature of the hyperbola, for, by considering the equation of the hyperbola in the form xy = const., it is evident that the area included between the arc of a hyperbola, its nearest asymptote, and two ordinates drawn parallel to the other asymptote from points on the first asymptote distant a and b from their point of intersection, is proportional to log b/a.

The following fundamental properties of log x are readily deducible from the definition

(i.) $\log xy = \log x + \log y$.

(ii.) Limit of $(x^h - 1)/h = \log x$, when h is indefinitely diminished.

Either of these properties might be taken as itself the definition of log x.

There is no series for log x proceeding either by ascending or descending powers of x, but there is an expansion for log (1 + x), viz.

$$\log (1 + x) = x - \tfrac{1}{2} x^2 + \tfrac{1}{3} x^3 - \tfrac{1}{4} x^4 + \ldots;$$

the series, however, is convergent for real values of x only when x lies between +1 and −1. Other formulae which are deducible from this equation are given in the portion of this article relating to the calculation of logarithms.

The function log x as x increases from 0 towards ∞ steadily increases from −∞ towards +∞. It has the important property that it tends to infinity with x, but more slowly than any power of x, *i.e.* that $x^{-m} \log x$ tends to zero as x tends to ∞ for every positive value of m however small.

The *exponential function*, exp x, may be defined as the inverse of the logarithm: thus x = exp y if y = log x. It is positive for all values of y and increases steadily from 0 toward ∞ as y increases from -∞ towards +∞. As y tends

towards ∞, exp y tends towards ∞ more rapidly than any power of y.

The exponential function possesses the properties

(i.) $\exp(x + y) = \exp x \times \exp y$.
(ii.) $(d/dx) \exp x = \exp x$.
(iii.) $\exp x = 1 + x + x^2/2! + x^3/3! + \ldots$

From (i.) and (ii.) it may be deduced that

$$\exp x = (1 + 1 + 1/2! + 1/3! + \ldots)^x,$$

where the right-hand side denotes the positive xth power of the number $1 + 1 + 1/2! + 1/3! + \ldots$ usually denoted by e. It is customary, therefore, to denote the exponential function by e^x and the result

$$e^x = 1 + x + x^2/2! + x^3/3! \ldots$$

is known as the *exponential theorem*.

The definitions of the logarithmic and exponential functions may be extended to complex values of x. Thus if $x = \xi + i\eta$

$$\log x = \int_1^x \frac{dt}{t}$$

where the path of integration in the plane of the complex variable t is any curve which does not pass through the origin; but now log x is not a uniform function, that is to say, if x describes a closed curve it does not follow that log x also describes a closed curve: in fact we have

$$\log(\xi + i\eta) = \log \sqrt{(\xi^2 + \eta^2)} + i(\alpha + 2n\pi),$$

where α is the numerically least angle whose cosine and sine are $\xi/\sqrt{(\xi^2 + \eta^2)}$ and $\eta/\sqrt{(\xi^2 + \eta^2)}$, and n denotes any integer. Thus even when the argument is real log x has an infinite number of values; for putting $\eta = 0$ and taking ξ positive, in which case $\alpha = 0$, we obtain for log ξ the infinite system of values $\log \xi + 2n\pi i$. It follows from this property of the function that we cannot have for log x a series which shall be convergent for all values of x, as is the case with sin x and cos x, for such a series could only represent a uniform function, and in fact the equation

$$\log(1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \ldots$$

is true only when the analytical modulus of x is less than unity. The exponential function, which may still be defined as the inverse of the logarithmic function, is, on the other hand, a uniform function of x, and its fundamental properties may be stated in the same form as for real values of x. Also

$$\exp(\xi - i\eta) = e^{\xi}(\cos\eta + i \sin\eta).$$

An alternative method of developing the theory of the exponential function is to start from the definition

$$\exp x = 1 + x + x^2/2! + x^3/3! + \ldots,$$

the series on the right-hand being convergent for all values of x and therefore defining an analytical function of x which is uniform and regular all over the plane.

Invention and Early History of Logarithms.—The invention of logarithms has been accorded to John Napier, baron of Merchiston in Scotland, with a unanimity which is rare with regard to important scientific discoveries: in fact, with the exception of the tables of Justus Byrgius, which will be referred to further on, there seems to have been no other mathematician of the time whose mind had conceived the principle on which logarithms depend, and no partial anticipations of the discovery are met with in previous writers.

The first announcement of the invention was made in Napier's *Mirifici Logarithmorum Canonis Descriptio ...* (Edinburgh, 1614). The work is a small quarto containing fifty-seven pages of explanatory matter and a table of ninety pages (see Napier, John). The nature of logarithms is explained by reference to the motion of points in a straight line, and the principle upon which they are based is that of the correspondence of a geometrical and an arithmetical series of numbers. The table gives the logarithms of sines for every minute of seven figures; it is arranged semi-quadrantally, so that the *differentiae*, which are the differences of the two logarithms in the same line, are the logarithms of the tangents. Napier's logarithms are not the logarithms now termed Napierian or hyperbolic, that is to say, logarithms to the base *e* where *e* = 2.7182818...; the relation between N (a sine) and L its logarithm, as defined in the *Canonis Descriptio*, being $N = 10^7 e^{-L/(10^7)}$, so that (ignoring the factors 10^7, the effect of which is to render sines and logarithms integral to 7 figures), the base is e^{-1}. Napier's logarithms decrease as the sines increase. If l denotes the logarithm to base e (that is, the so-called "Napierian" or hyperbolic logarithm) and L denotes, as above, "Napier's" logarithm, the connexion between *l* and L is expressed by

$$L = 10^7 \log_e 10^7 - 10^7 l \text{ or } e^l = 10^7 e^{-L/(10^7)}$$

Napier's work (which will henceforth in this article be referred to as the *Descriptio*) immediately on its appearance in 1614 attracted the attention of perhaps the two most eminent English mathematicians then living—Edward Wright and Henry Briggs. The former translated the work into English; the latter was concerned with Napier in the change of the logarithms from those originally invented to decimal or common logarithms, and it is to him that the original calculation of the logarithmic tables now in use is mainly due. Both Napier and Wright died soon after the publication of the *Descriptio*, the date of Wright's death being 1615 and that of Napier 1617, but Briggs lived until 1631. Edward Wright, who was a fellow of Caius College, Cambridge, occupies a conspicuous place in the history of navigation. In 1599 he published *Certaine errors in Navigation detected and corrected*, and he was the author of other works; to him also is chiefly due the invention of the method known as Mercator's sailing. He at once saw the value of logarithms as an aid to navigation, and lost no time in preparing a translation, which he submitted to Napier himself. The preface to Wright's edition consists of a translation of the preface to the *Descriptio*, together with the addition of the following sentences written by Napier himself: "But now some of our countreymen in this Island well affected to these studies, and the more publique good, procured a most learned Mathematician to translate the same into our vulgar English tongue, who after he had finished it, sent the Coppy of it to me, to bee seene and considered on by myselfe. I having most willingly and gladly done the same, finde it to bee most exact and precisely conformable to my minde and the originall. Therefore it may please you who are inclined to these studies, to receive it from me and the Translator, with as much good will as we recommend it unto you." There is a short "preface to the reader" by Briggs, and a description of a triangular diagram invented by Wright for finding the proportional parts. The table is printed to one figure less than in the *Descriptio*. Edward Wright died, as has been mentioned, in 1615, and his son, Samuel Wright, in the

preface states that his father “gave much commendation of this work (and often in my hearing) as of very great use to mariners”; and with respect to the translation he says that “shortly after he had it returned out of Scotland, it pleased God to call him away afore he could publish it.” The translation was published in 1616. It was also reissued with a new title-page in 1618.

Henry Briggs, then professor of geometry at Gresham College, London, and afterwards Savilian professor of geometry at Oxford, welcomed the *Descriptio* with enthusiasm. In a letter to Archbishop Usher, dated Gresham House, March 10, 1615, he wrote, “Napper, lord of Markinston, hath set my head and hands a work with his new and admirable logarithms. I hope to see him this summer, if it please God, for I never saw book which pleased me better, or made me more wonder.[1] I purpose to discourse with him concerning eclipses, for what is there which we may not hope for at his hands,” and he also states “that he was wholly taken up and employed about the noble invention of logarithms lately discovered.” Briggs accordingly visited Napier in 1615, and stayed with him a whole month.[2] He brought with him some calculations he had made, and suggested to Napier the advantages that would result from the choice of 10 as a base, an improvement which he had explained in his lectures at Gresham College, and on which he had written to Napier. Napier said that he had already thought of the change, and pointed out a further improvement, viz., that the characteristics of numbers greater than unity should be positive and not negative, as suggested by Briggs. In 1616 Briggs again visited Napier and showed him the work he had accomplished, and, he says, he would gladly have paid him a third visit in 1617 had Napier’s life been spared.

Briggs’s *Logarithmorum chilias prima*, which contains the first published table of decimal or common logarithms, is only a small octavo tract of sixteen pages, and gives the logarithms of numbers from unity to 1000 to 14 places of decimals. It was published, probably privately, in 1617, after Napier’s death,[3] and there is no author’s name, place or date. The date of publication is, however, fixed as 1617 by a letter from Sir Henry Bourchier to Usher, dated December 6, 1617, containing the passage—“Our kind friend, Mr Briggs, hath lately published a supplement to the most excellent tables of logarithms, which I presume he has sent to you.” Briggs’s tract of 1617 is extremely rare, and has generally been ignored or incorrectly described. Hutton erroneously states that it contains the logarithms to 8 places, and his account has been followed by most writers. There is a copy in the British Museum.

Briggs continued to labour assiduously at the calculation of logarithms, and in 1624 published his *Arithmetica logarithmica*, a folio work containing the logarithms of the numbers from l to 20,000, and from 90,000 to 100,000 (and in some copies to 101,000) to 14 places of decimals. The table occupies 300 pages, and there is an introduction of 88 pages relating to the mode of calculation, and the applications of logarithms.

There was thus left a gap between 20,000 and 90,000, which was filled up by Adrian Vlacq (or Ulaccus), who published at Gouda, in Holland, in 1628, a table containing the logarithms of the numbers from unity to 100,000 to 10 places of decimals. Having calculated 70,000 logarithms and copied only 30,000, Vlacq would have been quite entitled to have called his a new work. He designates it, however, only a second edition of Briggs’s *Arithmetica logarithmica*, the title running *Arithmetica logarithmica sive Logarithmorum Chiliades centum, ... editio secunda aucta per Adrianum Vlacq, Goudanum*. This table of Vlacq’s was published, with an English explanation prefixed, at London in 1631 under the title *Logarithmicall Arithmetike ... London, printed by George Miller*, 1631. There are also copies with the title-page and introduction in French and in Dutch (Gouda, 1628).

Briggs had himself been engaged in filling up the gap, and in a letter to John Pell, written after the publication of Vlacq’s work, and dated October 25, 1628, he says:—

> “My desire was to have those chiliades that are wantinge betwixt 20 and 90 calculated and printed, and I had done them all almost by my selfe, and by some frendes whom my rules had sufficiently informed, and by agreement the busines was conveniently parted amongst us; but I am eased of that charge and care by one Adrian Vlacque, an Hollander, who hathe done all the whole hundred chiliades and printed them in Latin, Dutche and Frenche, 1000 bookes in these 3 languages, and hathe sould them almost all. But he hathe cutt off 4 of my figures throughout; and hathe left out my dedication, and to the reader, and two chapters the 12 and 13, in the rest he hath not varied from me at all.”

The original calculation of the logarithms of numbers from unity to 101,000 was thus performed by Briggs and Vlacq between 1615 and 1628. Vlacq’s table is that from which all the hundreds of tables of logarithms that have subsequently appeared have been derived. It contains of course many errors, which were gradually discovered and corrected in the course of the next two hundred and fifty years.

The first calculation or publication of Briggian or common logarithms of trigonometrical functions was made in 1620 by Edmund Gunter, who was Briggs’s colleague as professor of astronomy in Gresham College. The title of Gunter’s book, which is very scarce, is *Canon triangulorum*, and it contains logarithmic sines and tangents for every minute of the quadrant to 7 places of decimals.

The next publication was due to Vlacq, who appended to his logarithms of numbers in the *Arithmetica logarithmica* of 1628 a table giving log sines, tangents and secants for every minute of the quadrant to 10 places; these were obtained by calculating the logarithms of the natural sines, &c. given in the *Thesaurus mathematicus* of Pitiscus (1613).

During the last years of his life Briggs devoted himself to the calculation of logarithmic sines, &c. and at the time of his death in 1631 he had all but completed a logarithmic canon to every hundredth of a degree. This work was published by Vlacq at his own expense at Gouda in 1633, under the title *Trigonometria Britannica*. It contains log sines (to 14 places) and tangents (to 10 places), besides natural sines, tangents and secants, at intervals of a hundredth of a degree. In the same year Vlacq published at Gouda his *Trigonometria artificialis*, giving log sines and tangents to every 10 seconds of the quadrant to 10 places. This work also contains the logarithms of numbers from unity to 20,000 taken from the *Arithmetica logarithmica* of 1628. Briggs appreciated clearly the advantages of a centesimal division of the quadrant, and by dividing the degree into hundredth parts instead of into minutes, made a step towards a reformation in this respect, and but for the appearance of Vlacq’s work the decimal division of the degree might have become recognized, as is now the case with the corresponding division of the second. The calculation of the logarithms not only of numbers but also of the trigonometrical functions is therefore due to Briggs and Vlacq; and the results contained in their four fundamental works—*Arithmetica logarithmica* (Briggs), 1624; *Arithmetica logarithmica* (Vlacq), 1628; *Trigonometria Britannica* (Briggs), 1633; *Trigonometria artificialis* (Vlacq), 1633—have not been superseded by any subsequent calculations.

In the preceding paragraphs an account has been given of the actual announcement of the invention of logarithms and of the calculation of the tables. It now remains to refer in more detail to the invention itself and to examine the claims of Napier and Briggs to the capital improvement involved in the change from Napier’s original logarithms to logarithms to the base 10.

The *Descriptio* contained only an explanation of the use of the logarithms without any account of the manner in which the canon was constructed. In an "Admonitio" on the seventh page Napier states that, although in that place the mode of construction should be explained, he proceeds at once to the use of the logarithms, "ut praelibatis prius usu, et rei utilitate, caetera aut magis placeant posthac edenda, aut minus saltem displiceant silentio sepulta." He awaits therefore the judgment and censure of the learned "priusquam caetera in lucem temerè prolata lividorum detrectationi exponantur"; and in an "Admonitio" on the last page of the book he states that he will publish the mode of construction of the canon "si huius inventi usum eruditis gratum fore intellexero." Napier, however, did not live to keep this promise. In 1617 he published a small work entitled *Rabdologia* relating to mechanical methods of performing multiplications and divisions, and in the same year he died.

The proposed work was published in 1619 by Robert Napier, his second son by his second marriage, under the title *Mirifici logarithmorum canonis constructio*.... It consists of two pages of preface followed by sixty-seven pages of text. In the preface Robert Napier says that he has been assured from undoubted authority that the new invention is much thought of by the ablest mathematicians, and that nothing would delight them more than the publication of the mode of construction of the canon. He therefore issues the work to satisfy their desires, although, he states, it is manifest that it would have seen the light in a far more perfect state if his father could have put the finishing touches to it; and he mentions that, in the opinion of the best judges, his father possessed, among other most excellent gifts, in the highest degree the power of explaining the most difficult matters by a certain and easy method in the fewest possible words.

It is important to notice that in the *Constructio* logarithms are called artificial numbers; and Robert Napier states that the work was composed several years (*aliquot annos*) before Napier had invented the name logarithm. The *Constructio* therefore may have been written a good many years previous to the publication of the *Descriptio* in 1614.

Passing now to the invention of common or decimal logarithms, that is, to the transition from the logarithms originally invented by Napier to logarithms to the base 10, the first allusion to a change of system occurs in the "Admonitio" on the last page of the *Descriptio* (1614), the concluding paragraph of which is "Verùm si huius inventi usum eruditis gratum fore intellexero, dabo fortasse brevi (Deo aspirante) rationem ac methodum aut hunc canonem emendandi, aut emendatiorem de novo condendi, ut ita plurium Logistarum diligentia, limatior tandem et accuratior, quàm unius opera fieri potuit, in lucem prodeat. Nihil in ortu perfectum." In some copies, however, this "Admonitio" is absent. In Wright's translation of 1616 Napier has added the sentence—"But because the addition and subtraction of these former numbers may seeme somewhat painfull, I intend (if it shall please God) in a second Edition, to set out such Logarithmes as shall make those numbers above written to fall upon decimal numbers, such as 100,000,000, 200,000,000, 300,000,000, &c., which are easie to be added or abated to or from any other number" (p. 19); and in the dedication of the *Rabdologia* (1617) he wrote "Quorum quidem Logarithmorum speciem aliam multò praestantiorem nunc etiam invenimus, & creandi methodum, unà cum eorum usu (si Deus longiorem vitae & valetudinis usuram concesserit) evulgare statuimus; ipsam autem novi canonis supputationem, ob infirmam corporis nostri valetudinem, viris in hoc studii genere versatis relinquimus: imprimis verò doctissimo viro D. Henrico Briggio Londini publico Geometriae Professori, et amico mihi longè charissimo."

Briggs in the short preface to his *Logarithmorum chilias* (1617) states that the reason why his logarithms are different from those introduced by Napier "sperandum, ejus librum posthumum, abunde nobis propediem satisfacturum." The "liber posthumus" was the *Constructio* (1619), in the preface to which Robert Napier states that he has added an appendix relating to another and more excellent species of logarithms, referred to by the inventor himself in the *Rabdologia*, and in which the logarithm of unity is 0. He also mentions that he has published some remarks upon the propositions in spherical trigonometry and upon the new species of logarithms by Henry Briggs, "qui novi hujus Canonis supputandi laborem gravissimum, pro singulari amicitiâ quae illi cum Patre meo L. M. intercessit, animo libentissimo in se suscepit; creandi methodo, et usuum explanatione Inventori relictis. Nunc autem ipso ex hâc vitâ evocato, totius negotii onus doctissimi Briggii humeris incumbere, et Sparta haec ornanda illi sorte quadam obtigisse videtur."

In the address prefixed to the *Arithmetica logarithmica* (1625) Briggs bids the reader not to be surprised that these logarithms are different from those published in the *Descriptio*:—

> "Ego enim, cum meis auditoribus Londini, publice in Collegio Greshamensi horum doctrinam explicarem; animadverti multo futurum commodius, si Logarithmus sinus totius servaretur 0 (ut in Canone mirifico), Logarithmus autem partis decimae ejusdem sinus totius, nempe sinus 5 graduum, 44, m. 21, s., esset 10000000000. atque ea de re scripsi statim ad ipsum authorem, et quamprimum per anni tempus, et vacationem a publico docendi munere licuit, profectus sum Edinburgum; ubi humanissime ab eo acceptus haesi per integrum mensem. Cum autem inter nos de horum mutatione sermo haberetur; ille se idem dudum sensisse, et cupivisse dicebat: veruntamen istos, quos jam paraverat edendos curasse, donec alios, si per negotia et valetudinem liceret, magis commodos confecisset. Istam autem mutationem ita faciendam censebat, ut 0 esset Logarithmus unitatis, et 10000000000 sinus totius: quod ego longe commodissimum esse non potui non agnoscere. Coepi igitur, ejus hortatu, rejectis illis quos anteà paraveram, de horum calculo serio cogitare; et sequenti aestate iterum profectus Edinburgum, horum quos hic exhibeo praecipuos, illi ostendi, idem etiam tertia aestate libentissime facturus, si Deus illum nobis tamdiu superstitem esse voluisset."

There is also a reference to the change of the logarithms on the title-page of the work.

These extracts contain all the original statements made by Napier, Robert Napier and Briggs which have reference to the origin of decimal logarithms. It will be seen that they are all in perfect agreement. Briggs pointed out in his lectures at Gresham College that it would be more convenient that 0 should stand for the logarithm of the whole sine as in the *Descriptio*, but that the logarithm of the tenth part of the whole sine should be 10,000,000,000. He wrote also to Napier at once; and as soon as he could he went to Edinburgh to visit him, where, as he was most hospitably received by him, he remained for a whole month. When they conversed about the change of system, Napier said that he had perceived and desired the same thing, but that he had published the tables which he had already prepared, so that they might be used until he could construct others more convenient. But he considered that the change ought to be so made that 0 should be the logarithm of unity and 10,000,000,000 that of the whole sine, which Briggs could not but admit was by far the most convenient of all. Rejecting therefore, those which he had prepared already, Briggs began, at Napier's advice, to consider seriously the question of the calculation of new tables. In the following summer he went to Edinburgh and showed Napier the principal portion of the logarithms which he published in 1624. These probably included the logarithms of the first chiliad which he published in 1617.

It has been thought necessary to give in detail the facts relating to the conversion of the logarithms, as unfortunately Charles Hutton in his history of logarithms, which was prefixed to the early editions of his *Mathematical Tables*, and was also published as one of his *Mathematical Tracts*, has charged Napier with want of candour in not telling the world of Briggs's share in the change of system, and he expresses the suspicion that "Napier was desirous that the world should ascribe to him alone the merit of this very useful improvement of the logarithms." According to Hutton's view,

the words, "*it is to be hoped* that his posthumous work" ... which occur in the preface to the *Chilias*, were a modest hint that the share Briggs had had in changing the logarithms should be mentioned, and that, as no attention was paid to it, he himself gave the account which appears in the *Arithmetica* of 1624. There seems, however, no ground whatever for supposing that Briggs meant to express anything beyond his hope that the reason for the alteration would be explained in the posthumous work; and in his own account, written seven years after Napier's death and five years after the appearance of the work itself, he shows no injured feeling whatever, but even goes out of his way to explain that he abandoned his own proposed alteration in favour of Napier's, and, rejecting the tables he had already constructed, began to consider the calculation of new ones. The facts, as stated by Napier and Briggs, are in complete accordance, and the friendship existing between them was perfect and unbroken to the last. Briggs assisted Robert Napier in the editing of the "posthumous work," the *Constructio*, and in the account he gives of the alteration of the logarithms in the *Arithmetica* of 1624 he seems to have been more anxious that justice should be done to Napier than to himself; while on the other hand Napier received Briggs most hospitably and refers to him as "amico mihi longè charissimo."

Hutton's suggestions are all the more to be regretted as they occur as a history which is the result of a good deal of investigation and which for years was referred to as an authority by many writers. His prejudice against Napier naturally produced retaliation, and Mark Napier in defending his ancestor has fallen into the opposite extreme of attempting to reduce Briggs to the level of a mere computer. In connexion with this controversy it should be noticed that the "Admonitio" on the last page of the *Descriptio*, containing the reference to the new logarithms, does not occur in all the copies. It is printed on the back of the last page of the table itself, and so cannot have been torn out from the copies that are without it. As there could have been no reason for omitting it after it had once appeared, we may assume that the copies which do not have it are those which were first issued. It is probable, therefore, that Briggs's 872
copy contained no reference to the change, and it is even possible that the "Admonitio" may have been added after Briggs had communicated with Napier. As special attention has not been drawn to the fact that some copies have the "Admonitio" and some have not, different writers have assumed that Briggs did or did not know of the promise contained in the "Admonitio" according as it was present or absent in the copies they had themselves referred to, and this has given rise to some confusion. It may also be remarked that the date frequently assigned to Briggs's first visit to Napier is 1616, and not 1615 as stated above, the reason being that Napier was generally supposed to have died in 1618 until Mark Napier showed that the true date was 1617. When the *Descriptio* was published Briggs was fifty-seven years of age, and the remaining seventeen years of his life were devoted with steady enthusiasm to extend the utility of Napier's great invention.

The only other mathematician besides Napier who grasped the idea on which the use of logarithm depends and applied it to the construction of a table is Justus Byrgius (Jobst Bürgi), whose work *Arithmetische und geometrische Progress-Tabulen* ... was published at Prague in 1620, six years after the publication of the *Descriptio* of Napier. This table distinctly involves the principle of logarithms and may be described as a modified table of antilogarithms. It consists of two series of numbers, the one being an arithmetical and the other a geometrical progression: thus

0, 1,0000 0000
10, 1,0001 0000
20, l,0002 0001
. . . .
990, l,0099 4967
. . . .

In the arithmetical column the numbers increase by 10, in the geometrical column each number is derived from its predecessor by multiplication by 1.0001. Thus the number 10x in the arithmetical column corresponds to 10^8 $(1.0001)^x$ in the geometrical column; the intermediate numbers being obtained by interpolation. If we divide the numbers in the geometrical column by 10^8 the correspondence is between 10x and $(1.0001)^x$, and the table then becomes one of antilogarithms, the base being $(1.0001)^{1/10}$, viz. for example $(l.0001)^{1/10\cdot 990} = 1.00994967$. The table extends to 230270 in the arithmetical column, and it is shown that 230270.022 corresponds to 9.9999 9999 or 109 in the geometrical column; this last result showing that $(1.0001)^{23027.022} = 10$. The first contemporary mention of Byrgius's table occurs on page 11 of the "Praecepta" prefixed to Kepler's *Tabulae Radolphinae* (1627); his words are: "apices logistici J. Byrgio multis annis ante editionem Neperianam viam praeiverent ad hos ipsissimos logarithmos. Etsi homo cunctator et secretorum suorum custos foetum in partu destituit, non ad usus publicos educavit." Another reference to Byrgius occurs in a work by Benjamin Bramer, the brother-in-law and pupil of Byrgius, who, writing in 1630, says that the latter constructed his table twenty years ago or more.[4]

As regards priority of publication, Napier has the advantage by six years, and even fully accepting Bramer's statement, there are grounds for believing that Napier's work dates from a still earlier period.

The power of 10, which occurs as a factor in the tables of both Napier and Byrgius, was rendered necessary by the fact that the decimal point was not yet in use. Omitting this factor in the case of both tables, the connexion between N a number and L its "logarithm" is

$$N = (e^{-1})^L \text{ (Napier)}, \qquad L = (1.0001)^{\frac{1}{10}N} \text{ (Byrgius)},$$

viz. Napier gives logarithms to base e^{-1}, Byrgius gives antilogarithms to base $(1.0001)^{1/10}$.

There is indirect evidence that Napier was occupied with logarithms as early as 1594, for in a letter to P. Crügerus from Kepler, dated September 9, 1624 (Frisch's *Kepler*, vi. 47), there occurs the sentence: "Nihil autem supra Neperianam rationem esse puto: etsi quidem Scotus quidam literis ad Tychonem 1594 scriptis jam spem fecit Canonis illius Mirifici." It is here distinctly stated that some Scotsman in the year 1594, in a letter to Tycho Brahe, gave him some hope of the logarithms; and as Kepler joined Tycho after his expulsion from the island of Huen, and had been so closely associated with him in his work, he would be likely to be correct in any assertion of this kind. In connexion with Kepler's statement the following story, told by Anthony wood in the *Athenae Oxonienses*, is of some importance:—

> "It must be now known, that one Dr Craig, a Scotchman ... coming out of Denmark into his own country, called upon Joh. Neper, Baron of Mercheston, near Edinburgh, and told him, among other discourses, of a new invention in Denmark (by Longomontanus, as 'tis said), to save the tedious multiplication and division in astronomical calculations. Neper being solicitous to know farther of him concerning this matter, he could give no other account of it than that it was by proportional numbers. Which hint Neper taking, he desired him at his return to call upon him again. Craig, after some weeks had passed, did so, and Neper then showed him a rude draught of what he called *Canon mirabilis logarithmorum*. which draught, with some alterations, he printing in 1614, it came forthwith into the hands of our author Briggs, and into those of Will. Oughtred, from whom the relation of this matter came."

This story, though obviously untrue in some respects, gives valuable information by connecting Dr Craig with Napier and Longomontanus, who was Tycho Brahe's assistant. Dr Craig was John Craig, the third son of Thomas Craig, who was one of the colleagues of Sir Archibald Napier, John Napier's father, in the office of justice-depute. Between John Craig and John Napier a friendship sprang up which may have been due to their common taste for mathematics. There are extant three letters from Dr John Craig to Tycho Brahe, which show that he was on the most friendly terms with him. In the first letter, of which the date is not given, Craig says that Sir William Stuart has safely delivered to him, "about the beginning of last winter," the book which he sent him. Now Mark Napier found in the library of the university of Edinburgh a mathematical work bearing a sentence in Latin which he translates, "To Doctor John Craig of Edinburgh, in Scotland, a most illustrious man, highly gifted with various and excellent learning, professor of medicine, and exceedingly skilled in the mathematics, Tycho Brahe hath sent this gift, and with his own hand written this at Uraniburg, 2d November 1588." As Sir William Stuart was sent to Denmark to arrange the preliminaries of King James's marriage, and returned to Edinburgh on the 15th of November 1588, it would seem probable that this was the volume referred to by Craig. It appears from Craig's letter, to which we may therefore assign the date 1589, that, five years before, he had made an attempt to reach Uranienburg, but had been baffled by the storms and rocks of Norway, and that ever since then he had been longing to visit Tycho. Now John Craig was physician to the king, and in 1590 James VI. spent some days at Uranienburg, before returning to Scotland from his matrimonial expedition. It seems not unlikely therefore that Craig may have accompanied the king in his visit to Uranienburg.[5] In any case it is certain that Craig was a friend and correspondent of Tycho's, and it is probable that he was the "Scotus quidam."

We may infer therefore that as early as 1594 Napier had communicated to some one, probably John Craig, his hope of being able to effect a simplification in the processes of arithmetic. Everything tends to show that the invention of logarithms was the result of many years of labour and thought,[6] undertaken with this special object, and it would seem that Napier had seen some prospect of success nearly twenty years before the publication of the *Descriptio*. It is very evident that no mere hint with regard to the use of proportional numbers could have been of any service to him, but it is possible that the news brought by Craig of the difficulties placed in the progress of astronomy by the labour of the calculations may have stimulated him to persevere in his efforts.

The "new invention in Denmark" to which Anthony Wood refers as having given the hint to Napier was probably the method of calculation called prosthaphaeresis (often written in Greek letters προσθαφαίρεσις), which had its origin in the solution of spherical triangles.[7] The method consists in the use of the formula

$$\sin a \sin b = \tfrac{1}{2}\{\cos(a - b) - \cos(a + b)\},$$

by means of which the multiplication of two sines is reduced to the addition or subtraction of two tabular results taken from a table of sines; and, as such products occur in the solution of spherical triangles, the method affords the solution of spherical triangles in certain cases by addition and subtraction only. It seems to be due to Wittich of Breslau, who was assistant for a short time to Tycho Brahe; and it was used by them in their calculations in 1582. Wittich in 1584 made known at Cassel the calculation of one case by this prosthaphaeresis; and Justus Byrgius proved it in such a manner that from his proof the extension to the solution of all triangles could be deduced.[8] Clavius generalized the method in his treatise *De astrolabio* (1593), lib. i. lemma liii. The lemma is enunciated as follows:—

> "Quaestiones omnes, quae per sinus, tangentes, atque secantes absolvi solent, per solam prosthaphaeresim, id est, per solam additionem, subtractionem, sine laboriosa numerorum multiplicatione divisioneque expedire."

Clavius then refers to a work of Raymarus Ursus Dithmarsus as containing an account of a particular case. The work is probably the *Fundamentum astronomicum* (1588). Longomontanus, in his *Astronomia Danica* (1622), gives an account of the method, stating that it is not to be found in the writings of the Arabs or Regiomontanus. As Longomontanus is mentioned in Anthony Wood's anecdote, and as Wittich as well as Longomontanus were assistants of Tycho, we may infer that Wittich's prosthaphaeresis is the method referred to by Wood.

It is evident that Wittich's prosthaphaeresis could not be a good method of practically effecting multiplications unless the quantities to be multiplied were sines, on account of the labour of the interpolations. It satisfies the condition, however, equally with logarithms, of enabling multiplication to be performed by the aid of a table of single entry; and, analytically considered, it is not so different in principle from the logarithmic method. In fact, if we put $xy = \varphi(X + Y)$, X being a function of x only and Y a function of y only, we can show that we must have $X = Ae^{qx}$, $y = Be^{qy}$; and if we put $xy = \varphi(X + Y) - \varphi(X - Y)$, the solutions are $\varphi(X + Y) = \frac{1}{4}(x + y)^2$, and $x = \sin X$, $y = \sin Y$, $\varphi(X + Y) = -\frac{1}{2}\cos(X + Y)$. The former solution gives a method known as that of quarter-squares; the latter gives the method of prosthaphaeresis.

An account has now been given of Napier's invention and its publication, the transition to decimal logarithms, the calculation of the tables by Briggs, Vlacq and Gunter, as well as of the claims of Byrgius and the method of prosthaphaeresis. To complete the early history of logarithms it is necessary to return to Napier's *Descriptio* in order to describe its reception on the continent, and to mention the other logarithmic tables which were published while Briggs was occupied with his calculations.

John Kepler, who has been already quoted in connexion with Craig's visit to Tycho Brahe, received the invention of logarithms almost as enthusiastically as Briggs. His first mention of the subject occurs in a letter to Schikhart dated the 11th of March 1618, in which he writes-"Extitit Scotus Baro, cujus nomen mihi excidit, qui praeclari quid praestitit, necessitate omni multiplicationum et divisionum in meras additiones et subtractiones commutata, nec sinibus utitur; at tamen opus est ipsi tangentium canone: et varietas, crebritas, difficultasque additionum subtractionumque alicubi laborem multiplicandi et dividendi superat." This erroneous estimate was formed when he had seen the *Descriptio* but had not read it; and his opinion was very different when he became acquainted with the nature of logarithms. The dedication of his *Ephemeris* for 1620 consists of a letter to Napier dated the 28th of July 1619, and he there congratulates him warmly on his invention and on the benefit he has conferred upon astronomy generally and upon Kepler's own Rudolphine tables. He says that, although Napier's book had been published five years, he first saw it at Prague two years before; he was then unable to read it, but last year he had met with a little work by Benjamin Ursinus[9] containing the substance of the method, and he at once recognized the importance of what had been effected. He then explains how he verified the canon, and so found that there were no essential errors in it, although there were a few inaccuracies near the beginning of the quadrant, and he proceeds, "Haec te obiter scire volui, ut quibus tu methodis incesseris, quas non dubito et plurimas et ingeniosissimas tibi in promptu esse, eas publici juris fieri, mihi saltem (puto et caeteris) scires fore gratissimum; eoque percepto, tua promissa folio 57, in debitum cecidisse intelligeres." This letter was written two years after Napier's death (of which Kepler was unaware), and in the same year as that in which the *Constructio* was published. In the same year (1620) Napier's *Descriptio* (1614) and *Constructio* (1619) were reprinted by Bartholomew Vincent at Lyons and issued together.[10]

Napier calculated no logarithms of numbers, and, as already stated, the logarithms invented by him were not to base *e*. The first logarithms to the base e were published by John Speidell in his *New Logarithmes* (London, 1619), which

contains hyperbolic log sines, tangents and secants for every minute of the quadrant to 5 places of decimals.

In 1624 Benjamin Ursinus published at Cologne a canon of logarithms exactly similar to Napier's in the *Descriptio* of 1614, only much enlarged. The interval of the arguments is 10″, and the results are given to 8 places; in Napier's canon the interval is 1′, and the number of places is 7. The logarithms are strictly Napierian, and the arrangement is identical with that in the canon of 1614. This is the largest Napierian canon that has ever been published.

In the same year (1624) Kepler published at Marburg a table of Napierian logarithms of sines with certain additional columns to facilitate special calculations.

The first publication of Briggian logarithms on the continent is due to Wingate, who published at Paris in 1625 his *Arithmétique logarithmétique*, containing seven-figure logarithms of numbers up to 1000, and log sines and tangents from Gunter's *Canon* (1620). In the following year, 1626, Denis Henrion published at Paris a *Traicté des Logarithmes*, containing Briggs's logarithms of numbers up to 20,001 to 10 places, and Gunter's log sines and tangents to 7 places for every minute. In the same year de Decker also published at Gouda a work entitled *Nieuwe Telkonst, inhoudende de Logarithmi voor de Ghetallen beginnende van 1 tot 10,000*, which contained logarithms of numbers up to 10,000 to 10 places, taken from Briggs's *Arithmetica* of 1624, and Gunter's log sines and tangents to 7 places for every minute.[11] Vlacq rendered assistance in the publication of this work, and the privilege is made out to him.

The invention of logarithms and the calculation of the earlier tables form a very striking episode in the history of exact science, and, with the exception of the *Principia* of Newton, there is no mathematical work published in the country which has produced such important consequences, or to which so much interest attaches as to Napier's *Descriptio*. The calculation of tables of the natural trigonometrical functions may be said to have formed the work of the last half of the 16th century, and the great canon of natural sines for every 10 seconds to 15 places which had been calculated by Rheticus was published by Pitiscus only in 1613, the year before that in which the *Descriptio* appeared. In the construction of the natural trigonometrical tables Great Britain had taken no part, and it is remarkable that the discovery of the principles and the formation of the tables that were to revolutionize or supersede all the methods of calculation then in use should have been so rapidly effected and developed in a country in which so little attention had been previously devoted to such questions.

> For more detailed information relating to Napier, Briggs and Vlacq, and the invention of logarithms, the reader is referred to the life of Briggs in Ward's *Lives of the Professors of Gresham College* (London, 1740); Thomas Smith's *Vitae quorundam eruditissimorum et illustrium virorum* (Vita Henrici Briggii) (London, 1707); Mark Napier's *Memoirs of John Napier* already referred to, and the same author's *Naperi libri qui supersunt* (1839); Hutton's *History*; de Morgan's article already referred to; Delambre's *Histoire de l'Astronomie moderne*; the report on mathematical tables in the *Report of the British Association* for 1873; and the *Philosophical Magazine* for October and December 1872 and May 1873. It may be remarked that the date usually assigned to Briggs's first visit to Napier is 1616 and not 1615 as stated above, the reason being that Napier was generally supposed to have died in 1618; but it was shown by Mark Napier that the true date is 1617.

In the years 1791-1807 Francis Maseres published at London, in six volumes quarto "Scriptores Logarithmici, or a collection of several curious tracts on the nature and construction of logarithms, mentioned in Dr Hutton's historical introduction to his new edition of Sherwin's mathematical tables ...," which contains reprints of Napier's *Descriptio* of 1614, Kepler's writings on logarithms (1624-1625), &c. In 1889 a translation of Napier's *Constructio* of 1619 was published by Walter Rae Macdonald. Some valuable notes are added by the translator, in one of which he shows the accuracy of the method employed by Napier in his calculations, and explains the origin of a small error which occurs in Napier's table. Appended to the Catalogue is a full and careful bibliography of all Napier's writings, with mention of the public libraries, British and foreign, which possess copies of each. A facsimile reproduction of Bartholomew Vincent's Lyons edition (1620) of the *Constructio* was issued in 1895 by A. Hermann at Paris (this imprint occurs on page 62 after the word "Finis").

It now remains to notice briefly a few of the more important events in the history of logarithmic tables subsequent to the original calculations.

> *Common or Briggian Logarithms of Numbers.*—Nathaniel Roe's *Tabulae logarithmicae* (1633) was the first complete seven-figure table that was published. It contains seven-figure logarithms of numbers from 1 to 100,000, with characteristics unseparated from the mantissae, and was formed from Vlacq's table (1628) by leaving out the last three figures. All the figures of the number are given at the head of the columns, except the last two, which run down the extreme columns—1 to 50 on the left-hand side, and 50 to 100 on the right-hand side. The first four figures of the logarithms are printed at the top of the columns. There is thus an advance half way towards the arrangement now universal in seven-figure tables. The final step was made by John Newton in his *Trigonometria Britannica* (1658), a work which is also noticeable as being the only extensive eight-figure table that until recently had been published; it contains logarithms of sines, &c., as well as logarithms of numbers.
>
> In 1705 appeared the original edition of Sherwin's tables, the first of the series of ordinary seven-figure tables of logarithms of numbers and trigonometrical functions such as are in general use now. The work went through several editions during the 18th century, and was at length superseded in 1785 by Hutton's tables, which continued in successive editions to maintain their position for a century.
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> In 1717 Abraham Sharp published in his *Geometry Improv'd* the Briggian logarithms of numbers from 1 to 100, and of primes from 100 to 1100, to 61 places; these were copied into the later editions of Sherwin and other works.
>
> In 1742 a seven-figure table was published in quarto form by Gardiner, which is celebrated on account of its accuracy and of the elegance of the printing. A French edition, which closely resembles the original, was published at Avignon in 1770.
>
> In 1783 appeared at Paris the first edition of François Callet's tables, which correspond to those of Hutton in England. These tables, which form perhaps the most complete and practically useful collection of logarithms for the general computer that has been published, passed through many editions.
>
> In 1794 Vega published his *Thesaurus logarithmorum completus*, a folio volume containing a reprint of the logarithms of numbers from Vlacq's *Arithmetica logarithmica* of 1628, and *Trigonometria artificialis* of 1633. The logarithms of numbers are arranged as in an ordinary seven-figure table. In addition to the logarithms reprinted from the *Trigonometria*, there are given logarithms for every second of the first two degrees, which were the result of an original calculation. Vega devoted great attention to the detection and correction of the errors in Vlacq's work of 1628. Vega's *Thesaurus* has been reproduced photographically by the Italian government. Vega also published in 1797, in 2 vols. 8vo, a collection of logarithmic and trigonometrical tables which has passed through many editions, a very useful one volume stereotype edition having been published in 1840 by Hülsse. The tables in this work may be regarded as to some extent supplementary to those in Callet.
>
> If we consider only the logarithms of numbers, the main line of descent from the original calculation of Briggs and

Vlacq is Roe, John Newton, Sherwin, Gardiner; there are then two branches, viz. Hutton founded on Sherwin and Callet on Gardiner, and the editions of Vega form a separate offshoot from the original tables. Among the most useful and accessible of modern ordinary seven-figure tables of logarithms of numbers and trigonometrical functions may be mentioned those of Bremiker, Schrön and Bruhns. For logarithms of numbers only perhaps Babbage's table is the most convenient.[12]

In 1871 Edward Sang published a seven-figure table of logarithms of numbers from 20,000 to 200,000, the logarithms between 100,000 and 200,000 being the result of a new calculation. By beginning the table at 20,000 instead of at 10,000 the differences are halved in magnitude, while the number of them in a page is quartered. In this table multiples of the differences, instead of proportional parts, are given.[13] John Thomson of Greenock (1782-1855) made an independent calculation of logarithms of numbers up to 120,000 to 12 places of decimals, and his table has been used to verify the errata already found in Vlacq and Briggs by Lefort (see *Monthly Not. R.A.S.* vol. 34, p. 447). A table of ten-figure logarithms of numbers up to 100,009 was calculated by W. W. Duffield and published in the *Report of the U.S. Coast and Geodetic Survey for 1895-1896* as Appendix 12, pp. 395-722. The results were compared with Vega's *Thesaurus* (1794) before publication.

Common or Briggian Logarithms of Trigonometrical Functions.—The next great advance on the Trigonometria artificialis took place more than a century and a half afterwards, when Michael Taylor published in 1792 his seven-decimal table of log sines and tangents to every second of the quadrant; it was calculated by interpolation from the *Trigonometria* to 10 places and then contracted to 7. On account of the great size of this table, and for other reasons, it never came into very general use, Bagay's *Nouvelles tables astronomiques* (1829), which also contains log sines and tangents to every second, being preferred; this latter work, which for many years was difficult to procure, has been reprinted with the original title-page and date unchanged. The only other logarithmic canon to every second that has been published forms the second volume of Shortrede's *Logarithmic Tables* (1849). In 1784 the French government decided that new tables of sines, tangents, &c., and their logarithms, should be calculated in relation to the centesimal division of the quadrant. Prony was charged with the direction of the work, and was expressly required "non seulement à composer des tables qui ne laissassent rien à désirer quant à l'exactitude, mais à en faire le monument de calcul le plus vaste et le plus imposant qui eût jamais été exécuté ou même conçu." Those engaged upon the work were divided into three sections: the first consisted of five or six mathematicians, including Legendre, who were engaged in the purely analytical work, or the calculation of the fundamental numbers; the second section consisted of seven or eight calculators possessing some mathematical knowledge; and the third comprised seventy or eighty ordinary computers. The work, which was performed wholly in duplicate, and independently by two divisions of computers, occupied two years. As a consequence of the double calculation, there are two manuscripts, one deposited at the Observatory, and the other in the library of the Institute, at Paris. Each of the two manuscripts consists essentially of seventeen large folio volumes, the contents being as follows:—

Logarithms of numbers up to 200,000	8	vols.
Natural sines	1	”
Logarithms of the ratios of arcs to sines from $0^q.00000$ to $0^q.05000$, and log sines throughout the quadrant	4	”
Logarithms of the ratios of arcs to tangents from $0^q.00000$ to $0^q.05000$, and log tangents throughout the quadrant	4	”

The trigonometrical results are given for every hundred-thousandth of the quadrant (10″ centesimal or 3″.24 sexagesimal). The tables were all calculated to 14 places, with the intention that only 12 should be published, but the twelfth figure is not to be relied upon. The tables have never been published, and are generally known as the *Tables du Cadastre*, or, in England, as the great French manuscript tables.

A very full account of these tables, with an explanation of the methods of calculation, formulae employed, &c., was published by Lefort in vol. iv. of the *Annales de l'observatoire de Paris*. The printing of the table of natural sines was once begun, and Lefort states that he has seen six copies, all incomplete, although including the last page. Babbage compared his table with the *Tables du Cadastre*, and Lefort has given in his paper just referred to most important lists of errors in Vlacq's and Briggs's logarithms of numbers which were obtained by comparing the manuscript tables with those contained in the *Arithmetica logarithmica* of 1624 and of 1628.

As the *Tables du Cadastre* remained unpublished, other tables appeared in which the quadrant was divided centesimally, the most important of these being Hobert and Ideler's *Nouvelles tables trigonométriques* (1799), and Borda and Delambre's *Tables trigonométriques décimales* (1800-1801), both of which are seven-figure tables. The latter work, which was much used, being difficult to procure, and greater accuracy being required, the French government in 1891 published an eight-figure centesimal table, for every ten seconds, derived from the *Tables du Cadastre*.

Decimal or Briggian Antilogarithms.—In the ordinary tables of logarithms the natural numbers are all integers, while the logarithms tabulated are incommensurable. In an antilogarithmic table, the logarithms are exact quantities such as .00001, .00002, &c., and the numbers are incommensurable. The earliest and largest table of this kind that has been constructed is Dodson's *Antilogarithmic canon* (1742), which gives the numbers to 11 places, corresponding to the logarithms from .00001 to .99999 at intervals of .00001. Antilogarithmic tables are few in number, the only other extensive tables of the same kind that have been published occurring in Shortrede's *Logarithmic tables* already referred to, and in Filipowski's *Table of antilogarithms* (1849). Both are similar to Dodson's tables, from which they were derived, but they only give numbers to 7 places.

Hyperbolic or Napierian logarithms (*i.e.* to base *e*).—The most elaborate table of hyperbolic logarithms that exists is due to Wolfram, a Dutch lieutenant of artillery. His table gives the logarithms of all numbers up to 2200, and of primes (and also of a great many composite numbers) from 2200 to 10,009, to 48 decimal places. The table appeared in Schulze's *Neue und erweiterte Sammlung logarithmischer Tafeln* (1778), and was reprinted in Vega's *Thesaurus* (1794), already referred to. Six logarithms omitted in Schulze's work, and which Wolfram had been prevented from computing by a serious illness, were published subsequently, and the table as given by Vega is complete. The largest hyperbolic table as regards range was published by Zacharias Dase at Vienna in 1850 under the title *Tafel der natürlichen Logarithmen der Zahlen*.

Hyperbolic antilogarithms are simple exponentials, *i.e.* the hyperbolic antilogarithm of x is e^x. Such tables can scarcely be said to come under the head of logarithmic tables. See Tables, Mathematical: *Exponential Functions*.

Logistic or Proportional Logarithms.—The old name for what are now called ratios or fractions are *logistic numbers*, so that a table of log (a/x) where x is the argument and a a constant is called a table of logistic or proportional logarithms; and since log (a/x) = log a − log x it is clear that the tabular results differ from those given in an ordinary table of logarithms only by the subtraction of a constant and a change of sign. The first table of this kind appeared in Kepler's work of 1624 which has been already referred to. The object of a table of log (a/x) is to facilitate the working

out of proportions in which the third term is a constant quantity a. In most collections of tables of logarithms, and especially those intended for use in connexion with navigation, there occurs a small table of logistic logarithms in which a = 3600″ (= 1° or 1^h), the table giving log 3600 − log x, and x being expressed in minutes and seconds. It is also common to find tables in which a = 10800″ (= 3° or 3^h), and x is expressed in degrees (or hours), minutes and seconds. Such tables are generally given to 4 or 5 places. The usual practice in books seems to be to call logarithms logistic when a is 3600″, and proportional when a has any other value.

Addition and Subtraction, or Gaussian Logarithms.—*Gaussian logarithms* are intended to facilitate the finding of the logarithms of the sum and difference of two numbers whose logarithms are known, the numbers themselves being unknown; and on this account they are frequently called addition and subtraction logarithms. The object of the table is in fact to give log (a ± b) by only one entry when log a and log b are given. The utility of such logarithms was first pointed out by Leonelli in a book entitled *Supplément logarithmique*, printed at Bordeaux in the year XI. (1802/3); he calculated a table to 14 places, but only a specimen of it which appeared in the *Supplément* was printed. The first table that was actually published is due to Gauss, and was printed in Zach's *Monatliche Correspondenz*, xxvi. 498 (1812). Corresponding to the argument log x it gives the values of log $(1 + x^{-1})$ and log (1 + x).

Dual Logarithms.—This term was used by Oliver Byrne in a series of works published between 1860 and 1870. Dual numbers and logarithms depend upon the expression of a number as a product of 1.1, 1.01, 1.001 ... or of .9, .99, .999....

In the preceding *résumé* only those publications have been mentioned which are of historic importance or interest.[14] For fuller details with respect to some of these works, for an account of tables published in the latter part of the 19th century, and for those which would now be used in actual calculation, reference should be made to the article TABLES, MATHEMATICAL.

Calculation of Logarithms.—The name logarithm is derived from the words λόγων ἀριθμός, the number of the ratios, and the way of regarding a logarithm which justifies the name may be explained as follows. Suppose that the ratio of 10, or any other particular number, to 1 is compounded of a very great number of equal ratios, as, for example, 1,000,000, then it can be shown that the ratio of 2 to 1 is very nearly equal to a ratio compounded of 301,030 of these small ratios, or *ratiunculae*, that the ratio of 3 to 1 is very nearly equal to a ratio compounded of 477,121 of them, and so on. The small ratio, or *ratiuncula*, is in fact that of the millionth root of 10 to unity, and if we denote it by the ratio of a to 1, then the ratio of 2 to 1 will be nearly the same as that of $a^{301,030}$ to 1, and so on; or, in other words, if a denotes the millionth root of 10, then 2 will be nearly equal to $a^{301,030}$, 3 will be nearly equal to $a^{477,121}$, and so on.

Napier's original work, the *Descriptio Canonis* of 1614, contained, not logarithms of numbers, but logarithms of sines, and the relations between the sines and the logarithms were explained by the motions of points in lines, in a manner not unlike that afterwards employed by Newton in the method of fluxions. An account of the processes by which Napier constructed his table was given in the *Constructio Canonis* of 1619. These methods apply, however, specially to Napier's own kind of logarithms, and are different from those actually used by Briggs in the construction of the tables in the *Arithmetica Logarithmica*, although some of the latter are the same in principle as the processes described in an appendix to the *Constructio*.

The processes used by Briggs are explained by him in the preface to the *Arithmetica Logarithmica* (1624). His method of finding the logarithms of the small primes, which consists in taking a great number of continued geometric means between unity and the given primes, may be described as follows. He first formed the table of numbers and their logarithms:—

Numbers.	Logarithms,
10	1
3.162277...	0.5
1.778279...	0.25
1.333521...	0.125
1.154781...	0.0625

each quantity in the left-hand column being the square root of the one above it, and each quantity in the right-hand column being the half of the one above it. To construct this table Briggs, using about thirty places of decimals, extracted the square root of 10 fifty-four times, and thus found that the logarithm of 1.00000 00000 00000 12781 91493 20032 35 was 0.00000 00000 00000 05551 11512 31257 82702, and that for numbers of this form (*i.e.* for numbers beginning with 1 followed by fifteen ciphers, and then by seventeen or a less number of significant figures) the logarithms were proportional to these significant figures. He then by means of a simple proportion deduced that log (1.00000 00000 00000 1) = 0.00000 00000 00000 04342 94481 90325 1804, so that, a quantity 1.00000 00000 00000 x (where x consists of not more than seventeen figures) having been obtained by repeated extraction of the square root of a given number, the logarithm of 1.00000 00000 00000 x could then be found by multiplying x by .00000 00000 00000 04342....

To find the logarithm of 2, Briggs raised it to the tenth power, viz. 1024, and extracted the square root of 1.024 forty-seven times, the result being 1.00000 00000 00000 16851 60570 53949 77. Multiplying the significant figures by 4342 ... he obtained the logarithm of this quantity, viz. 0.00000 00000 00000 07318 55936 90623 9336, which multiplied by 2^{47} gave 0.01029 99566 39811 95265 277444, the logarithm of 1.024, true to 17 or 18 places. Adding the characteristic 3, and dividing by 10, he found (since 2 is the tenth root of 1024) log 2 = .30102 99956 63981 195. Briggs calculated in a similar manner log 6, and thence deduced log 3.

It will be observed that in the first process the value of the modulus is in fact calculated from the formula.

$$\frac{h}{10^h - 1} = \frac{1}{\log_e 10},$$

the value of h being $1/2^{54}$, and in the second process $\log_{10} 2$ is in effect calculated from the formula.

$$\log_{10} 2 = \left(2^{10/2^{47}} - 1 \right) \times \frac{1}{\log_e 10} \times \frac{2^{47}}{10}.$$

Briggs also gave methods of forming the mean proportionals or square roots by differences; and the general method of constructing logarithmic tables by means of differences is due to him.

The following calculation of log 5 is given as an example of the application of a method of mean proportionals. The process consists in taking the geometric mean of numbers above and below 5, the object being to at length arrive at 5.000000. To every geometric mean in the column of numbers there corresponds the arithmetical mean in the column of logarithms. The numbers are denoted by A, B, C, &c., in order to indicate their mode of formation.

	Numbers.	Logarithms.

A =		1.000000	0.0000000
B =		10.000000	1.0000000
C = √(AB)	=	3.162277	0.5000000
D = √(BC)	=	5.623413	0.7500000
E = √(CD)	=	4.216964	0.6250000
F = √(DE)	=	4.869674	0.6875000
G = √(DF)	=	5.232991	0.7187500
H = √(FG)	=	5.048065	0.7031250
I = √(FH)	=	4.958069	0.6953125
K = √(HI)	=	5.002865	0.6992187
L = √(IK)	=	4.980416	0.6972656
M = √(KL)	=	4.991627	0.6982421
N = √(KM)	=	4.997242	0.6987304
O = √(KN)	=	5.000052	0.6989745
P = √(NO)	=	4.998647	0.6988525
Q = √(OP)	=	4.999350	0.6989135
R = √(OQ)	=	4.999701	0.6989440
S = √(OR)	=	4.999876	0.6989592
T = √(OS)	=	4.999963	0.6989668
V = √(OT)	=	5.000008	0.6989707
W = √(TV)	=	4.999984	0.6989687
X = √(WV)	=	4.999997	0.6989697
Y = √(VX)	=	5.000003	0.6989702
Z = √(XY)	=	5.000000	0.6989700

Great attention was devoted to the methods of calculating logarithms during the 17th and 18th centuries. The earlier methods proposed were, like those of Briggs, purely arithmetical, and for a long time logarithms were regarded from the point of view indicated by their name, that is to say, as depending on the theory of compounded ratios. The introduction of infinite series into mathematics effected a great change in the modes of calculation and the treatment of the subject. Besides Napier and Briggs, special reference should be made to Kepler (*Chilias*, 1624) and Mercator (*Logarithmotechnia*, 1668), whose methods were arithmetical, and to Newton, Gregory, Halley and Cotes, who employed series. A full and valuable account of these methods is given in Hutton's "Construction of Logarithms," which occurs in the introduction to the early editions of his *Mathematical Tables*, and also forms tract 21 of his *Mathematical Tracts* (vol. i., 1812). Many of the early works on logarithms were reprinted in the *Scriptores logarithmici* of Baron Maseres already referred to.

In the following account only those formulae and methods will be referred to which would now be used in the calculation of logarithms.

Since

$$\log_e (1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \&c.,$$

we have, by changing the sign of x,

$$\log_e (1 - x) = -x - \tfrac{1}{2}x^2 - \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 - \&c.;$$

whence

$$\log_e \frac{1 + x}{1 - x} = 2\,(x + \tfrac{1}{3}x^3 + \tfrac{1}{5}x^5 + \&c.),$$

and, therefore, replacing x by (p − q)/(p + q),

$$\log_e \frac{p}{q} = 2\left\{ \frac{p - q}{p + q} + \tfrac{1}{3}\left(\frac{p - q}{p + q}\right)^3 + \tfrac{1}{5}\left(\frac{p - q}{p + q}\right)^5 + \&c. \right\},$$

in which the series is always convergent, so that the formula affords a method of deducing the logarithm of one number from that of another.

As particular cases we have, by putting q = 1,

$$\log_e p = 2\left\{ \frac{p - 1}{p + 1} + \tfrac{1}{3}\left(\frac{p - 1}{p + 1}\right)^3 + \tfrac{1}{5}\left(\frac{p - 1}{p + 1}\right)^5 + \&c. \right\},$$

and by putting q = p + 1,

$$\log_e(p + 1) - \log_e p = 2\left\{ \frac{1}{2p + 1} + \tfrac{1}{3}\frac{1}{(2p + 1)^3} + \tfrac{1}{5}\frac{1}{(2p + 1)^5} + \&c. \right\};$$

the former of these equations gives a convergent series for $\log_e p$, and the latter a very convergent series by means of which the logarithm of any number may be deduced from the logarithm of the preceding number.

From the formula for $\log_e (p/q)$ we may deduce the following very convergent series for $\log_e 2$, $\log_e 3$ and $\log_e 5$, viz.:—

$$\begin{aligned} \log_e 2 &= 2\,(7P + 5Q + 3R), \\ \log_e 3 &= 2\,(11P + 8Q + 5R), \\ \log_e 5 &= 2\,(16P + 12Q + 7R), \end{aligned}$$

where

$$\begin{aligned} P &= \frac{1}{31} + \tfrac{1}{3}\cdot\frac{1}{(31)^3} + \tfrac{1}{5}\cdot\frac{1}{(31)^5} + \&c. \\ Q &= \frac{1}{49} + \tfrac{1}{3}\cdot\frac{1}{(49)^3} + \tfrac{1}{5}\cdot\frac{1}{(49)^5} + \&c. \\ R &= \frac{1}{161} + \tfrac{1}{3}\cdot\frac{1}{(161)^3} + \tfrac{1}{5}\cdot\frac{1}{(161)^5} + \&c. \end{aligned}$$

The following still more convenient formulae for the calculation of $\log_e 2$, $\log_e 3$, &c. were given by J. Couch Adams in the *Proc. Roy. Soc.*, 1878, 27, p. 91. If

$$a = \log \frac{10}{9} = -\log\left(1 - \frac{1}{10}\right), \quad b = \log \frac{25}{24} = -\log\left(1 - \frac{4}{100}\right),$$

$$81 \qquad\qquad 1 \qquad\qquad 50 \qquad\qquad 2$$

$$c = \log \overline{80} = \log \left(1 + \overline{80} \right), \quad d = \log \overline{49} = -\log \left(1 - \overline{100} \right),$$
$$e = \log \frac{126}{125} = \log \left(1 + \frac{8}{1000} \right),$$

then

$$\log 2 = 7a - 2b + 3c, \log 3 = 11a - 3b + 5c, \log 5 = 16a - 4b + 7c,$$

and

$$\log 7 = \tfrac{1}{2} (39a - 10b + 17c - d) \text{ or } = 19a - 4b + 8c + e,$$

and we have the equation of condition,

$$a - 2b + c = d + 2e.$$

By means of these formulae Adams calculated the values of $\log_e 2$, $\log_e 3$, $\log_e 5$, and $\log_e 7$ to 276 places of decimals, and deduced the value of $\log_e 10$ and its reciprocal M, the modulus of the Briggian system of logarithms. The value of the modulus found by Adams is

Mo = 0.43429 44819 03251 82765 11289
18916 60508 22943 97005 80366
65661 14453 78316 58646 49208
87077 47292 24949 33843 17483
18706 10674 47663 03733 64167
92871 58963 90656 92210 64662

81226 58521 27086 56867 03295
93370 86965 88266 88331 16360
77384 90514 28443 48666 76864
65860 85135 56148 21234 87653
43543 43573 17253 83562 21868
25

which is true certainly to 272, and probably to 273, places (*Proc. Roy. Soc.*, 1886, 42, p. 22, where also the values of the other logarithms are given).

If the logarithms are to be Briggian all the series in the preceding formulae must be multiplied by M, the modulus; thus,

$$\log_{10} (1 + x) = M (x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \&c.),$$

and so on.

As has been stated, Abraham Sharp's table contains 61-decimal Briggian logarithms of primes up to 1100, so that the logarithms of all composite numbers whose greatest prime factor does not exceed this number may be found by simple addition; and Wolfram's table gives 48-decimal hyperbolic logarithms of primes up to 10,009. By means of these tables and of a factor table we may very readily obtain the Briggian logarithm of a number to 61 or a less number of places or of its hyperbolic logarithm to 48 or a less number of places in the following manner. Suppose the hyperbolic logarithm of the prime number 43,867 required. Multiplying by 50, we have 50 × 43,867 = 2,193,350, and on looking in Burckhardt's *Table des diviseurs* for a number near to this which shall have no prime factor greater than 10,009, it appears that

$$2,193,349 = 23 \times 47 \times 2029;$$

thus

$$43,867 = \tfrac{1}{50} (23 \times 47 \times 2029 + 1),$$

and therefore

$$\log_e 43,867 = \log_e 23 + \log_e 47 + \log_e 2029 - \log_e 50$$
$$+ \frac{1}{2,193,349} - \tfrac{1}{2} \frac{1}{(2,193,349)^2} + \tfrac{1}{3} \frac{1}{(193,349)^3} - \&c.$$

The first term of the series in the second line is

0.00000 04559 23795 07319 6286;

dividing this by 2 × 2,193,349 we obtain

0.00000 00000 00103 93325 3457,

and the third term is

0.00000 00000 00000 00003 1590,

so that the series =

0.00000 04559 23691 13997 4419;

whence, taking out the logarithms from Wolfram's table,

$\log_e 43,867 = 10.68891$ 76079 60568 10191 3661.

The principle of the method is to multiply the given prime (supposed to consist of 4, 5 or 6 figures) by such a factor that the product may be a number within the range of the factor tables, and such that, when it is increased by 1 or 2, the prime factors may all be within the range of the logarithmic tables. The logarithm is then obtained by use of the formula

$$\log_e (x + d) = \log_e x + \frac{d}{x} - \tfrac{1}{2} \frac{d^2}{x^2} + \tfrac{1}{3} \frac{d^3}{x^3} - \&c.,$$

in which of course the object is to render d/x as small as possible. If the logarithm required is Briggian, the value of the series is to be multiplied by M.

If the number is incommensurable or consists of more than seven figures, we can take the first seven figures of it (or

multiply and divide the result by any factor, and take the first seven figures of the result) and proceed as before. An application to the hyperbolic logarithm of π is given by Burckhardt in the introduction to his *Table des diviseurs* for the second million.

The best general method of calculating logarithms consists, in its simplest form, in resolving the number whose logarithm is required into factors of the form $1 - .1^r n$, where n is one of the nine digits; and making use of subsidiary tables of logarithms of factors of this form. For example, suppose the logarithm of 543839 required to twelve places. Dividing by 10^5 and by 5 the number becomes 1.087678, and resolving this number into factors of the form $1 - .1^r n$ we find that

$$\begin{aligned} 543839 = 10^5 \quad & \times 5(1 - .1^2 8)\,(1 - .1^4 6)\,(1 - .1^5 6)\,(1 - .1^6 3)\,(1 - .1^7 3) \\ & \times (1 - .1^8 5)\,(1 - .1^9 7)\,(1 - .1^{10} 9)\,(1 - .1^{11} 3)\,(1 - .1^{12} 2), \end{aligned}$$

where $1 - 1^2 8$ denotes 1 − .08, $1 - .1^4 6$ denotes 1 − .0006, &c., and so on. All that is required therefore in order to obtain the logarithm of any number is a table of logarithms, to the required number of places, of .n, .9n, .99n, .999n, &c., for n = 1, 2, 3, ... 9.

The resolution of a number into factors of the above form is easily performed. Taking, for example, the number 1.087678, the object is to destroy the significant figure 8 in the second place of decimals; this is effected by multiplying the number by 1-.08, that is, by subtracting from the number eight times itself advanced two places, and we thus obtain 1.00066376. To destroy the first 6 multiply by 1 − .0006 giving 1.000063361744, and multiplying successively by 1 − .00006 and 1 − .000003, we obtain 1.000000357932, and it is clear that these last six significant figures represent without any further work the remaining factors required. In the corresponding antilogarithmic process the number is expressed as a product of factors of the form $1 + .1^n x$.

This method of calculating logarithms by the resolution of numbers into factors of the form $1 - .1^r n$ is generally known as Weddle's method, having been published by him in *The Mathematician* for November 1845, and the corresponding method for antilogarithms by means of factors of the form $1 + (.1)^r n$ is known by the name of Hearn, who published it in the same journal for 1847. In 1846 Peter Gray constructed a new table to 12 places, in which the factors were of the form $1 - (.01)^r n$, so that n had the values 1, 2, ... 99; and subsequently he constructed a similar table for factors of the form $1 + (.01)^r n$. He also devised a method of applying a table of Hearn's form (*i.e.* of factors of the form $1 + .1^r n$) to the construction of logarithms, and calculated a table of logarithms of factors of the form $1 + (.001)^r n$ to 24 places. This was published in 1876 under the title *Tables for the formation of logarithms and antilogarithms to twenty-four or any less number of places*, and contains the most complete and useful application of the method, with many improvements in points of detail. Taking as an example the calculation of the Briggian logarithm of the number 43,867, whose hyperbolic logarithm has been calculated above, we multiply it by 3, giving 131,601, and find by Gray's process that the factors of 1.31601 are

(1) 1.316	(5) $1.(001)^4 002$
(2) 1.000007	(6) $1.(001)^5 602$
(3) $1.(001)^2 598$	(7) $1.(001)^6 412$
(4) $1.(001)^3 780$	(8) $1.(001)^7 340$

Taking the logarithms from Gray's tables we obtain the required logarithm by addition as follows:—

522	878	745	280	337	562	704	972 = colog 3
119	255	889	277	936	685	553	913 = log (1)
	3	040	050	733	157	610	239 = log (2)
		259	708	022	525	453	597 = log (3)
			338	749	695	752	424 = log (4)
					868	588	964 = log (5)
					261	445	278 = log (6)
						178	929 = log (7)
							148 = log (8)
4.642	137	934	655	780	757	288	464 = $\log_{10}$ 43,867

In Shortrede's *Tables* there are tables of logarithms and factors of the form $1 \pm (.01)^r$ n to 16 places and of the form $1 \pm (.1)^r$ n to 25 places; and in his *Tables de Logarithmes à 27 Décimales* (Paris, 1867) Fédor Thoman gives tables of logarithms of factors of the form $1 \pm .1^r$ n. In the *Messenger of Mathematics*, vol. iii. pp. 66-92, 1873, Henry Wace gave a simple and clear account of both the logarithmic and antilogarithmic processes, with tables of both Briggian and hyperbolic logarithms of factors of the form $1 \pm .1^r n$ to 20 places.

Although the method is usually known by the names of Weddle and Hearn, it is really, in its essential features, due to Briggs, who gave in the *Arithmetica logarithmica* of 1624 a table of the logarithms of $1 + .1^r n$ up to r = 9 to 15 places of decimals. It was first formally proposed as an independent method, with great improvements, by Robert Flower in *The Radix, a new way of making Logarithms*, which was published in 1771; and Leonelli, in his *Supplement logarithmique* (1802-1803), already noticed, referred to Flower and reproduced some of his tables. A complete bibliography of this method has been given by A. J. Ellis in a paper "on the potential radix as a means of calculating logarithms," printed in the *Proceedings of the Royal Society*, vol. xxxi., 1881, pp. 401-407, and vol. xxxii., 1881, pp. 377-379. Reference should also be made to Hoppe's *Tafeln zur dreissigstelligen logarithmischen Rechnung* (Leipzig, 1876), which give in a somewhat modified form a table of the hyperbolic logarithm of $1 + .1^r n$.

The preceding methods are only appropriate for the calculation of isolated logarithms. If a complete table had to be reconstructed, or calculated to more places, it would undoubtedly be most convenient to employ the method of differences. A full account of this method as applied to the calculation of the *Tables du Cadastre* is given by Lefort in vol. iv. of the *Annales de l'Observatoire de Paris*.

(J. W. L. G.)

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1 Dr Thomas Smith thus describes the ardour with which Briggs studied the *Descriptio*: "Hunc in deliciis habuit, in sinu, in manibus, in pectore gestavit, oculisque avidissimis, et mente attentissima, iterum iterumque perlegit,..." *Vitae quorundam eruditissimorum et illustrium virorum* (London, 1707).

2 William Lilly's account of the meeting of Napier and Briggs at Merchiston is quoted in the article Napier.

3 It was certainly published after Napier's death, as Briggs mentions his "librum posthumum." This *liber posthumus* was the *Constructio* referred to later in this article.

4 Frisch's *Kepleri opera omnia*, ii. 834. Frisch thinks Bramer possibly relied on Kepler's statement quoted in the text ("Quibus forte confisus Kepleri verbis Benj. Bramer...."). See also vol. vii. p. 298.

The claims of Byrgius are discussed in Kästner's *Geschichte der Mathematik*, ii. 375, and iii. 14; Montucla's *Histoire des mathématiques*, ii. 10; Delambre's *Histoire de l'astronomie moderne*, i. 560; de Morgan's article on "Tables" in the *English Cyclopaedia*; Mark Napier's *Memoirs of John Napier of Merchiston* (1834), p. 392, and Cantor's *Geschichte der Mathematik*, ii. (1892), 662. See also Gieswald, *Justus Byrg als Mathematiker und dessen Einleitung in seine Logarithmen* (Danzig, 1856).

5 See Mark Napier's *Memoirs of John Napier of Merchiston* (1834), p. 362.

6 In the *Rabdologia* (1617) he speaks of the canon of logarithms as "a me longo tempore elaboratum."

7 A careful examination of the history of the method is given by Scheibel in his *Einleitung zur mathematischen Bücherkenntniss*, Stück vii. (Breslau, 1775), pp. 13-20; and there is also an account in Kästner's *Geschichte der Mathematik*, i. 566-569 (1796); in Montucla's *Histoire des mathématiques*, i. 583-585 and 617-619; and in Klügel's *Wörterbuch* (1808), article "Prosthaphaeresis."

8 Besides his connexion with logarithms and improvements in the method of prosthaphaeresis, Byrgius has a share in the invention of decimal fractions. See Cantor, *Geschichte*, ii. 567. Cantor attributes to him (in the use of his prosthaphaeresis) the first introduction of a subsidiary angle into trigonometry (vol. ii. 590).

9 The title of this work is—*Benjaminis Ursini ... cursus mathematici practici volumen primum continens illustr. & generosi Dn. Dn. Johannis Neperi Baronis Merchistonij &c. Scoti trigonometriam logarithmicam usibus discentium accommodatam ... Coloniae ... CIↃ IↃC XIX.* At the end, Napier's table is reprinted, but to two figures less. This work forms the earliest publication of logarithms on the continent.

10 The title is *Logarithmorum canonis descriptio, seu arithmeticarum supputationum mirabilis abbreviatio. Ejusque usus in utraque trigonometria ut etiam in omni logistica mathematica, amplissimi, facillimi & expeditissimi explicatio. Authore ac inventore Ioanne Nepero, Barone Merchistonii, &c. Scoto. Lugduni....* It will be seen that this title is different from that of Napier's work of 1614; many writers have, however, erroneously given it as the title of the latter.

11 In describing the contents of the works referred to, the language and notation of the present day have been adopted, so that for example a table to radius 10,000,000 is described as a table to 7 places, and so on. Also, although logarithms have been spoken of as to the base *e*, &c., it is to be noticed that neither Napier nor Briggs, nor any of their successors till long afterwards, had any idea of connecting logarithms with exponents.

12 The smallest number of entries which are necessary in a table of logarithms in order that the intermediate logarithms may be calculable by proportional parts has been investigated by J. E. A. Steggall in the *Proc. Edin. Math. Soc.*, 1892, 10, p. 35. This number is 1700 in the case of a seven-figure table extending to 100,000.

13 Accounts of Sang's calculations are given in the *Trans. Roy. Soc. Edin.*, 1872, 26, p. 521, and in subsequent papers in the *Proceedings* of the same society.

14 In vol. xv. (1875) of the *Verhandelingen* of the Amsterdam Academy of Sciences, Bierens de Haan has given a list of 553 tables of logarithms. A previous paper of the same kind, containing notices of some of the tables, was published by him in the *Verslagen en Mededeelingen* of the same academy (Afd. Natuurkunde) deel. iv. (1862), p. 15.

LOGAU, FRIEDRICH, Freiherr von (1604-1655), German epigrammatist, was born at Brockut, near Nimptsch, in Silesia, in June 1604. He was educated at the gymnasium of Brieg and subsequently studied law. He then entered the service of the duke of Brieg. In 1644 he was made "ducal councillor." He died at Liegnitz on the 24th of July 1655. Logau's epigrams, which appeared in two collections under the pseudonym "Salomon von Golaw" (an anagram of his real name) in 1638 (*Erstes Hundert Teutscher Reimensprüche*) and 1654 (*Deutscher Sinngedichte drei Tausend*), show a marvellous range and variety of expression. He had suffered bitterly under the adverse conditions of the time; but his satire is not merely the outcome of personal feeling. In the turbulent age of the Thirty Years' War he was one of the few men who preserved intact his intellectual integrity and judged his contemporaries fairly. He satirized with unsparing hand the court life, the useless bloodshed of the war, the lack of national pride in the German people, and their slavish imitation of the French in customs, dress and speech. He belonged to the *Fruchtbringende Gesellschaft* under the name *Der Verkleinernde*, and regarded himself as a follower of Martin Opitz; but he did not allow such ties to influence his independence or originality.

Logau's *Sinngedichte* were edited in 1759 by G. E. Lessing and K. W. Ramler, who first drew attention to their merits; a second edition appeared in 1791. A critical edition was published by G. Eitner in 1872, who also edited a selection of Logau's epigrams for the *Deutsche Dichter des XVII. Jahrhunderts* (vol. iii., 1870); there is also a selection by H. Oesterley in Kürschner's *Deutsche Nationalliteratur*, vol. xxviii. (1885). See H. Denker, *Beiträge zur literarischen Würdigung Logaus* (1889); W. Heuschkel, *Untersuchungen über Ränders und Lessings Bearbeitung Logauscher Sinngedichte* (1901).

LOGIA, a title used to describe a collection of the sayings of Jesus Christ (λόγια Ἰησοῦ) and therefore generally applied to the "Sayings of Jesus" discovered in Egypt by B. P. Grenfell and A. S. Hunt. There is some question as to whether the term is rightly used for this purpose. It does not occur in the Papyri in this sense. Each "saying" is introduced by the phrase "Jesus says" (λέγει) and the collection is described in the introductory words of the 1903 series as λόγοι not as λόγια. Some justification for the employment of the term is found in early Christian literature. Several writers speak of the λόγια τοῦ κυρίου or τὰ κυριακὰ λόγια, *i.e.* oracles of (or concerning) the Lord. Polycarp, for instance, speaks of "those who pervert the oracles of the Lord." (Philipp. 7), and Papias, as Eusebius tells us, wrote a work with the title "Expositions of the Oracles of the Lord." The expression has been variously interpreted. It need mean no more (Lightfoot, *Essays on Supernatural Religion*, 172 seq.) than narratives of (or concerning) the Lord; on the other hand, the phrase is capable of a much more definite meaning, and there are many scholars who hold that it refers to a document which contained a collection of the sayings of Jesus. Some such document, we know, must lie at the base of our Synoptic Gospels, and it is quite possible that it may have been known to and used by Papias. It is only

on this assumption that the use of the term Logia in the sense described above can be justified.

"The Sayings," to which the term Logia is generally applied, consist of (*a*) a papyrus leaf containing seven or eight sayings of Jesus discovered in 1897, (*b*) a second leaf containing five more sayings discovered in 1903, (*c*) two fragments of unknown Gospels, the former published in 1903, the latter in 1907. All these were found amongst the great mass of papyri acquired by the Egyptian Exploration Fund from the ruins of Oxyrhynchus, one of the chief early Christian centres in Egypt, situated some 120 m. S. of Cairo.

The eight "sayings" discovered in 1897 are as follows:—

1. ... καὶ τότε διαβλέψεις ἐκβαλεῖν τὸ κάρφος τὸ ἐν τῷ ὀφθαλμῷ τοῦ ἀδελφοῦ σου.

2. Λέγει Ἰησοῦς ἐὰν μὴ νηστεύσητε τὸν κόσμον οὐ μὴ εὕρητε τὴν βασίλειαν τοῦ θεοῦ. καὶ ἐὰν μὴ σαββατίσητε τὸ σάββατον οὐκ ὄψεσθε τὸν πατέρα.

3. Λέγει Ἰησοῦς ἔ[σ]την ἐν μεσῷ τοῦ κόσμου καὶ ἐν σαρκὶ ὤφθην αὐτοῖς, καὶ εὗρον πάντας μεθύοντας καὶ οὐδένα εὗρον διψῶντα ἐν αὐτοῖς, καὶ πονεῖ ἡ ψυχή μου ἐπὶ τοῖς υἱοῖς τῶν ἀνθρώπων, ὅτι τυφλοί εἰσιν τῇ καρδίᾳ αὐτῶ[ν] κ[αὶ] ο̣ὐ̣ βλ̣έ[πουσιν]....

4. [Illegible: possibly joins on to 3] ... [τ]ὴν πτωχείαν.

5. [Λέγ]ει [Ἰ]ησοῦς ὅπ]ου ἐὰν ὦσιν [β, οὐκ] ε[ἰσὶ]ν ἄθεοι καὶ [ὅ]που ε[ἷς] ἐστιν μόνος, [λέ]γω, ἐγώ εἰμι μετ᾽ αὐτ[οῦ] ἔγει[ρ]ον τὸν λίθον κἀκεῖ εὑρήσεις με, σχίσον τὸ ξύλον κἀγὼ ἐκεῖ εἰμι.

6. Λέγει Ἰησοῦς οὐκ ἔστιν δεκτὸς προφήτης ἐν τῇ πατρίδι αὐτ[ο]ῦ, οὐδὲ ἰατρὸς ποιεῖ θεραπείας εἰς τοὺς γινώσκοντας αὐτόν.

7. Λέγει Ἰησοῦς πόλιςοἰ κοδομημένη ἐπ᾽ ἄκρον [ὄ]ρους ὑψηλοῦ καὶ ἐστηριγμένη οὔτε πε[σ]εῖν δύναται οὔτε κρυ[β]ῆναι.

8. Λέγει Ἰησοῦς ἀκούεις [ε]ἰ̣ς τ̣ὸ ἓ̣ν ᾠ̣τίον σοῦ τ̣ὸ [δὲ ἕτερον συνέκλεισας].

Letters in brackets are missing in the original: letters which are dotted beneath are doubtful.

1. "... and then shalt thou see clearly to cast out the mote that is in thy brother's eye."

2. "Jesus saith, Except ye fast to the world, ye shall in no wise find the kingdom of God; and except ye make the sabbath a real sabbath, ye shall not see the Father."

3. "Jesus saith, I stood in the midst of the world and in the flesh was I seen of them, and I found all men drunken, and none found I athirst among them, and my soul grieveth over the sons of men, because they are blind in their heart, and see not...."

4. "... poverty...."

5. "Jesus saith, Wherever there are two, they are not without God, and wherever there is one alone, I say, I am with him. Raise the stone and there thou shalt find me, cleave the wood and there am I."

6. "Jesus saith, A prophet is not acceptable in his own country, neither doth a physician work cures upon them that know him."

7. "Jesus saith, A city built upon the top of a high hill and stablished can neither fall nor be hid."

8. "Jesus saith, Thou hearest with one ear [but the other ear hast thou closed]."

The "sayings" of 1903 were prefaced by the following introductory statement:—

οἱ τοῖοι οἱ λόγοι οἱ [... οὓς ἐλάλησεν Ἰη(σοῦ)ς ὁ ζῶν κ[ύριος? ... καὶ Θωμᾷ καὶ εἶπεν [αὐτοῖς· πᾶς ὅστις ἂν τῶν λόγων τούτ[ων ἀκούσῃ θανάτου οὐ μὴ γεύσηται.

"These are the (wonderful?) words which Jesus the living (Lord) spake to ... and Thomas and he said unto (them) every one that hearkens to these words shall never taste of death."

The "sayings" themselves are as follows:—

(1) [λέγει Ἰη(σοῦ)ς· μὴ παυσάσθω ὁ ζη[τῶν ...
ἕως ἄν εὕρῃ καὶ ὅταν εὕρῃ [θαμβηθήσεαι
καὶ θαμβηθεὶς βασιλεύσει κα[ὶ βασιλεύσας
ἀναπαήσεται.

(2) λέγει Ἰ[η(σοῦς ... τίνες ...
οἱ ἕλκοντες ἡμᾶς [εἰς τὴν βασιλείαν εἰ
ἡ βασιλεία ἐν οὐρα[νῷ ἐστιν;
τὰ πετεινὰ τοῦ οὐρ[ανοῦ καὶ τῶν θηρίων ὅ
τι ὑπὸ τὴν γῆν ἐστ[ιν ἢ ἐπὶ τῆς γῆς καὶ
οἱ ἰχθύες τῆς θαλά[σσης οὗτοι οἱ ἕλκον-
τες ὑμᾶς καὶ ᾖ βασ[ιλεία τῶν οὐρανῶν
ἐντὸς ὑμῶν [ἐ]στι [καὶ ὅστις ἂν ἑαυτὸν
γνῷ ταύτην εὑρή[σει ...
ἑαυτοὺς γνώσεσθε [καὶ εἰδήσετε ὅτι υἱοὶ
ἔστε ὑμεῖς τοῦ πατρὸς τοῦ τ[...
γνώσ(εσ)θε ἑαυτοὺς ἐν[...
καὶ ὐ εἶς ἐστὲ ηπτο̣[

(3) [λέγει Ἰη(σοῦ)ς
οὐκ ἀποκνήσει ἄνθ[ρωπος ...
ρων ἐπερωτῆσαι πα[...
ρων περὶ τοῦ τόπου τῆ[ς ...
σετε ὅτι πολλοὶ ἔσονται π[ρῶτοι ἔσχατοι καὶ
οἱ ἔσχατοι πρῶτοι καὶ [...
σιν.

(4) λέγει Ἰη(σοῦ)ς· [πᾶν τὸ μὴ ἔμπροσ-
θεν τῆς ὄψεως σου καὶ[τὸ κεκρυμμένον
ἀπὸ σοῦ ἀποκαλυφ(θ)ήσετ[αί σοι. οὐ γάρ ἐσ-

τιν κρυπτὸν ὃ οὐ φανε[ρὸν γενήσεται
καὶ τεθαμμένον ὃ ο[ὐκ ἐγερθήσεται.

(5) [ἐξ] ετάζουσιν αὐτὸν ο[ἱ μαθηταὶ αὐτοῦ καὶ
[λέ]γουσιν· πῶς νηστεύ[σομεν καὶ πῶς ...
[...] μεθα καὶ πῶς [...
[... κ]αὶ τί παρατηρήσ[ομεν ...
[...]ν; λέγει Ἰη(σοῦ)ς· [...
[...]ειται μὴ ποεῖτ[ε ...
[...]ης ἀληθείας ἀν[...
[...]ν ἀ[π]οκεκρ[υ ...
[... μα] κάρι[ός] ἐστιν [...
[...]ω ἐστ[ι ...
[...]ιν [...

1. “Jesus saith, Let not him who seeks ... cease until he finds and when he finds he shall be astonished; astonished he shall reach the kingdom and having reached the kingdom he shall rest.”

2. “Jesus saith (ye ask? who are those) that draw us (to the kingdom if) the kingdom is in Heaven? ... the fowls of the air and all beasts that are under the earth or upon the earth and the fishes of the sea (these are they which draw) you and the kingdom of Heaven is within you and whosoever shall know himself shall find it. (Strive therefore?) to know yourselves and ye shall be aware that ye are the sons of the (Almighty?) Father; (and?) ye shall know that ye are in (the city of God?) and ye are (the city?).”

3. “Jesus saith, A man shall not hesitate ... to ask concerning his place (in the kingdom. Ye shall know) that many that are first shall be last and the last first and (they shall have eternal life?).”

4. “Jesus saith, Everything that is not before thy face and that which is hidden from thee shall be revealed to thee. For there is nothing hidden which shall not be made manifest nor buried which shall not be raised.”

5. “His disciples question him and say, How shall we fast and how shall we (pray?) ... and what (commandment) shall we keep ... Jesus saith ... do not ... of truth ... blessed is he ...”

The fragment of a lost Gospel which was discovered in 1903 contained originally about fifty lines, but many of them have perished and others are undecipherable. The translation, as far as it can be made out, is as follows:—

1-7. “(Take no thought) from morning until even nor from evening until morning either for your food what ye shall eat or for your raiment what ye shall put on. 7-13. Ye are far better than the lilies which grow but spin not. Having one garment what do ye (lack)?... 13-15. Who could add to your stature? 15-16. He himself will give you your garment. 17-23. His disciples say unto him, When wilt thou be manifest unto us and when shall we see thee? He saith, When ye shall be stripped and not be ashamed ... 41-46. He said, The key of knowledge ye hid: ye entered not in yourselves, and to them that were entering in, ye opened not.”

The second Gospel fragment discovered in 1907 “consists of a single vellum leaf, practically complete except at one of the lower corners and here most of the lacunae admit of a satisfactory solution.” The translation is as follows:—

... before he does wrong makes all manner of subtle excuse. But give heed lest ye also suffer the same things as they: for the evil doers among men receive their reward not among the living only, but also await punishment and much torment. And he took them and brought them into the very place of purification and was walking in the temple. And a certain Pharisee, a chief priest, whose name was Levi, met them and said to the Saviour, Who gave thee leave to walk in this place of purification, and to see these holy vessels when thou hast not washed nor yet have thy disciples bathed their feet? But defiled thou hast walked in this temple, which is a pure place, wherein no other man walks except he has washed himself and changed his garments neither does he venture to see these holy vessels. And the Saviour straightway stood still with his disciples and answered him, Art thou then, being here in the temple, clean? He saith unto him, I am clean; for I washed in the pool of David and having descended by one staircase, I ascended by another and I put on white and clean garments, and then I came and looked upon these holy vessels. The Saviour answered and said unto him, Woe ye blind, who see not. Thou hast washed in these running waters wherein dogs and swine have been cast night and day and hast cleansed and wiped the outside skin which also the harlots and flute-girls anoint and wash and wipe and beautify for the lust of men; but within they are full of scorpions and all wickedness. But I and my disciples who thou sayest have not bathed have been dipped in the waters of eternal life which come from.... But woe unto thee....

These documents have naturally excited considerable interest and raised many questions. The papyri of the “sayings” date from the 3rd century and most scholars agree that the “sayings” themselves go back to the 2nd. The year A.D. 140 is generally assigned as the *terminus ad quem*. The problem as to their origin has been keenly discussed. There are two main types of theory. (1) Some suppose that they are excerpts from an uncanonical Gospel. (2) Others think that they represent an independent and original collection of sayings. The first theory has assumed three main forms. (*a*) Harnack maintains that they were taken from the Gospel according to the Egyptians. This theory, however, is based upon a hypothetical reconstruction of the Gospel in question which has found very few supporters. (*b*) Others have advocated the Gospel of the Hebrews as the source of the “sayings,” on the ground of the resemblance between the first “saying” of the 1903 series and a well-authenticated fragment of that Gospel. The resemblance, however, is not sufficiently clear to support the conclusion. (*c*) A third view supposes that they are extracts from the Gospel of Thomas—an apocryphal Gospel dealing with the boyhood of Jesus. Beyond the allusion to Thomas in the introductory paragraph to the 1903 series, there seems to be no tangible evidence in support of this view. The second theory, which maintains that the papyri represent an independent collection of “sayings,” seems to be the opinion which has found greatest favour. It has won the support of W. Sanday, H. B. Swete, Rendel Harris, W. Lock, Heinrici, &c. There is a considerable diversity of judgment, however, with regard to the value of the collection. (*a*) Some scholars maintain that the collection goes back to the 1st century and represents one of the earliest attempts to construct an account of the teaching of Jesus. They are therefore disposed to admit to a greater or less extent and with widely varying degrees of confidence the presence of genuine elements in the new matter. (*b*) Sanday and many others regard the sayings as originating early in the 2nd century and think that, though not “directly dependent on the Canonical Gospels,” they have “their origin under conditions of thought which these Gospels had created.” The “sayings” must be regarded as expansions of the true tradition, and little value is therefore to be attached to the new material.

With the knowledge at our disposal, it is impossible to reach an assured conclusion between these two views. The real problem, to which at present no solution has been found, is to account for the new material in the “sayings.” There seems to be no motive sufficient to explain the additions that have been made to the text of the Gospels. It cannot be proved that the expansions have been made in the interests of any sect or heresy. Unless new discoveries provide the clue, or some reasonable explanation can otherwise be found, there seems to be no reason why we should not regard

the “sayings” as containing material which ought to be taken into account in the critical study of the teaching of Jesus.

The 1903 Gospel fragment is so mutilated in many of its parts that it is difficult to decide upon its character and value. It appears to be earlier than 150, and to be taken from a Gospel which followed more or less closely the version of the teaching of Jesus given by Matthew and Luke. The phrase “when ye shall be stripped and not be ashamed” contains an idea which has some affinity with two passages found respectively in the Gospel according to the Egyptians and the so-called Second Epistle of Clement. The resemblance, however, is not sufficiently close to warrant the deduction that either the Gospel of the Egyptians or the Gospel from which the citation in 2 Clement is taken (if these two are distinct) is the source from which our fragment is derived.

The second Gospel fragment (1907) seems to be of later origin than the documents already mentioned. Grenfell and Hunt date the Gospel, from which it is an excerpt, about 200. There is considerable difficulty with regard to some of the details. The statement that an ordinary Jew was required to wash and change his clothes before visiting the inner court of the temple is quite unsupported by any other evidence. Nothing is known about “the place of purification” (ἀγνευτήριον) nor “the pool of David” (λίμνη τοῦ Δαυείδ). Nor does the statement that “the sacred vessels” were visible from the place where Jesus was standing seem at all probable. Grenfell and Hunt conclude therefore—“So great indeed are the divergences between this account and the extant and no doubt well-informed authorities with regard to the topography and ritual of the Temple that it is hardly possible to avoid the conclusion that much of the local colour is due to the imagination of the author who was aiming chiefly at dramatic effect and was not really well acquainted with the Temple. But if the inaccuracy of the fragment in this important respect is admitted the historical character of the whole episode breaks down and it is probably to be regarded as an apocryphal elaboration of Matt. xv. 1-20 and Mark vii. 1-23.”

See the *Oxyrhynchus Papyri*, part i. (1897), part iv. (1904), part v. (1908).

(H. T. A.)

LOGIC (λογική, sc. τέχνη, the art of reasoning), the name given to one of the four main departments of philosophy, though its sphere is very variously delimited. The present article is divided into 1. *The Problems of Logic*, II. *History*.

I. *The Problems of Logic.*

Introduction.—Logic is the science of the processes of inference, what, then, is inference? It is that mental operation which proceeds by combining two premises so as to cause a consequent conclusion. Some suppose that we may infer from one premise by a so-called “immediate inference.” But one premise can only reproduce itself in another form, *e.g.* all men are some animals; therefore some animals are men. It requires the combination of at least two premises to infer a conclusion different from both. There are as many kinds of inference as there are different ways of combining premises, and in the main three types:—

1. *Analogical Inference*, from particular to particular: *e.g.* border-war between Thebes and Phocis is evil; border-war between Thebes and Athens is similar to that between Thebes and Phocis; therefore, border-war between Thebes and Athens is evil.

2. *Inductive Inference*, from particular to universal: *e.g.* border-war between Thebes and Phocis is evil; all border-war is like that between Thebes and Phocis; therefore, all border-war is evil.

3. *Deductive or Syllogistic Inference*, from universal to particular, *e.g.* all border-war is evil; border-war between Thebes and Athens is border-war; therefore border-war between Thebes and Athens is evil.

In each of these kinds of inference there are three mental judgments capable of being expressed as above in three linguistic propositions; and the two first are the premises which are combined, while the third is the conclusion which is consequent on their combination. Each proposition consists of two terms, the subject and its predicate, united by the copula. Each inference contains three terms. In syllogistic inference the subject of the conclusion is the minor term, and its predicate the major term, while between these two extremes the term common to the two premises is the middle term, and the premise containing the middle and major terms is the major premise, the premise containing the middle and minor terms the minor premise. Thus in the example of syllogism given above, “border-war between Thebes and Athens” is the minor term, “evil” the major term, and “border-war” the middle term. Using S for minor, P for major and M for middle, and preserving these signs for corresponding terms in analogical and inductive inferences, we obtain the following formula of the three inferences:—

Analogical.	*Inductive.*	*Deductive or Syllogistic.*
S^1 is P	S is P	Every M is P
S^2 is similar to S^1	Every M is similar to S	S is M
∴ S^2 is P.	∴ Every M is P.	∴ S is P.

The love of unity has often made logicians attempt to resolve these three processes into one. But each process has a peculiarity of its own; they are similar, not the same. Analogical and inductive inference alike begin with a particular premise containing one or more instances; but the former adds a particular premise to draw a particular conclusion, the latter requires a universal premise to draw a universal conclusion. A citizen of Athens, who had known the evils of the border-war between Thebes and Phocis, would readily perceive the analogy of a similar war between Thebes and Athens, and conclude analogously that it would be evil; but he would have to generalize the similarity of all border-wars in order to draw the inductive conclusion that all alike are evil. Induction and deduction differ still more, and are in fact opposed, as one makes a particular premise the evidence of a universal conclusion, the other makes a universal premise evidence of a particular conclusion. Yet they are alike in requiring the generalization of the universal and the belief that there are classes which are whole numbers of similars. On this point both differ from inference by analogy, which proceeds entirely from particular premises to a particular conclusion. Hence we may redivide inference into particular inference by analogy and universal inference by induction and deduction. Universal inference is what we call reasoning; and its two species are very closely connected, because universal conclusions of induction become universal premises of deduction. Indeed, we often induce in order to deduce, ascending from particular to universal and descending from universal to particular in one act as it were; so that we may proceed either directly from particular to

particular by analogical inference, or indirectly from particular through universal to particular by an inductive-deductive inference which might be called “perduction.” On the whole, then, analogical, inductive and deductive inferences are not the same but three similar and closely connected processes.

The three processes of inference, though different from one another, rest on a common principle of similarity of which each is a different application. Analogical inference requires that one particular is similar to another, induction that a whole number or class is similar to its particular instances, deduction that each particular is similar to the whole number or class. Not that these inferences require us to believe, or assume, or premise or formulate this principle either in general, or in its applied forms: the premises are all that any inference needs the mind to assume. The principle of similarity is used, not assumed by the inferring mind, which in accordance with the similarity of things and the parity of inference spontaneously concludes in the form that similars are similarly determined (“similia similibus convenire”). In applying this principle of similarity, each of the three processes in its own way has to premise both that something is somehow determined and that something is similar, and by combining these premises to conclude that this is similarly determined to that. Thus the very principle of inference by similarity requires it to be a combination of premises in order to draw a conclusion.

The three processes, as different applications of the principle of similarity, consisting of different combinations of premises, cause different degrees of cogency in their several conclusions. Analogy hardly requires as much evidence as induction. Men speculate about the analogy between Mars and the earth, and infer that it is inhabited, without troubling about all the planets. Induction has to consider more instances, and the similarity of a whole number or class. Even so, however, it starts from a particular premise which only contains many instances, and leaves room to doubt the universality of its conclusions. But deduction, starting from a premise about all the members of a class, compels a conclusion about every and each of necessity. One border-war may be similar to another, and the whole number may be similar, without being similarly evil; but if all alike are evil, each is evil of necessity. Deduction or syllogism is superior to analogy and induction in combining premises so as to involve or contain the conclusion. For this reason it has been elevated by some logicians above all other inferences, and for this very same reason attacked by others as no inference at all. The truth is that, though the premises contain the conclusion, neither premise alone contains it, and a man who knows both but does not combine them does not draw the conclusion; it is the synthesis of the two premises which at once contains the conclusion and advances our knowledge; and as syllogism consists, not indeed in the discovery, but essentially in the synthesis of two premises, it is an inference and an advance on each premise and on both taken separately. As again the synthesis contains or involves the conclusion, syllogism has the advantage of compelling assent to the consequences of the premises. Inference in general is a combination of premises to cause a conclusion; deduction is such a combination as to compel a conclusion involved in the combination, and following from the premises of necessity.

Nevertheless, deduction or syllogism is not independent of the other processes of inference. It is not the primary inference of its own premises, but constantly converts analogical and inductive conclusions into its particular and universal premises. Of itself it causes a necessity of consequence, but only a hypothetical necessity; if these premises are true, then this conclusion necessarily follows. To eliminate this “if” ultimately requires other inferences before deduction. Especially, induction to universals is the warrant and measure of deduction from universals. So far as it is inductively true that all border-war is evil, it is deductively true that a given border-war is therefore evil. Now, as an inductive combination of premises does not necessarily involve the inductive conclusion, induction normally leads, not to a necessary, but to a probable conclusion; and whenever its probable conclusions become deductive premises, the deduction only involves a probable conclusion. Can we then infer any certainty at all? In order to answer this question we must remember that there are many degrees of probability, and that induction, and therefore deduction, draw conclusions more or less probable, and rise to the point at which probability becomes moral certainty, or that high degree of probability which is sufficient to guide our lives, and even condemn murderers to death. But can we rise still higher and infer real necessity? This is a difficult question, which has received many answers. Some noölogists suppose a mental power of forming necessary principles of deduction a priori; but fail to show how we can apply principles of mind to things beyond mind. Some empiricists, on the other hand, suppose that induction only infers probable conclusions which are premises of probable deductions; but they give up all exact science. Between these extremes there is room for a third theory, empirical yet providing a knowledge of the really necessary. In some cases of induction concerned with objects capable of abstraction and simplification, we have a power of identification, by which, not a priori but in the act of inducing a conclusion, we apprehend that the things signified by its subject and predicate are one and the same thing which cannot exist apart from itself. Thus by combined induction and identification we apprehend that one and one are the same as two, that there is no difference between a triangle and a three-sided rectilineal figure, that a whole must be greater than its part by being the whole, that inter-resisting bodies necessarily force one another apart, otherwise they would not be inter-resisting but occupy the same place at the same moment. Necessary principles, discovered by this process of induction and identification, become premises of deductive demonstration to conclusions which are not only necessary consequents on the premises, but also equally necessary in reality. Induction thus is the source of deduction, of its truth, of its probability, of its moral certainty; and induction, combined with identification, is the origin of the necessary principles of demonstration or deduction to necessary conclusions.

Analogical inference in its turn is as closely allied with induction. Like induction, it starts from a particular premise, containing one or more examples or instances; but, as it is easier to infer a particular than a universal conclusion, it supplies particular conclusions which in their turn become further particular premises of induction. Its second premise is indeed merely a particular apprehension that one particular is similar to another, whereas the second premise of induction is a universal apprehension that a whole number of particulars is similar to those from which the inference starts; but at bottom these two apprehensions of similarity are so alike as to suggest that the universal premise of induction has arisen as a generalized analogy. It seems likely that man has arrived at the apprehension of a whole individual, *e.g.* a whole animal including all its parts, and thence has inferred by analogy a whole number, or class, *e.g.* of animals including all individual animals; and accordingly that the particular analogy of one individual to another has given rise to the general analogy of every to each individual in a class, or whole number of individuals, contained in the second premise of induction. In this case, analogical inference has led to induction, as induction to deduction. Further, analogical inference from particular to particular suggests inductive-deductive inference from particular through universal to particular.

Newton, according to Dr Pemberton, thought in 1666 that the moon moves so like a falling body that it has a similar centripetal force to the earth, 20 years before he demonstrated this conclusion from the laws of motion in the *Principia*. In fact, analogical, inductive and deductive inferences, though different processes of combining premises to cause different conclusions, are so similar and related, so united in principle and interdependent, so consolidated into a system of inference, that they cannot be completely investigated apart, but together constitute a single subject of science. This science of inference in general is logic.

Logic, however, did not begin as a science of all inference. Rather it began as a science of reasoning (λόγος), of

syllogism (συλλογισμός), of deductive inference. Aristotle was its founder. He was anticipated of course by many generations of spontaneous thinking (*logica naturalis*). Many of the higher animals infer by analogy: otherwise we cannot explain their thinking. Man so infers at first: otherwise we cannot explain the actions of young children, who before they begin to speak give no evidence of universal thinking. It is likely that man began with particular inference and with particular language; and that, gradually generalizing thought and language, he learnt at last to think and say "all," to infer universally, to induce and deduce, to reason, in short, and raise himself above other animals. In ancient times, and especially in Egypt, Babylon and Greece, he went on to develop reason into science or the systematic investigation of definite subjects, *e.g.* arithmetic of number, geometry of magnitude, astronomy of stars, politics of government, ethics of goods. In Greece he became more and more reflective and conscious of himself, of his body and soul, his manners and morals, his mental operations and especially his reason. One of the characteristics of Greek philosophers is their growing tendency, in investigating any subject, to turn round and ask themselves what should be the method of investigation. In this way the Presocratics and Sophists, and still more Socrates and Plato, threw out hints on sense and reason, on inferential processes and scientific methods which may be called anticipations of logic. But Aristotle was the first to conceive of reasoning itself as a definite subject of a special science, which he called analytics or analytic science, specially designed to analyse syllogism and especially demonstrative syllogism, or science, and to be in fact a science of sciences. He was therefore the founder of the science of logic.

Among the Aristotelian treatises we have the following, which together constitute this new science of reasoning:—

1. The *Categories*, or names signifying things which can become predicates;

2. The *De Interpretatione*, or the enumeration of conceptions and their combinations by (1) nouns and verbs (names), (2) enunciations (propositions);

3. The *Prior Analytics*, on syllogism;

4. The *Posterior Analytics*, on demonstrative syllogism, or science;

5. The *Topics*, on dialectical syllogism; or argument;

6. The *Sophistical Elenchi*, on sophistical or contentious syllogism, or sophistical fallacies.

So far as we know, Aristotle had no one name for all these investigations. "Analytics" is only applied to the *Prior* and *Posterior Analytics*, and "logical," which he opposed to "analytical," only suits the *Topics* and at most the *Sophistical Elenchi*; secondly, while he analyzed syllogism into premises, major and minor, and premises into terms, subject and predicate, he attempted no division of the whole science; thirdly, he attempted no order and arrangement of the treatises into a system of logic, but only of the *Analytics*, *Topics* and *Sophistical Elenchi* into a system of syllogisms. Nevertheless, when his followers had arranged the treatises into the *Organon*, as they called it to express that it is an instrument of science, then there gradually emerged a system of syllogistic logic, arranged in the triple division—terms, propositions and syllogisms—which has survived to this day as technical logic, and has been the foundation of all other logics, even of those which aim at its destruction.

The main problem which Aristotle set before him was the analysis of syllogism, which he defined as "reasoning in which certain things having been posited something different from them of necessity follows by their being those things" (*Prior Analytics*, i. 1). What then did he mean by reasoning, or rather by the Greek word λόγος of which "reasoning" is an approximate rendering? It was meant (cf. *Post. An.* i. 10) to be both internal, in the soul (ὁ ἔσω λόγος, ἐν τῇ ψυχῇ), and external, in language (ὁ ἔξω λόγος): hence after Aristotle the Stoics distinguished λόγος ἐνδιάθετος and προφορικός. It meant, then, both reason and discourse of reason (cf. Shakespeare, *Hamlet*, i. 2). On its mental side, as reason it meant combination of thoughts. On its linguistic side, as discourse it was used for any combination of names to form a phrase, such as the definition "rational animal," or a book, such as the *Iliad*. It had also the mathematical meaning of *ratio*; and in its use for definition it is sometimes transferred to essence as the object of definition, and has a mixed meaning, which may be expressed by "account." In all its uses, however, the common meaning is combination. When Aristotle called syllogism λόγος, he meant that it is a combination of premises involving a conclusion of necessity. Moreover, he tended to confine the term λόγος to syllogistic inference. Not that he omitted other inferences (πίστεις). On the contrary, to him (cf. *Prior Analytics*, ii. 24) we owe the triple distinction into inference from particular to particular (παράδειγμα, example, or what we call "analogy"), inference from particular to universal (ἐπαγωγή, induction), and inference from universal to particular (συλλογισμός, syllogism, or deduction). But he thought that inferences other than syllogism are imperfect; that analogical inference is rhetorical induction; and that induction, through the necessary preliminary of syllogism and the sole process of ascent from sense, memory and experience to the principles of science, is itself neither reasoning nor science. To be perfect he thought that all inference must be reduced to syllogism of the first figure, which he regarded as the specially scientific inference. Accordingly, the syllogism appeared to him to be the rational process (μετὰ λόγου), and the demonstrative syllogism from inductively discovered principles to be science (ἐπιστήμη). Hence, without his saying it in so many words, Aristotle's logic perforce became a logic of deductive reasoning, or syllogism. As it happened this deductive tendency helped the development of logic. The obscurer premises of analogy and induction, together with the paucity of experience and the backward state of physical science in Aristotle's time would have baffled even his analytical genius. On the other hand, the demonstrations of mathematical sciences of his time, and the logical forms of deduction evinced in Plato's dialogues, provided him with admirable examples of deduction, which is also the inference most capable of analysis. Aristotle's analysis of the syllogism showed man how to advance by combining his thoughts in trains of deductive reasoning. Nevertheless, the wider question remained for logic: what is the nature of all inference, and the special form of each of its three main processes?

As then the reasoning of the syllogism was the main problem of Aristotle's logic, what was his analysis of it? In distinguishing inner and outer reason, or reasoning and discourse, he added that it is not to outer reason but to inner reason in the soul that demonstration and syllogism are directed (*Post. An.* i. 10). One would expect, then, an analysis of mental reasoning into mental judgments (κρίσεις) as premises and conclusion. In point of fact, he analysed it into premises, but then analysed a premise into terms, which he divided into subject and predicate, with the addition of the copula "is" or "is not." This analysis, regarded as a whole and as it is applied in the *Analytics* and in the other logical treatises, was evidently intended as a linguistic analysis. So in the *Categories*, he first divided things said (τὰ λεγόμενα) into uncombined and combined, or names and propositions, and then divided the former into categories; and in the *De interpretatione* he expressly excluded mental conceptions and their combinations, and confined himself to nouns and verbs and enunciations, or, as we should say, to names and propositions. Aristotle apparently intended, or at all events has given logicians in general the impression, that he intended to analyse syllogism into propositions as premises, and premise into names as terms. His logic therefore exhibits the curious paradox of being an analysis of mental reasoning into linguistic elements. The explanation is that outer speech is more obvious than inner thought, and that grammar and poetic criticism, rhetoric and dialectic preceded logic, and that out of those arts of language arose the science of reasoning. The sophist Protagoras had distinguished various kinds of sentences, and Plato had divided the sentence into noun and verb, signifying a thing and the action of a thing. Rhetoricians had enumerated various means of persuasion, some of which are logical forms, *e.g.* probability and sign, example and enthymeme. Among the

dialecticians, Socrates had used inductive arguments to obtain definitions as data of deductive arguments against his opponents, and Plato had insisted on the processes of ascending to and descending from an unconditional principle by the power of giving and receiving argument. All these points about speech, eloquence and argument between man and man were absorbed into Aristotle's theory of reasoning, and in particular the grammar of the sentence consisting of noun and verb caused the logic of the proposition consisting of subject and predicate. At the same time, Aristotle was well aware that the science of reasoning is no art of language and must take up a different position towards speech as the expression of thought. In the *Categories* he classified names, not, however, as a grammarian by their structure, but as a logician by their signification. In the *De interpretatione*, having distinguished the enunciation, or proposition, from other sentences as that in which there is truth or falsity, he relegated the rest to rhetoric or poetry, and founded the logic of the proposition, in which, however, he retained the grammatical analysis into noun and verb. In the *Analytics* he took the final step of originating the logical analysis of the proposition as premise into subject and predicate as terms mediated by the copula, and analysed the syllogism into these elements. Thus did he become the founder of the logical but linguistic analysis of reasoning as discourse (ὁ ἔξω λόγος) into propositions and terms. Nevertheless, the deeper question remained, what is the logical but mental analysis of reasoning itself (ὁ ἔσω λόγος) into its mental premises and conclusion?

Aristotle thus was the founder of logic as a science. But he laid too much stress on reasoning as syllogism or deduction, and on deductive science; and he laid too much stress on the linguistic analysis of rational discourse into proposition and terms. These two defects remain ingrained in technical logic to this day. But in the course of the development of the science, logicians have endeavoured to correct those defects, and have diverged into two schools. Some have devoted themselves to induction from sense and experience and widened logic till it has become a general science of inference and scientific method. Others have devoted themselves to the mental analysis of reasoning, and have narrowed logic into a science of conception, judgment and reasoning. The former belong to the school of empirical logic, the latter to the school of conceptual and formal logic. Both have started from points which Aristotle indicated without developing them. But we shall find that his true descendants are the empirical logicians.

Aristotle was the first of the empiricists. He consistently maintained that sense is knowledge of particulars and the origin of scientific knowledge of universals. In his view, sense is a congenital form of judgment (δύναμις σύμφυτος κριτική, *Post. An.* ii. 19); a sensation of each of the five senses is always true of its proper object; without sense there is no science; sense is the origin of induction, which is the origin of deduction and science. The *Analytics* end (*Post. An.* ii. 19) with a detailed system of empiricism, according to which sense is the primary knowledge of particulars, memory is the retention of a sensation, experience is the sum of many memories, induction infers universals, and intelligence is the true apprehension of the universal principles of science, which is rational, deductive, demonstrative, from empirical principles.

This empirical groundwork of Aristotle's logic was accepted by the Epicureans, who enunciated most distinctly the fundamental doctrine that all sensations are true of their immediate objects, and falsity begins with subsequent opinions, or what the moderns call "interpretation." Beneath deductive logic, in the logic of Aristotle and the canonic of the Epicureans, there already lay the basis of empirical logic: sensory experience is the origin of all inference and science. It remained for Francis Bacon to develop these beginnings into a new logic of induction. He did not indeed accept the infallibility of sense or of any other operation unaided. He thought, rather, that every operation becomes infallible by method. Following Aristotle in this order—sense, memory, intellect—he resolved the whole process of induction into three ministrations:—

1. The ministration to sense, aided by observation and experiment.

2. The ministration to memory, aided by registering and arranging the data, of observation and experiment in tables of instances of agreement, difference and concomitant variations.

3. The ministration to intellect or reason, aided by the negative elimination by means of contradictory instances of whatever in the instances is not always present, absent and varying with the given subject investigated, and finally by the positive inference that whatever in the instances is always present, absent and varying with the subject is its essential cause.

Bacon, like Aristotle, was anticipated in this or that point; but, as Aristotle was the first to construct a system of deduction in the syllogism and its three figures, so Bacon was the first to construct a system of induction in three ministrations, in which the requisites of induction, hitherto recognized only in sporadic hints, were combined for the first time in one logic of induction. Bacon taught men to labour in inferring from particular to universal, to lay as much stress on induction as on deduction, and to think and speak of inductive reasoning, inductive science, inductive logic. Moreover, while Aristotle had the merit of discerning the triplicity of inference, to Bacon we owe the merit of distinguishing the three processes without reduction:—

1. Inference from particular to particular by Experientia Literata, in plano;

2. Inference from particular to universal by Inductio, ascendendo;

3. Inference from universal to particular by Syllogism, descendendo.

In short, the comprehensive genius of Bacon widened logic into a general science of inference.

On the other hand, as Aristotle over-emphasized deduction so Bacon over-emphasized induction by contending that it is the only process of discovering universals (*axiomata*), which deduction only applies to particulars. J. S. Mill in his *Logic* pointed out this defect, and without departing from Baconian principles remedied it by quoting scientific examples, in which deduction, starting from inductive principles, applies more general to less general universals, *e.g.* when the more general law of gravitation is shown to include the less general laws of planetary gravitation. Mill's logic has the great merit of copiously exemplifying the principles of the variety of method according to subject-matter. It teaches us that scientific method is sometimes induction, sometimes deduction, and sometimes the consilience of both, either by the inductive verification of previous deductions, or by the deductive explanation of previous inductions.

It is also most interesting to notice that Aristotle saw further than Bacon in this direction. The founder of logic anticipated the latest logic of science, when he recognized, not only the deduction of mathematics, but also the experience of facts followed by deductive explanations of their causes in physics.

The consilience of empirical and deductive processes was an Aristotelian discovery, elaborated by Mill against Bacon. On the whole, however, Aristotle, Bacon and Mill, purged from their errors, form one empirical school, gradually growing by adapting itself to the advance of science; a school in which Aristotle was most influenced by Greek deductive Mathematics, Bacon by the rise of empirical physics at the Renaissance, and Mill by the Newtonian combination of empirical facts and mathematical principles in the *Principia*. From studying this succession of empirical logicians, we cannot doubt that sense, memory and experience are the real origin of inference, analogical, inductive and deductive. The deepest problem of logic is the relation of sense and inference. But we must first consider the mental analysis of inference, and this brings us to conceptual and formal logic.

Aristotle's logic has often been called formal logic; it was really a technical logic of syllogism analysed into linguistic elements, and of science rested on an empirical basis. At the same time his psychology, though maintaining his empiricism, contained some seeds of conceptual logic, and indirectly of formal logic. Intellectual development, which according to the logic of the *Analytics* consists of sense, memory, experience, induction and intellect, according to the psychology of the *De Anima* consists of sense, imagination and intellect, and one division of intellect is into conception of the undivided and combination of conceptions as one (*De An.* iii. 6). The *De Interpretatione* opens with a reference to this psychological distinction, implying that names represent conceptions, propositions represent combinations of conceptions. But the same passage relegates conceptions and their combinations to the *De Anima*, and confines the *De Interpretatione* to names and propositions in conformity with the linguistic analysis which pervades the logical treatises of Aristotle, who neither brought his psychological distinction between conceptions and their combinations into his logic, nor advanced the combinations of conceptions as a definition of judgment (κρίσις), nor employed the mental distinction between conceptions and judgments as an analysis of inference, or reasoning, or syllogism: he was no conceptual logician. The history of logic shows that the linguistic distinction between terms and propositions was the sole analysis of reasoning in the logical treatises of Aristotle; that the mental distinction between conceptions (ἔννοιαι) and judgments (ἀξιώματα in a wide sense) was imported into logic by the Stoics; and that this mental distinction became the logical analysis of reasoning under the authority of St Thomas Aquinas. In his commentary on the *De Interpretatione*, St Thomas, after citing from the *De Anima* Aristotle's "duplex operatio intellectus," said, "Additur autem et tertia operatio, scilicet ratiocinandi," and concluded that, since logic is a rational science (*rationalis scientia*), its consideration must be directed to all these operations of reason. Hence arose conceptual logic; according to which conception is a simple apprehension of an idea without belief in being or not being, *e.g.* the idea of man or of running; judgment is a combination of conceptions, adding being or not being, *e.g.* man is running or not running; and reasoning is a combination of judgments: conversely, there is a mental analysis of reasoning into judgments, and judgment into conceptions, beneath the linguistic analysis of rational discourse into propositions, and propositions into terms. Logic, according to this new school, which has by our time become an old school, has to co-ordinate these three operations, direct them, and, beginning with conceptions, combine conceptions into judgments, and judgments into inference, which thus becomes a complex combination of conceptions, or, in modern parlance, an extension of our ideas. Conceptual logicians were, indeed, from the first aware that sense supplies the data, and that judgment and therefore inference contains belief that things are or are not. But they held, and still hold that sensation and conception are alike mere apprehensions, and that the belief that things are or are not arises somehow after sensation and conception in judgment, from which it passes into inference. At first, they were more sanguine of extracting from these unpromising beginnings some knowledge of things beyond ideas. But at length many of them became formal logicians, who held that logic is the investigation of formal thinking, or consistent conception, judgment and reasoning; that it shows how we infer formal truths of consistency without material truth of signifying things; that, as the science of the form or process, it must entirely abstract from the matter, or objects, of thought; and that it does not tell us how we infer from experience. Thus has logic drifted further and further from the real and empirical logic of Aristotle the founder and Bacon the reformer of the science.

The great merit of conceptual logic was the demand for a mental analysis of mental reasoning, and the direct analysis of reasoning into judgments which are the sole premises and conclusions of reasoning and of all mental inferences. Aristotle had fallen into the paradox of resolving a mental act into verbal elements. The Schoolmen, however, gradually came to realize that the result to their logic was to make it a *sermocionalis scientia*, and to their metaphysics the danger of nominalism. St Thomas made a great advance by making logic throughout a *rationalis scientia*; and logicians are now agreed that reasoning consists of judgments, discourse of propositions. This distinction is, moreover, vital to the whole logic of inference, because we always think all the judgments of which our inference consists, but seldom state all the propositions by which it is expressed. We omit propositions, curtail them, and even express a judgment by a single term, *e.g.* "Good!" "Fire!". Hence the linguistic expression is not a true measure of inference; and to say that an inference consists of two propositions causing a third is not strictly true. But to say that it is two judgments causing a third is always true, and the very essence of inference, because we must think the two to conclude the third in "the sessions of sweet silent thought." Inference, in short, consists of actual judgments capable of being expressed in propositions.

> Inference always consists of judgments. But judgment does not always consist of conceptions. It is not a combination of conceptions; it does not arise from conceptions, nor even at first require conception. Sense is the origin of judgment. One who feels pained or pleased, who feels hot or cold or resisting in touch, who tastes the flavoured, who smells the odorous, who hears the sounding, who sees the coloured, or is conscious, already believes that something sensible exists before conception, before inference, and before language; and his belief is true of the immediate object of sense, the sensible thing, *e.g.* the hot felt in touch. But a belief in the existence of something is a judgment and a categorical judgment of existence. Sense, then, outer and inner, or sensation and consciousness, is the origin of sensory judgments which are true categorical beliefs in the existence of sensible things; and primary judgments are such true categorical sensory beliefs that things exist, and neither require conception nor are combinations of conceptions. Again, since sense is the origin of memory and experience, memorial and experiential judgments are categorical and existential judgments, which so far as they report sensory judgments are always true. Finally, since sense, memory and experience are the origin of inference, primary inference is categorical and existential, starting from sensory, memorial and experiential judgments as premises, and proceeding to inferential judgments as conclusions, which are categorical and existential, and are true, so far as they depend on sense, memory and experience.
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> Sense, then, is the origin of judgment; and the consequence is that primary judgments are true, categorical and existential judgments of sense, and primary inferences are inferences from categorical and existential premises to categorical and existential conclusions, which are true so far as they arise from outer and inner sense, and proceed to things similar to sensible things. All other judgments and inferences about existing things, or ideas, or names, whether categorical or hypothetical, are afterthoughts, partly true and partly false.
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> Sense, then, because it involves a true belief in existence is fitted to be the origin of judgment. Conception on the other hand is the simple apprehension of an idea, particular or universal, but without belief that anything is or is not, and therefore is unfitted to beget judgment. Nor could a combination of conceptions make a difference so fundamental as that between conceiving and believing. The most that it could do would be to cause an ideal judgment, *e.g.* that the idea of a centaur is the idea of a man-horse; and even here some further origin is needed for the addition of the copula "is."
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> So far from being a cause, conception is not even a condition of all judgments; a sensation of hot is sufficient evidence that hot exists, before the idea of hot is either present or wanted. Conception is, however, a condition of a memorial judgment: in order to remember being hot, we require an idea of hot. Memory, however, is not that idea, but involves a judgment that there previously existed the hot now represented by the idea, which is about the sensible thing beyond the conceived idea; and the cause of this memorial judgment is past sense and present memory. So sense, memory and experience, the sum of sense and memory, though requiring conception, are the causes of the experiential judgment that there exist and have existed many similar, sensible things, and these sensory, memorial and experiential judgments about the existence of past and present sensible things beyond conceived ideas become the particular

premises of primary inference. Starting from them, inference is enabled to draw conclusions which are inferential judgments about the existence of things similar to sensible things beyond conceived ideas. In rising, however, from particular to universal inference, induction, as we have seen, adds to its particular premise, S is P, a universal premise, every M is similar to S, in order to infer the universal conclusion, every M is P. This universal premise requires a universal conception of a class or whole number of similar particulars, as a condition. But the premise is not that conception; it is a belief that there is a whole number of particulars similar to those already experienced. The generalization of a class is not, as the conceptual logic assumes, the abstraction of a general idea, but an inference from the analogy of a whole individual thing, *e.g.* a whole man, to a whole number of similar individuals, *e.g.* the whole of men. The general idea of all men or the combination that the idea of all men is similar to the idea of particular men would not be enough; the universal premise that all men in fact are similar to those who have died is required to induce the universal conclusion that all men in fact die. Universal inference thus requires particular and universal conceptions as its condition; but, so far as it arises from sense, memory, experience, and involves generalization, it consists of judgments which do not consist of conceptions, but are beliefs in things existing beyond conception. Inference then, so far as it starts from categorical and existential premises, causes conclusions, or inferential judgments, which require conceptions, but are categorical and existential judgments beyond conception. Moreover, as it becomes more deductive, and causes conclusions further from sensory experience, these inferential judgments become causes of inferential conceptions. For example, from the evidence of molar changes due to the obvious parts of bodies, science first comes to believe in molecular changes due to imperceptible particles, and then tries to conceive the ideas of particles, molecules, atoms, electrons. The conceptual logic supposes that conception always precedes judgment; but the truth is that sensory judgment begins and inferential judgment ends by preceding conception. The supposed triple order—conception, judgment, reasoning—is defective and false. The real order is sensation and sensory judgment, conception, memory and memorial judgment, experience and experiential judgment, inference, inferential judgment, inferential conception. This is not all: inferential conceptions are inadequate, and finally fail. They are often symbolical; that is, we conceive one thing only by another like it, *e.g.* atoms by minute bodies not nearly small enough. Often the symbol is not like. What idea can the physicist form of intraspatial ether? What believer in God pretends to conceive Him as He really is? We believe many things that we cannot conceive; as Mill said, the inconceivable is not the incredible; and the point of science is not what we can conceive but what we should believe on evidence. Conception is the weakest, judgment the strongest power of man's mind. Sense before conception is the original cause of judgment; and inference from sense enables judgment to continue after conception ceases. Finally, as there is judgment without conception, so there is conception without judgment. We often say "I understand, but do not decide." But this suspension of judgment is a highly refined act, unfitted to the beginning of thought. Conception begins as a condition of memory, and after a long continuous process of inference ends in mere ideation. The conceptual logic has made the mistake of making ideation a stage in thought prior to judgment.

It was natural enough that the originators of conceptual logic, seeing that judgments can be expressed by propositions, and conceptions by terms, should fall into the error of supposing that, as propositions consist of terms, so judgments consist of conceptions, and that there is a triple mental order—conception, judgment, reasoning—parallel to the triple linguistic order—term, proposition, discourse. They overlooked the fact that man thinks long before he speaks, makes judgments which he does not express at all, or expresses them by interjections, names and phrases, before he uses regular propositions, and that he does not begin by conceiving and naming, and then proceed to believing and proposing. Feeling and sensation, involving believing or judging, come before conception and language. As conceptions are not always present in judgment, as they are only occasional conditions, and as they are unfitted to cause beliefs or judgments, and especially judgments of existence, and as judgments both precede conceptions in sense and continue after them in inference, it follows that conceptions are not the constituents of judgment, and judgment is not a combination of conceptions. Is there then any analysis of judgment? Paradoxical as it may sound, the truth seems to be that primary judgment, beginning as it does with the simplest feeling and sensation, is not a combination of two mental elements into one, but is a division of one sensible thing into the thing itself and its existence and the belief that it is determined as existing, *e.g.* that hot exists, cold exists, the pained exists, the pleased exists. Such a judgment has a cause, namely sense, but no mental elements. Afterwards come judgments of complex sense, *e.g.* that the existing hot is burning or becoming more or less hot, &c. Thus there is a combination of sensations causing the judgment; but the judgment is still a division of the sensible thing into itself and its being, and a belief that it is so determined. Afterwards follow judgments arising from more complex causes, *e.g.* memory, experience, inference. But however complicated these mental causes, there still remain these points common to all judgment:—(1) The mental causes of judgment are sense, memory, experience and inference; while conception is a condition of some judgments. (2) A judgment is not a combination either of its causes or of its conditions, *e.g.* it is not a combination of sensations any more than of ideas. (3) A judgment is a unitary mental act, dividing not itself but its object into the object itself and itself as determined, and signifying that it is so determined. (4) A primary judgment is a judgment that a sensible thing is determined as existing; but later judgments are concerned with either existing things, or with ideas, or with words, and signify that they are determined in all sorts of ways. (5) When a judgment is expressed by a proposition, the proposition expresses the results of the division by two terms, subject and predicate, and by the copula that what is signified by the subject is what is signified by the predicate; and the proposition is a combination of the two terms; *e.g.* border war is evil. (6) A complex judgment is a combination of two judgments, and may be copulative, *e.g.* you and I are men, or hypothetical, or disjunctive, &c.

Empirical logic, the logic of Aristotle and Bacon, is on the right way. It is the business of the logician to find the causes of the judgments which form the premises and the conclusions of inference, reasoning and science. What knowledge do we get by sense, memory and experience, the first mental causes of judgment? What is judgment, and what its various kinds? What is inference, how does it proceed by combining judgments as premises to cause judgments as conclusions, and what are its various kinds? How does inference draw conclusions more or less probable up to moral certainty? How does it by the aid of identification convert probable into necessary conclusions, which become necessary principles of demonstration? How is categorical succeeded by conditional inference? What is scientific method as a system of inferences about definite subjects? How does inference become the source of error and fallacy? How does the whole process from sense to inference discover the real truth of judgments, which are true so far as they signify things known by sense, memory, experience and inference? These are the fundamental questions of the science of inference. Conceptual logic, on the other hand, is false from the start. It is not the first business of logic to direct us how to form conceptions signified by terms, because sense is a prior cause of judgment and inference. It is not the second business of logic to direct us how out of conceptions to form judgments signified by propositions, because the real causes of judgments are sense, memory, experience and inference. It is, however, the main business of logic to direct us how out of judgments to form inferences signified by discourse; and this is the one point which conceptual logic has contributed to the science of inference. But why spoil the further mental analysis of inference by supposing that conceptions are constituents of judgment and therefore of inference, which thus becomes merely a complex combination of conceptions, an extension of ideas? The mistake has been to convert three operations of mind into three processes in a fixed order—conception, judgment, inference. Conception and judgment are decisions: inference alone is a process, from decisions to decision, from judgments to judgment. Sense, not conception, is the origin of judgment. Inference is the process which from judgments about sensible things proceeds to judgments about things similar to sensible things. Though some conceptions are its conditions and some judgments its causes, inference itself in its conclusions causes many more judgments and conceptions. Finally, inference is an extension, not

of ideas, but of beliefs, at first about existing things, afterwards about ideas, and even about words; about anything in short about which we think, in what is too fancifully called “the universe of discourse.”

Formal logic has arisen out of the narrowness of conceptual logic. The science of inference no doubt has to deal primarily with formal truth or the consistency of premises and conclusion. But as all truth, real as well as formal, is consistent, formal rules of consistency become real rules of truth, when the premises are true and the consistent conclusion is therefore true. The science of inference again rightly emphasizes the formal thinking of the syllogism in which the combination of premises involves the conclusion. But the combinations of premises in analogical and inductive inference, although the combination does not involve the conclusion, yet causes us to infer it, and in so similar a way that the science of inference is not complete without investigating all the combinations which characterize different kinds of inference. The question of logic is how we infer in fact, as well as perfectly; and we cannot understand inference unless we consider inferences of probability of all kinds. Moreover, the study of analogical and inductive inference is necessary to that of the syllogism itself, because they discover the premises of syllogism. The formal thinking of syllogism alone is merely necessary consequence; but when its premises are necessary principles, its conclusions are not only necessary consequents but also necessary truths. Hence the manner in which induction aided by identification discovers necessary principles must be studied by the logician in order to decide when the syllogism can really arrive at necessary conclusions. Again, the science of inference has for its subject the form, or processes, of thought, but not its matter or objects. But it does not follow that it can investigate the former without the latter. Formal logicians say that, if they had to consider the matter, they must either consider all things, which would be impossible, or select some, which would be arbitrary. But there is an intermediate alternative, which is neither impossible nor arbitrary; namely, to consider the general distinctions and principles of all things; and without this general consideration of the matter the logician cannot know the form of thought, which consists in drawing inferences about things on these general principles. Lastly, the science of inference is not indeed the science of sensation, memory and experience, but at the same time it is the science of using those mental operations as data of inference; and, if logic does not show how analogical and inductive inferences directly, and deductive inferences indirectly, arise from experience, it becomes a science of mere thinking without knowledge.

Logic is related to all the sciences, because it considers the common inferences and varying methods used in investigating different subjects. But it is most closely related to the sciences of metaphysics and psychology, which form with it a triad of sciences. Metaphysics is the science of being in general, and therefore of the things which become objects apprehended by our minds. Psychology is the science of mind in general, and therefore of the mental operations, of which inference is one. Logic is the science of the processes of inference. These three sciences, of the objects of mind, of the operations of mind, of the processes used in the inferences of mind, are differently, but closely related, so that they are constantly confused. The real point is their interdependence, which is so intimate that one sign of great philosophy is a consistent metaphysics, psychology and logic. If the world of things is *known* to be partly material and partly mental, then the mind must have powers of sense and inference enabling it to know these things, and there must be processes of inference carrying us from and beyond the sensible to the insensible world of matter and mind. If the whole world of things is matter, operations and processes of mind are themselves material. If the whole world of things is mind, operations and processes of mind have only to recognize their like all the world over. It is clear then that a man’s metaphysics and psychology must colour his logic. It is accordingly necessary to the logician to know beforehand the general distinctions and principles of things in metaphysics, and the mental operations of sense, conception, memory and experience in psychology, so as to discover the processes of inference from experience about things in logic.

The interdependence of this triad of sciences has sometimes led to their confusion. Hegel, having identified being with thought, merged metaphysics in logic. But he divided logic into objective and subjective, and thus practically confessed that there is one science of the objects and another of the processes of thought. Psychologists, seeing that inference is a mental operation, often extemporize a theory of inference to the neglect of logic. But we have a double consciousness of inference. We are conscious of it as one operation among many, and of its omnipresence, so to speak, to all the rest. But we are also conscious of the processes of the operation of inference. To a certain extent this second consciousness applies to other operations: for example, we are conscious of the process of association by which various mental causes recall ideas in the imagination. But how little does the psychologist know about the association of ideas, compared with what the logician has discovered about the processes of inference! The fact is that our primary consciousness of all mental operations is hardly equal to our secondary consciousness of the processes of the one operation of inference from premises to conclusions permeating long trains and pervading whole sciences. This elaborate consciousness of inferential process is the justification of logic as a distinct science, and is the first step in its method. But it is not the whole method of logic, which also and rightly considers the mental process necessary to language, without substituting linguistic for mental distinctions.

Nor are consciousness and linguistic analysis all the instruments of the logician. Logic has to consider the things we know, the minds by which we know them from sense, memory and experience to inference, and the sciences which systematize and extend our knowledge of things; and having considered these facts, the logician must make such a science of inference as will explain the power and the poverty of human knowledge.

General Tendencies of Modern Logic

There are several grounds for hope in the logic of our day. In the first place, it tends to take up an intermediate position between the extremes of Kant and Hegel. It does not, with the former, regard logic as purely formal in the sense of abstracting thought from being, nor does it follow the latter in amalgamating metaphysics with logic by identifying being with thought. Secondly, it does not content itself with the mere formulae of thinking, but pushes forward to theories of method, knowledge and science; and it is a hopeful sign to find this epistemological spirit, to which England was accustomed by Mill, animating German logicians such as Lotze, Dühring, Schuppe, Sigwart and Wundt. Thirdly, there is a determination to reveal the psychological basis of logical processes, and not merely to describe them as they are in adult reasoning, but to explain also how they arise from simpler mental operations and primarily from sense. This attempt is connected with the psychological turn given to recent philosophy by Wundt and others, and is dangerous only so far as psychology itself is hypothetical. Unfortunately, however, these merits are usually connected with a less admirable characteristic—contempt for tradition, Writing his preface to his second edition in 1888, Sigwart says: “Important works have appeared by Lotze, Schuppe, Wundt and Bradley, to name only the most eminent; and all start from the conception which has guided this attempt. That is, logic is grounded by them, not upon an effete tradition but upon a new investigation of thought as it actually is in its psychological foundations, in its significance for knowledge, and its actual operation in scientific methods.” How strange! The spirit of every one of the three reforms above enumerated is an unconscious return to Aristotle’s *Organon*. Aristotle’s was a logic which steered, as Trendelenburg has shown, between Kantian formalism and Hegelian metaphysics; it was a logic which in the Analytics investigated the syllogism as a means to understanding knowledge and science: it was a logic which, starting from the psychological foundations of sense, memory and experience, built up the logical structure of

induction and deduction on the profoundly Aristotelian principle that “there is no process from universals without induction, and none by induction without sense.” Wundt’s comprehensive view that logic looks backwards to psychology and forward to epistemology was hundreds of years ago one of the many discoveries of Aristotle.

Judgment

1. *Judgment and Conception.*—The emphasis now laid on judgment, the recovery from Hume’s confusion of beliefs with ideas and the association of ideas, and the distinction of the mental act of judging from its verbal expression in a proposition, are all healthy signs in recent logic. The most fundamental question, before proceeding to the investigation of inference, is not what we say but what we think in making the judgments which, whether we express them in propositions or not, are both the premises and the conclusion of inference; and, as this question has been diligently studied of late, but has been variously answered, it will be well to give a list of the more important theories of judgment as follows:—

a. It expresses a relation between the content of two ideas, not a relation of these ideas (Lotze).

b. It is consciousness concerning the objective validity of a subjective combination of ideas, *i.e.* whether between the corresponding objective elements an analogous combination exists (Ueberweg).

c. It is the synthesis of ideas into unity and consciousness of their objective validity, not in the sense of agreement with external reality but in the sense of the logical necessity of their synthesis (Sigwart).

d. It is the analysis of an aggregate idea (*Gesammtvorstellung*) into subject and predicate; based on a previous association of ideas, on relating and comparing, and on the apperceptive synthesis of an aggregate idea in consequence; but itself consisting in an apperceptive analysis of that aggregate idea; and requiring will in the form of apperception or attention (Wundt).

e. It requires an idea, because every object is conceived as well as recognized or denied; but it is itself an assertion of actual fact, every perception counts for a judgment, and every categorical is changeable into an existential judgment without change of sense (Brentano, who derives his theory from Mill except that he denies the necessity of a combination of ideas, and reduces a categorical to an existential judgment).

f. It is a decision of the validity of an idea requiring will (Bergmann, following Brentano).

g. Judgment (*Urtheil*) expresses that two ideas belong together: “by-judgment” (*Beurtheilung*) is the reaction of will expressing the validity or invalidity of the combination of ideas (Windelband, following Bergmann, but distinguishing the decision of validity from the judgment).

h. Judgment is consciousness of the identity or difference and of the causal relations of the given; naming the actual combinations of the data, but also requiring a priori categories of the understanding, the notions of identity, difference and causality, as principles of thought or laws, to combine the plurality of the given into a unity (Schuppe).

i. Judgment is the act which refers an ideal content recognized as such to a reality beyond the act, predicating an idea of a reality, a what of a that; so that the subject is reality and the predicate the meaning of an idea, while the judgment refers the idea to reality by an identity of content (Bradley and Bosanquet).

k. Judgment is an assertion of reality, requiring comparison and ideas which render it directly expressible in words (Hobhouse, mainly following Bradley).

These theories are of varying value in proportion to their proximity to Aristotle’s point that predication is about things, and to Mill’s point that judgments and propositions are about things, not about ideas. The essence of judgment is belief that something is (or is not) determined, either as existing (*e.g.* “I am,” “A centaur is not”) or as something in particular (*e.g.* “I am a man,” “I am not a monkey”). Neither Mill, however, nor any of the later logicians whose theories we have quoted, has been able quite to detach judgment from conception; they all suppose that an idea, or ideas, is a condition of all judgment. But judgment starts from sensation (*Empfindung*) and feeling (*Gefühl*), and not from idea (*Vorstellung*). When I feel pleased or pained, or when I use my senses to perceive a pressure, a temperature, a flavour, an odour, a colour, a sound, or when I am conscious of feeling and perceiving, I cannot resist the belief that something sensible is present; and this belief that something exists is already a judgment, a judgment of existence, and, so far as it is limited to sense without inference, a true judgment. It is a matter of words whether or not we should call this sensory belief a judgment; but it is no matter of choice to the logician, who regards all the constituents of inference as judgments; for the fundamental constituents are sensory beliefs, which are therefore judgments in the logical sense. Sense is the evidence of inference; directly of analogical and inductive, directly or indirectly of deductive, inference; and therefore, if logic refuses to include sensory beliefs among judgments, it will omit the fundamental constituents of inference, inference will no longer consist of judgments but of sensory beliefs plus judgments, and the second part of logic, the logic of judgment, the purpose of which is to investigate the constituents of inference, will be like *Hamlet* without the prince of Denmark. If, on the other hand, all the constituents of inference are judgments, there are judgments of sense; and the evidence of the senses means that a judgment of sense is true, while a judgment of inference is true so far as it is directly or indirectly concluded from judgments of sense. Now a sensory judgment, *e.g.* that a sensible pressure is existing, is explained by none of the foregoing theories, because it requires nothing but sensation and belief. It requires no will, but is usually involuntary, for the stimulus forces one’s attention, which is not always voluntary; not all judgment then requires will, as Wundt supposes. It requires no reference to reality beyond the sensible pressure, because it is merely a belief that this exists without inference of the external stimulus or any inference at all: not all judgment then requires the reference of subjective to objective supposed by Ueberweg, or the consciousness of logical necessity supposed by Sigwart. It requires in addition to the belief that something exists, no consideration as to whether the belief itself be true, because a man who feels pressure believes in the thing without further question about the belief: not all judgment then requires a decision of validity, as Bergmann supposes. It requires nothing beyond the sensation and belief in the given existence of the given pressure: not all judgment then requires categories of understanding, or notions of identity, difference and causality, or even of existence, such as Schuppe supposes. It requires no comparison in order to express it in words, for a judgment need not be expressed, and a sensory judgment of pressure is an irresistible belief that a real pressure exists, without waiting for words, or for a comparison which is wanted not to make a sensation a judgment, but to turn a judgment into language: not all judgment then requires comparison with a view to its expression, as supposed by Hobhouse. Lastly, all the authors of the above-quoted theories err in supposing that all judgment requires conception; for even Mill thinks a combination of ideas necessary, and Brentano, who comes still nearer to the nature of sensory judgment when he says, “Every perception counts for a judgment,” yet thinks that an idea is necessary at the same time in order to understand the thing judged. In reality, the sensation and the belief are sufficient; when I feel a sensible pressure, I cannot help believing in its reality, and therefore judging that it is real, without any *tertium quid*—an idea of pressure, or of existence or of pressure existing—intervening between the sensation and the belief. Only after sensation has ceased does an idea, or representation of what is not presented, become necessary as a substitute for a sensation and

as a condition not of the first judgment that there is, but of a second judgment that there was, something sensible. Otherwise there would be no judgment of sensible fact, for the first sensation would not give it, and the idea following the sensation would be still farther off. The sensory judgment then, which is nothing but a belief that at the moment of sense something sensible exists, is a proof that not all judgment requires conception, or synthesis or analysis of ideas, or decision about the content, or about the validity, of ideas, or reference of an ideal content to reality, as commonly, though variously, supposed in the logic of our day.

Not, however, that all judgment is sensory: after the first judgments of sense follow judgments of memory, and memory requires ideas. Yet memory is not mere conception, as Aristotle, and Mill after him, have perceived. To remember, we must have a present idea; but we must also have a belief that the thing, of which the idea is a representation, was (or was not) determined; and this belief is the memorial judgment. Originally such judgments arise from sensory judgments followed by ideas, and are judgments of memory after sense that something sensible existed, *e.g.* pressure existed: afterwards come judgments of memory after inference, *e.g.* Caesar was murdered. Finally, most judgments are inferential. These are conclusions which primarily are inferred from sensory and memorial judgments; and so far as inference starts from sense of something sensible in the present, and from memory after sense of something sensible in the past, and concludes similar things, inferential judgments are indirect beliefs in being and in existence beyond ideas. When from the sensible pressures between the parts of my mouth, which I feel and remember and judge that they exist and have existed, I infer another similar pressure (*e.g.* of the food which presses and is pressed by my mouth in eating), the inferential judgment with which I conclude is a belief that the latter exists as well as the former (*e.g.* the pressure of food without as well as the sensible pressures within). Inference, no doubt, is closely involved with conception. So far as it depends on memory, an inferential judgment presupposes memorial ideas in its data; and so far as it infers universal classes and laws, it produces general ideas. But even so the part played by conception is quite subordinate to that of belief. In the first place, the remembered datum, from which an inference of pressure starts, is not the conceived idea, but the belief that the sensible pressure existed. Secondly, the conclusion in which it ends is not the general idea of a class, but the belief that a class, represented by a general idea, exists, and is (or is not) otherwise determined (*e.g.* that things pressing and pressed exist and move). Two things are certain about inferential judgment: one, that when inference is based on sense and memory, inferential judgment starts from a combination of sensory and memorial judgment, both of which are beliefs that things exist; the other, that in consequence inferential judgment is a belief that similar things exist. There are thus three primary judgments: judgments of sense, of memory after sense, and of inference from sense. All these are beliefs in being and existence, and this existential belief is first in sense, and afterwards transferred to memory and inference. Moreover, it is transferred in the same irresistible way: frequently we cannot help either feeling pressure, or remembering it, or inferring it; and as there are involuntary sensation and attention, so there are involuntary memory and inference. Again, in a primary judgment existence need not be expressed; but if expressed, it may be expressed either by the predicate, *e.g.* "I exist," or by the subject, *e.g.* "I who exist think." There are indeed differences between primary judgments, in that the sensory is a belief in present, the memorial in past, and the inferential in present, past and future existence. But these differences in detail do not alter the main point that all these are beliefs in the existing, in the real as opposed to the ideal, in actual things which are not ideas. In short, a primary judgment is a belief in something existing apart from our idea of it; and not because we have an idea of it, or by comparing an idea with, or referring an idea to, reality; but because we have a sensation of it, or a memory of it or an inference of it. Sensation, not conception, is the origin of judgment.

2. *Different Significations of Being in different Kinds of Judgment.*—As Aristotle remarked both in the *De Interpretatione* and in the *Sophistici Elenchi*, "not-being is thinkable" does not mean "not-being exists." In the latter treatise he added that it is a *fallacia a dicto secundum quid ad dictum simpliciter* to argue from the former to the latter; "for," as he says, "it is not the same thing to be something and to exist absolutely." Without realizing their debt to tradition, Herbart, Mill and recently Sigwart, have repeated Aristotle's separation of the copula from the verb of existence, as if it were a modern discovery that "is" is not the same as "exists." It may be added that they do not quite realize what the copula exactly signifies: it does not signify existence, but it does signify a fact, namely, that something is (or is not) determined, either absolutely in a categorical judgment, or conditionally in a conditional judgment. Now we have seen that all primary judgments signify more than this fact; they are also beliefs in the existence of the thing signified by the subject. But, in the first place, primary judgments signify this existence never by the copula, but sometimes by the predicate, and sometimes by the subject; and, secondly, it does not follow that all judgments whatever signify existence. Besides inference of existence there is inference of non-existence, of things inconsistent with the objects of primary judgments. Hence secondary judgments, which no longer contain a belief that the thing exists, *e.g.* the judgment, "not-being is thinkable," cited by Aristotle; the judgment, "A square circle is impossible," cited by Herbart; the judgment, "A centaur is a fiction of the poets," cited by Mill. These secondary judgments of non-existence are partly like and partly unlike primary judgments of existence. They resemble them in that they are beliefs in being signified by the copula. They are beliefs in things of a sort; for, after all, ideas and names are things; their objects, even though non-existent, are at all events things conceivable or nameable; and therefore we are able to make judgments that things, non-existent but conceivable or nameable, are (or are not) determined in a particular manner. Thus the judgment about a centaur is the belief, "A conceivable centaur is a fiction of the poets," and the judgment about a square circle is the belief, "A so-called square circle is an impossibility." But, though beliefs that things of some sort are (or are not) determined, these secondary judgments fall short of primary judgments of existence. Whereas in a primary judgment there is a further belief, signified by subject or predicate, that the thing is an existing thing in the sense of being a real thing (*e.g.* a man), different from the idea of it as well as from the name for it; in a secondary judgment there is no further belief that the thing has any existence beyond the idea (*e.g.* a centaur), or even beyond the name (*e.g.* a square circle): though the idea or name exists, there is no belief that anything represented by idea or name exists. Starting, then, from this fundamental distinction between judgments of existence and judgments of non-existence, we may hope to steer our way between two extreme views which emanate from two important thinkers, each of whom has produced a flourishing school of psychological logic.

On the one hand, early in the 19th century Herbart started the view that a categorical judgment is never a judgment of existence, but always hypothetical; on the other hand, in the latter part of the century Brentano started the view that all categorical judgments are existential. The truth lies between these contraries. The view of Herbart and his school is contradicted by our primary judgments of and from sense, in which we cannot help believing existence; and it gives an inadequate account even of our secondary judgments in which we no longer indeed believe existence, but do frequently believe that a non-existent thing is (or is not) somehow determined unconditionally. It is true, as Herbart says, that the judgment, "A square circle is an impossibility," does not contain the belief, "A square circle is existent"; but when he goes on to argue that it means, "If a square circle is thought, the conception of impossibility must be added in thought," he falls into a *non-sequitur*. To be categorical, a judgment does not require a belief in existence, but only that something, existent or not, is (or is not) determined; and there are two quite different attitudes of mind even to a non-existent thing, such as a square circle, namely, unconditional and conditional belief. The judgment, "A non-existent but so-called square circle is an impossibility," is an unconditional, or categorical judgment of non-existence,

quite different from any hypothetical judgment, which depends on the conditions “if it is thought,” or “if it exists,” or any other “if.” On the other hand, the view of Brentano and his school is contradicted by these very categorical judgments of non-existence; and while it applies only to categorical judgments of existence, it does so inadequately. To begin with the latter objection, Brentano proposed to change the four Aristotelian forms of judgment, A, E, I, O, into the following existential forms:—

A. “There is not an immortal man.”

E. “There is not a live stone.”

I. “There is a sick man.”

O. “There is an unlearned man.”

This reconstruction, which merges subject and predicate in one expression, in order to combine it with the verb of existence, is repeated in similar proposals of recent English logicians. Venn, in his *Symbolic Logic*, proposes the four forms, $x\bar{y} = 0$, $xy = 0$, $xy > 0$, $x\bar{y} > 0$ (where $\bar{y}$ means “not-y”), but only as alternative to the ordinary forms. Bradley says that “‘S-P is real’ attributes S-P, directly or indirectly, to the ultimate reality,” and agrees with Brentano that “‘is’ never stands for anything but ‘exists’”; while Bosanquet, who follows Bradley, goes so far as to define a categorical judgment as “that which affirms the existence of its subject, or, in other words, asserts a fact.” Now it is true that our primary judgments do contain a belief in existence; but they do not all contain it in the same way, but are beliefs sometimes that something is determined as existing, and sometimes that something existing is particularly determined. Brentano’s forms do not express such a judgment of existence, as “All existing men are mortal”: nor does Bradley’s form, “Reality includes S-P.” Metaphysically, all realities are parts of one ultimate reality; but logically, even philosophers think more often only of finite realities, existing men, dogs, horses, &c.; and children know that their parents exist long before they apprehend ultimate reality. The normal form, then, of a judgment of existence is either “S is a real P,” or “A real S is P.” Hence the reconstruction of all categorical judgments by merging subject and predicate, either on Brentano’s or on Bradley’s plan, is a misrepresentation even of normal categorical judgments of existence. Secondly, it is much more a misrepresentation of categorical judgments of non-existence. No existential form suits a judgment such as “A centaur is a fiction,” when we do not believe that there is a centaur, or that reality includes a centaur. As Mill pointed out, it cannot be implied that a centaur exists, since the very thing asserted is that the thing has no real existence. In a correspondence with Mill, Brentano rejoined that the centaur exists in imagination; Bradley says, “inside our heads.” According to one, then, the judgment becomes “There is an imaginary centaur”; according to the other “Reality includes an imaginary centaur.” The rejoinder, however, though partly true, is not to the point. The idea of the centaur does exist in our imagination, and inside our heads, and the name of it in our mouths. But the point is that the centaur conceived and named does not exist beyond the idea of it and the name for it; it is not, like a man, a real thing which is neither the idea of it nor the name for it. No amount of subtlety will remove the difference between a categorical judgment of existence, *e.g.* “An existing man is mortal,” and a categorical judgment of non-existence, *e.g.* “A conceivable centaur is a fiction,” because in the former we believe and mean that the thing exists beyond the idea, and in the latter we do not. If, contrary to usage, we choose to call the latter a judgment of existence, there is no use in quarrelling about words; but we must insist that new terms must in that case be invented to express so fundamental a difference as that between judgments about real men and judgments about ideal centaurs. So long, however, as we use words in the natural sense, and call the former judgments of existence, and the latter judgments of non-existence, then “is” will not be, as Bradley supposes, the same as “exists,” for we use “is” in both judgments, but “exists” only in the first kind. Bosanquet’s definition of a categorical judgment contains a similar confusion. To assert a fact and to affirm the existence of a subject are not, as he makes out, the same thing: a judgment often asserts a fact and denies existence in the same breath, *e.g.* “Jupiter is non-existent.” Here, as usual in logic, tradition is better than innovation. All categorical judgment is an unconditional belief in the fact, signified by the copula, that a thing of some sort is (or is not) determined; but some categorical judgments are also beliefs that the thing is an existing thing, signified either by the subject or by the predicate, while others are not beliefs that the thing exists at all, but are only beliefs in something conceivable, or nameable, or in something or other, without particularizing what. Judgment then always signifies being, but not always existence.

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3. *Particular and Universal Judgments.*—Aristotle, by distinguishing affirmative and negative, particular and universal, made the fourfold classification of judgments, A, E, I and O, the foundation both of opposition and of inference. With regard to inference, he remarked that a universal judgment means by “all,” not every individual we know, but every individual absolutely, so that, when it becomes a major premise, we know therein every individual universally, not individually, and often do not know a given individual individually until we add a minor premise in a syllogism. Whereas, then, a particular judgment is a belief that some, a universal judgment is a belief that all, the individuals of a kind or total of similar individuals, are similarly determined, whether they are known or unknown individuals. Now, as we have already seen, what is signified by the subject may be existing or not, and in either case a judgment remains categorical so long as it is a belief without conditions. Thus, “Some existing men are poets,” “All existing men are mortal,” “Some conceivable centaurs are human in their forequarters,” “All conceivable centaurs are equine in their hindquarters,” are all categorical judgments, while the two first are also categorical judgments of existence. Nevertheless these obvious applications of Aristotelian traditions have been recently challenged, especially by Sigwart, who holds in his *Logic* (secs. 27, 36) that, while a particular is a categorical judgment of existence, a universal is hypothetical, on the ground that it does not refer to a definite number of individuals, or to individuals at all, but rather to general ideas, and that the appropriate form of “all M is P” is “if anything is M it is P.” This view, which has influenced not only German but also English logicians, such as Venn, Bradley and Bosanquet, destroys the fabric of inference, and reduces scientific laws to mere hypotheses. In reality, however, particular and universal judgments are too closely connected to have such different imports. In opposition, a categorical particular is the contradictory of a universal, which is also categorical, not hypothetical, *e.g.*, “not all M is P” is the contradictory of “all M is P,” not of “if anything is M it is P.” In inference, a particular is an example of a universal which in its turn may become a particular example of a higher universal. For instance, in the history of mechanics it was first inferred from some that all terrestrial bodies gravitate, and then from these as some that all ponderable bodies, terrestrial and celestial, gravitate. How absurd to suppose that here we pass from a particular categorical to a universal hypothetical, and then treat this very conclusion as a particular categorical to pass to a higher universal hypothetical! Sigwart, indeed, is deceived both about particulars and universals. On the one hand, some particulars are not judgments of existence, *e.g.* “some imaginary deities are goddesses”; on the other hand, some universals are not judgments of non-existence, *e.g.* “every existing man is mortal.” Neither kind is always a judgment of existence, but each is sometimes the one and sometimes the other. In no case is a universal hypothetical, unless we think it under a condition; for in a universal judgment about the non-existing, *e.g.* about all conceivable centaurs, we do not think, “If anything is a centaur,” because we do not believe that there are any; and in a universal judgment about the existent, *e.g.* about all existing men, we do not think, “If anything is a man,” because we believe that there is a whole class of men existing at different times and places. The cause of Sigwart’s error is his misconception of “all.” So far as he follows Aristotle in saying that “all” does not mean a definite number of individuals he is right; but when he says that we mean no

individuals at all he deserts Aristotle and goes wrong. By “all” we mean every individual whatever of a kind; and when from the experience of sense and memory we start with particular judgments of existence, and infer universal judgments of existence and scientific laws, we further mean those existing individuals which we have experienced, and every individual whatever of the kind which exists. We mean neither a definite number of individuals, nor yet an infinite number, but an incalculable number, whether experienced or inferred to exist. We do not mean existing here and now, nor yet out of time and place, but at any time and place (*semper et ubique*)—past, present and future being treated as simply existing, by what logicians used to call *suppositio naturalis*. We mean then by “all existing” every similar individual whatever, whenever, and wherever existing. Hence Sigwart is right in saying that “All bodies are extended” means “Whatever is a body is extended,” but wrong in identifying this form with “If anything is a body it is extended.” “Whatever” is not “if anything.” For the same reason it is erroneous to confuse “all existing” with a general idea. Nor does the use of abstract ideas and terms make any difference. When Bosanquet says that in “Heat is a mode of motion” there is no reference to individual objects, but “a pure hypothetical form which absolutely neglects the existence of objects,” he falls far short of expressing the nature of this scientific judgment, for in his *Theory of Heat* Clerk Maxwell describes it as “believing heat as it exists in a hot body to be in the form of kinetic energy.” As Bacon would say, it is a belief that all individual bodies *qua* hot are individually but similarly moving in their particles. When, again, Bradley and Bosanquet speak of the universal as if it always meant one ideal content referred to reality, they forget that in universal judgments of existence, such as “All men existing are mortal,” we believe that every individually existing man dies his own death individually, though similarly to other men; and that we are thinking neither of ideas nor of reality; but of all existent individual men being individually but similarly determined. A universal is indeed one whole; but it is one whole of many similars, which are not the same with one another. This is indeed the very essence of distribution, that a universal is predicable, not singly or collectively, but severally and similarly of each and every individual of a kind, or total of similar individuals. So also the essence of a universal judgment is that every individual of the kind is severally but similarly determined. Finally, a universal judgment is often existential; but whether it is so or not it remains categorical, so long as it introduces no hypothetical antecedent about the existence of the thing signified by the subject. It is true that even in universal judgments of existence there is often a hypothetical element; for example, “All men are mortal” contains a doubt whether every man whatever, whenever and wherever existing, must die. But this is only a doubt whether all the things signified by the subject are similarly determined as signified by the predicate, and not a doubt whether there are such things at all. Hence the hypothetical element is not a hypothetical antecedent “If anything is a man,” but an uncertain conclusion that “All existing men are mortal.” In other words, a categorical universal is often problematic, but a problematic is not the same as a hypothetical judgment.

4. *The Judgment and the Proposition.*—Judgment in general is the mental act of believing that something is (or is not) determined. A proposition is the consequent verbal expression of such a belief, and consists in asserting that the thing as signified by the subject is (or is not) determined as signified by the predicate. But the expression is not necessary. Sensation irresistibly produces a judgment of existence without needing language. Children think long before they speak; and indeed, as mere vocal sounds are not speech, and as the apprehension that a word signifies a thing is a judgment, judgment is originally not an effect, but a cause of significant language. At any rate, even when we have learnt to speak, we do not express all we think, as we may see not only from the fewness of words known to a child, but also from our own adult consciousness. The principle of thought is to judge enough to conclude. The principle of language is to speak only so far as to understand and be understood. Hence speech is only a curtailed expression of thought. Sometimes we express a whole judgment by one word, *e.g.* “Fire!” or by a phrase, *e.g.* “What a fire!” and only usually by a proposition. But even the normal proposition in the syllogistic form *tertii adjacentis*, with subject, predicate and copula, is seldom a complete expression of the judgment. The consequence is that the proposition, being different from a judgment arising after a judgment, and remaining an imperfect copy of judgment, is only a superficial evidence of its real nature. Fortunately, we have more profound evidences, and at least three evidences in all: the linguistic expression of belief in the proposition; the consciousness of what we mentally believe; and the analysis of reasoning, which shows what we must believe, and have believed, as data for inference. In these ways we find that a judgment is both different from, and more than, a proposition. But recent logicians, although they perceive the difference, nevertheless tend to make the proposition the measure of the judgment. This makes them omit sensory judgments, and count only those which require ideas, and even general ideas expressed in general terms. Sigwart, for example, gives as instances of our most elementary judgments, “This is Socrates,” “This is snow”—beliefs in things existing beyond ourselves which require considerable inferences from many previous judgments of sense and memory. Worse still, logicians seem unable to keep the judgment apart from the proposition. Herbart says that the judgment “A is B” does not contain the usually added thought that A is, because there is no statement of A’s existence; as if the statement mattered to the thought. So Sigwart, in order to reduce universals to hypotheticals, while admitting that existence is usually thought, argues that it is not stated in the universal judgment; so also Bosanquet. But in the judgment the point is not what we state, but what we think; and so long as the existence of A is added in thought, the judgment in question must contain the thought that A exists as well as that A is B, and therefore is a judgment that something is determined both as existing and in a particular manner. The statement only affects the proposition; and whenever we believe the existence of the thing, the belief in existence is part of the judgment thought, whether it is part of the proposition stated or not.

> Here Sir William Hamilton did a real service to logic in pointing out that “Logic postulates to be allowed to state explicitly in language all that is implicitly contained in the thought.” Not that men should or can carry this logical postulate out in ordinary life; but it is necessary in the logical analysis of judgments, and yet logicians neglect it. This is why they confuse the categorical and the universal with the hypothetical. Taking the carelessly expressed propositions of ordinary life, they do not perceive that similar judgments are often differently expressed, *e.g.* “I, being a man, am mortal,” and “If I am a man, I am mortal”; and conversely, that different judgments are often similarly expressed. In ordinary life we may say, “All men are mortal,” “All centaurs are figments,” “All square circles are impossibilities,” “All candidates arriving five minutes late are fined” (the last proposition being an example of the identification of categorical with hypothetical in Keynes’s *Formal Logic*). But of these universal propositions the first imperfectly expresses a categorical belief in existing things, the second in thinkable things, and the third in nameable things, while the fourth is a slipshod categorical expression of the hypothetical belief, “If any candidates arrive late they are fined.” The four judgments are different, and therefore logically the propositions fully expressing them are also different. The judgment, then, is the measure of the proposition, not the proposition the measure of the judgment. On the other hand, we may go too far in the opposite direction, as Hamilton did in proposing the universal quantification of the predicate. If the quantity of the predicate were always thought, it ought logically to be always stated. But we only sometimes think it. Usually we leave the predicate indefinite, because, as long as the thing in question is (or is not) determined, it does not matter about other things, and it is vain for us to try to think all things at once. It is remarkable that in *Barbara*, and therefore in many scientific deductions, to think the quantity of the predicate is not to the point either in the premises or in the conclusion; so that to quantify the propositions, as Hamilton proposes, would be to express more than a rational man thinks and judges. In judgments, and therefore in propositions, indefinite predicates are the rule, quantified predicates the exception. Consequently, A E I O are the normal propositions with indefinite predicates; whereas propositions with quantified predicates are only occasional forms, which we should use whenever we require

to think the quantity of the predicate, *e.g.* (1) in conversion, when we must think that all men are some animals, in order to judge that some animals are men; (2) in syllogisms of the 3rd figure, when the predicate of the minor premise must be particularly quantified in thought in order to become the particularly quantified subject of the conclusion; (3) in identical propositions including definitions, where we must think both that 1 + 1 are 2 and 2 are 1 + 1. But the normal judgment, and therefore the normal proposition, do not require the quantity of the predicate. It follows also that the normal judgment is not an equation. The symbol of equality (=) is not the same as the copula (is); it means "is equal to," where "equal to" is part of the predicate, leaving "is" as the copula. Now, in all judgment we think "is," but in few judgments predicate "equal to." In quantitative judgments we may think x = y, or, as Boole proposes, x = vy = (0/0)y or, as Jevons proposes, x = xy, or, as Venn proposes, x which is not y = 0; and equational symbolic logic is useful whenever we think in this quantitative way. But it is a byway of thought. In most judgments all we believe is that x is (or is not) y, that a thing is (or is not) determined, and that the thing signified by the subject is a thing signified by the predicate, but not that it is the only thing, or equal to everything signified by the predicate. The symbolic logic, which confuses "is" with "is equal to," having introduced a particular kind of predicate into the copula, falls into the mistake of reducing all predication to the one category of the quantitative; whereas it is more often in the substantial, *e.g.* "I am a man," not "I am equal to a man," or in the qualitative, *e.g.* "I am white," not "I am equal to white," or in the relative, *e.g.* "I am born in sin," not "I am equal to born in sin." Predication, as Aristotle saw, is as various as the categories of being. Finally, the great difficulty of the logic of judgment is to find the mental act behind the linguistic expression, to ascribe to it exactly what is thought, neither more nor less, and to apply the judgment thought to the logical proposition, without expecting to find it in ordinary propositions. Beneath Hamilton's postulate there is a deeper principle of logic—*A rational being thinks only to the point, and speaks only to understand and be understood*.

Inference

The nature and analysis of inference have been so fully treated in the Introduction that here we may content ourselves with some points of detail.

1. *False Views of Syllogism arising from False Views of Judgment.*—The false views of judgment, which we have been examining, have led to false views of inference. On the one hand, having reduced categorical judgments to an existential form, Brentano proposes to reform the syllogism, with the results that it must contain four terms, of which two are opposed and two appear twice; that, when it is negative, both premises are negative; and that, when it is affirmative, one premise, at least, is negative. In order to infer the universal affirmative that every professor is mortal because he is a man, Brentano's existential syllogism would run as follows:—

There is not a not-mortal man.
There is not a not-human professor.
∴ There is not a non-mortal professor.

On the other hand, if on the plan of Sigwart categorical universals were reducible to hypothetical, the same inference would be a pure hypothetical syllogism, thus:—

If anything is a man it is mortal.
If anything is a professor it is a man.
∴ If anything is a professor it is mortal.

But both these unnatural forms, which are certainly not analyses of any conscious process of categorical reasoning, break down at once, because they cannot explain those moods in the third figure, *e.g. Darapti*, which reason from universal premises to a particular conclusion. Thus, in order to infer that some wise men are good from the example of professors, Brentano's syllogism would be the following *non-sequitur*:—

There is not a not-good professor.
There is not a not-wise professor.
There is a wise good (*non-sequitur*).

So Sigwart's syllogism would be the following *non-sequitur*:—

If anything is a professor, it is good.
If anything is a professor, it is wise.
Something wise is good (*non-sequitur*).

But as by the admission of both logicians these reconstructions of *Darapti* are illogical, it follows that their respective reductions of categorical universals to existentials and hypotheticals are false, because they do not explain an actual inference. Sigwart does not indeed shrink from this and greater absurdities; he reduces the first figure to the *modus ponens* and the second to the *modus tollens* of the hypothetical syllogism, and then, finding no place for the third figure, denies that it can infer necessity; whereas it really infers the necessary consequence of particular conclusions. But the crowning absurdity is that, if all universals were hypothetical, *Barbara* in the first figure would become a purely hypothetical syllogism—a consequence which seems innocent enough until we remember that all universal affirmative conclusions in all sciences would with their premises dissolve into mere hypothesis. No logic can be sound which leads to the following analysis:—

If anything is a body it is extended.
If anything is a planet it is a body.
∴ If anything is a planet it is extended.

Sigwart, indeed, has missed the essential difference between the categorical and the hypothetical construction of syllogisms. In a categorical syllogism of the first figure, the major premise, "Every M whatever is P," is a universal, which we believe on account of previous evidence without any condition about the thing signified by the subject M, which we simply believe sometimes to be existent (*e.g.* "Every man existent"), and sometimes not (*e.g.*, "Every centaur conceivable"); and the minor premise, "S is M," establishes no part of the major, but adds the evidence of a particular not thought of in the major at all. But in a hypothetical syllogism of the ordinary mixed type, the first or hypothetical premise is a conditional belief, *e.g.* "If anything is M it is P," containing a hypothetical antecedent, "If anything is M," which is sometimes a hypothesis of existence (*e.g.* "If anything is an angel"), and sometimes a hypothesis of fact (*e.g.* "If an existing man is wise"); and the second premise or assumption, "Something is M," establishes part of the first, namely, the hypothetical antecedent, whether as regards existence (*e.g.* "Something is an angel"), or as regards fact (*e.g.* "This existing man is wise"). These very different relations of premises are obliterated by Sigwart's false

reduction of categorical universals to hypotheticals. But even Sigwart's errors are outdone by Lotze, who not only reduces "Every M is P" so "If S is M, S is P," but proceeds to reduce this hypothetical to the disjunctive, "If S is M, S is P^1 or P^2 or P^3," and finds fault with the Aristotelian syllogism because it contents itself with inferring "S is P" without showing what P. Now there are occasions when we want to reason in this disjunctive manner, to consider whether S is P^1 or P^2 or P^3, and to conclude that "S is a particular P"; but ordinarily all we want to know is that "S is P"; *e.g.* in arithmetic, that 2 + 2 are 4, not any particular 4, and in life that all our contemporaries must die, without enumerating all their particular sorts of deaths. Lotze's mistake is the same as that of Hamilton about the quantification of the predicate, and that of those symbolists who held that reasoning ought always to exhaust all alternatives by equations. It is the mistake of exaggerating exceptional into normal forms of thought, and ignoring the principle that a rational being thinks only to the point.

2. *Quasi-syllogisms.*—Besides reconstructions of the syllogistic fabric, we find in recent logic attempts to extend the figures of the syllogism beyond the syllogistic rules. An old error that we may have a valid syllogism from merely negative premises (*ex omnibus negativis*), long ago answered by Alexander and Boethius, is now revived by Lotze, Jevons and Bradley, who do not perceive that the supposed second negative is really an affirmative containing a "not" which can only be carried through the syllogism by separating it from the copula and attaching it to one of the extremes, thus:—

The just are not unhappy (*negative*).
The just are not-recognized (*affirmative*).
∴ Some not-recognized are not unhappy (*negative*).

Here the minor being the infinite term "not-recognized" in the conclusion, must be the same term also in the minor premise. Schuppe, however, who is a fertile creator of quasi-syllogisms, has managed to invent some examples from two negative premises of a different kind:—

(1)	(2)	(3)
No M is P.	No M is P.	No P is M.
S is not P.	S is not M.	S is not M.
∴ Neither S nor M is P.	∴ S may be P.	∴ S may be P.

But (1) concludes with a mere repetition, (2) and (3) with a contingent "may be," which, as Aristotle says, also "may not be," and therefore *nihil certo colligitur*. The same answer applies to Schuppe's supposed syllogisms from two particular premises:— 891

(1)	(2)
Some M is P.	Some M is P.
Some S is M.	Some M is S.
∴ Some S may be P.	∴ Some S may be P.

The only difference between these and the previous examples (2) and (3) is that, while those break the rule against two negative premises, these break that against undistributed middle. Equally fallacious are two other attempts of Schuppe to produce syllogisms from invalid moods:—

(1) 1st Fig.	(2) 2nd Fig.
All M is P.	P is M.
No S is M.	S is M.
∴ S may be P.	∴ S is partially identical with P.

In the first the fallacy is the indifferent contingency of the conclusion caused by the *non-sequitur* from a negative premise to an affirmative conclusion; while the second is either a mere repetition of the premises if the conclusion means "S is like P in being M," or, if it means "S is P," a *non-sequitur* on account of the undistributed middle. It must not be thought that this trifling with logical rules has no effect. The last supposed syllogism, namely, that having two affirmative premises and entailing an undistributed middle in the second figure, is accepted by Wundt under the title "Inference by Comparison" (*Vergleichungsschluss*), and is supposed by him to be useful for abstraction and subsidiary to induction, and by Bosanquet to be useful for analogy. Wundt, for example, proposes the following premises:—

Gold is a shining, fusible, ductile, simple body.
Metals are shining, fusible, ductile, simple bodies.

But to say from these premises, "Gold and metal are similar in what is signified by the middle term," is a mere repetition of the premises; to say, further, that "Gold may be a metal" is a *non-sequitur*, because, the middle being undistributed, the logical conclusion is the contingent "Gold may or may not be a metal," which leaves the question quite open, and therefore there is no syllogism. Wundt, who is again followed by Bosanquet, also supposes another syllogism in the third figure, under the title of "Inference by Connexion" (*Verbindungsschluss*), to be useful for induction. He proposes, for example, the following premises:—

Gold, silver, copper, lead, are fusible.
Gold, silver, copper, lead, are metals.

Here there is no syllogistic fallacy in the premises; but the question is what syllogistic conclusion can be drawn, and there is only one which follows without an illicit process of the minor, namely, "Some metals are fusible." The moment we stir a step further with Wundt m the direction of a more general conclusion (*ein allgemeinerer Satz*), we cannot infer from the premises the conclusion desired by Wundt, "Metals and fusible are connected"; nor can we infer "All metals are fusible," nor "Metals are fusible," nor "Metals may be fusible," nor "All metals may be fusible," nor any assertory conclusion, determinate or indeterminate, but the indifferent contingent, "All metals may or may not be fusible," which leaves the question undecided, so that there is no syllogism. We do not mean that in Wundt's supposed "inferences of relation by comparison and connexion" the premises are of no further use; but those of the first kind are of no syllogistic use in the second figure, and those of the second kind of no syllogistic use beyond particular conclusions in the third figure. What they really are in the inferences proposed by Wundt is not premises for syllogism, but data for induction parading as syllogism. We must pass the same sentence on Lotze's attempt to extend the second figure of the syllogism for inductive purposes, thus:—

S is M.
Q is M.
R is M.
∴ Every Σ, which is common to S, Q, R, is M.

We could not have a more flagrant abuse of the rule *Ne esto plus minusque in conclusione quam in praemissis*. As we see from Lotze's own defence, the conclusion cannot be drawn without another premise or premises to the effect that "S, Q, R, are Σ, and Σ is the one real subject of M." But how is all this to be got into the second figure? Again, Wundt and B. Erdmann propose new moods of syllogism with convertible premises, containing definitions and equations. Wundt's *Logic* has the following forms:—

(1) 1st Fig.	(2) 2nd Fig.	(3) 3rd Fig.
Only M is P.	x = y.	y = x.
No S is M.	z = y.	y = z.
∴ No S is P.	∴ x = z.	∴ x = z.

Now, there is no doubt that, especially in mathematical equations, universal conclusions are obtainable from convertible premises expressed in these ways. But the question is how the premises must be thought, and they must be thought in the converse way to produce a logical conclusion. Thus, we must think in (1) "All P is M" to avoid illicit process of the major, in (2) "All y is z" to avoid undistributed middle, in (3) "All x is y" to avoid illicit process of the minor. Indeed, it is the very essence of a convertible judgment to think it in both orders, and especially to think it in the order necessary to an inference from it. Accordingly, however expressed, the syllogisms quoted above are, as thought, ordinary syllogisms, (1) being *Camestres* in the second figure, (2) and (3) *Barbara* in the first figure. Aristotle, indeed, was as well aware as German logicians of the force of convertible premises; but he was also aware that they require no special syllogisms, and made it a point that, in a syllogism from a definition, the definition is the middle, and the *definitum* the major in a convertible major premise of *Barbara* in the first figure, *e.g.*:—

The interposition of an opaque body is (essentially) deprivation of light.
The moon suffers the interposition of the opaque earth.
∴ The moon suffers deprivation of light.

It is the same with all the recent attempts to extend the syllogism beyond its rules, which are not liable to exceptions, because they follow from the nature of syllogistic inference from universal to particular. To give the name of syllogism to inferences which infringe the general rules against undistributed middle, illicit process, two negative premises, *non-sequitur* from negative to affirmative, and the introduction of what is not in the premises into the conclusion, and which consequently infringe the special rules against affirmative conclusions in the second figure, and against universal conclusions in the third figure, is to open the door to fallacy, and at best to confuse the syllogism with other kinds of inference, without enabling us to understand any one kind.

3. *Analytic and Synthetic Deduction.*—Alexander the Commentator defined synthesis as a progress from principles to consequences, analysis as a regress from consequences to principles; and Latin logicians preserved the same distinction between the *progressus a principiis ad principiata*, and the *regressus a principiatis ad principia*. No distinction is more vital in the logic of inference in general and of scientific inference in particular; and yet none has been so little understood, because, though analysis is the more usual order of discovery, synthesis is that of instruction, and therefore, by becoming more familiar, tends to replace and obscure the previous analysis. The distinction, however, did not escape Aristotle, who saw that a progressive syllogism can be reversed thus:—

1. *Progression.*	2. *Regression.*	
	(1)	(2)
All M is P.	All P is M.	All S is P.
All S is M.	All S is P.	All M is S.
∴ All S is P.	∴ All S is M.	∴ All M is P.

Proceeding from one order to the other, by converting one of the premises, and substituting the conclusion as premise for the other premise, so as to deduce the latter as conclusion, is what he calls circular inference; and he remarked that the process is fallacious unless it contains propositions which are convertible, as in mathematical equations. Further, he perceived that the difference between the progressive and regressive orders extends from mathematics to physics, and that there are two kinds of syllogism: one progressing a priori from real ground to consequent fact (ὁ τοῦ διότι συλλογισμός), and the other regressing a posteriori from consequent fact to real ground (ὁ τοῦ ὅτι συλλογισμός). For example, as he says, the sphericity of the moon is the real ground of the fact of its light waxing; but we can deduce either from the other, as follows:— 892

1. *Progression.*	2. *Regression.*
What is spherical waxes.	What waxes is spherical.
The moon is spherical.	The moon waxes.
∴ The moon waxes.	∴ The moon is spherical.

These two kinds of syllogism are synthesis and analysis in the ancient sense. Deduction is analysis when it is regressive from consequence to real ground, as when we start from the proposition that the angles of a triangle are equal to two right angles and deduce analytically that therefore (1) they are equal to equal angles made by a straight line standing on another straight line, and (2) such equal angles are two right angles. Deduction is synthesis when it is progressive from real ground to consequence, as when we start from these two results of analysis as principles and deduce synthetically the proposition that therefore the angles of a triangle are equal to two right angles, in the order familiar to the student of Euclid. But the full value of the ancient theory of these processes cannot be appreciated until we recognize that as Aristotle planned them Newton used them. Much of the *Principia* consists of synthetical deductions from definitions and axioms. But the discovery of the centripetal force of the planets to the sun is an analytic deduction from the facts of their motion discovered by Kepler to their real ground, and is so stated by Newton in the first regressive order of Aristotle—P-M, S-P, S-M. Newton did indeed first show synthetically what kind of motions by mechanical laws have their ground in a centripetal force varying inversely as the square of the distance (all P is M); but his next step was, not to deduce synthetically the planetary motions, but to make a new start from the planetary motions as facts established by Kepler's laws and as examples of the kind of motions in question (all S is P); and then, by combining these two premises, one mechanical and the other astronomical, he analytically deduced that these facts of planetary motion have their ground in a centripetal force varying inversely as the squares of the distances of the

planets from the sun (all S is M). (See *Principia* I. prop. 2; 4 coroll. 6; III. Phaenomena, 4-5; prop. 2.) What Newton did, in short, was to prove by analysis that the planets, revolving by Kepler's astronomical laws round the sun, have motions such as by mechanical laws are consequences of a centripetal force to the sun. This done, as the major is convertible, the analytic order—P-M, S-P, S-M—was easily inverted into the synthetic order—M-P, S-M, S-P; and in this progressive order the deduction as now taught begins with the centripetal force of the sun as real ground, and deduces the facts of planetary motion as consequences. Thereupon the Newtonian analysis which preceded this synthesis, became forgotten; until at last Mill in his *Logic*, neglecting the *Principia*, had the temerity to distort Newton's discovery, which was really a pure example of analytic deduction, into a mere hypothetical deduction; as if the author of the saying "*Hypotheses non fingo*" started from the hypothesis of a centripetal force to the sun, and thence deductively explained the facts of planetary motion, which reciprocally verified the hypothesis. This gross misrepresentation has made hypothesis a kind of logical fashion. Worse still, Jevons proceeded to confuse analytic deduction from consequence to ground with hypothetical deduction from ground to consequence under the common term "inverse deduction." Wundt attempts, but in vain, to make a compromise between the old and the new. He re-defines analysis in the very opposite way to the ancients; whereas they defined it as a regressive process from consequence to ground, according to Wundt it is a progressive process of taking for granted a proposition and deducing a consequence, which being true verifies the proposition. He then divides it into two species: one categorical, the other hypothetical. By the categorical he means the ancient analysis from a given proposition to more general propositions. By the hypothetical he means the new-fangled analysis from a given proposition to more particular propositions, *i.e.* from a hypothesis to consequent facts. But his account of the first is imperfect, because in ancient analysis the more general propositions, with which it concludes, are not mere consequences, but the real grounds of the given proposition; while his addition of the second reduces the nature of analysis to the utmost confusion, because hypothetical deduction is progressive from hypothesis to consequent facts whereas analysis is regressive from consequent facts to real ground. There is indeed a sense in which all inference is from ground to consequence, because it is from logical ground (*principium cognoscendi*) to logical consequence. But in the sense in which deductive analysis is opposed to deductive synthesis, analysis is deduction from real consequence as logical ground (*principiatum* as *principium cognoscendi*) to real ground (*principium essendi*), *e.g.* from the consequential facts of planetary motion to their real ground, *i.e.* centripetal force to the sun. Hence Sigwart is undoubtedly right in distinguishing analysis from hypothetical deduction, for which he proposes the name "reduction." We have only further to add that many scientific discoveries about sound, heat, light, colour and so forth, which it is the fashion to represent as hypotheses to explain facts, are really analytical deductions from the facts to their real grounds in accordance with mechanical laws. Recent logic does scant justice to scientific analysis.

4. *Induction.*—As induction is the process from particulars to universals, it might have been thought that it would always have been opposed to syllogism, in which one of the rules is against using particular premises to draw universal conclusions. Yet such is the passion for one type that from Aristotle's time till now constant attempts have been made to reduce induction to syllogism. Aristotle himself invented an inductive syllogism in which the major (P) is to be referred to the middle (M) by means of the minor (S), thus:—

A, B, C magnets (S) attract iron (P).
A, B, C magnets (S) are all magnets whatever (M).
∴ All magnets whatever (M) attract iron (P).

As the second premise is supposed to be convertible, he reduced the inductive to a deductive syllogism as follows:—

Every S is P.	Every S is P.
Every S is M (convertibly).	Every M is S.
∴ Every M is P.	∴ Every M is P.

In the reduced form the inductive syllogism was described by Aldrich as "*Syllogismus in Barbara cujus minor* (*i.e.* every M is S) *reticetur*." Whately, on the other hand, proposed an inductive syllogism with the major suppressed, that is, instead of the minor premise above, he supposed a major premise, "Whatever belongs to A, B, C magnets belongs to all." Mill thereupon supposed a still more general premise, an assumption of the uniformity of nature. Since Mill's time, however, the logic of induction tends to revert towards syllogisms more like that of Aristotle. Jevons supposed induction to be inverse deduction, distinguished from direct deduction as analysis from synthesis, *e.g.* as division from multiplication; but he really meant that it is a deduction from a hypothesis of the law of a cause to particular effects which, being true, verify the hypothesis. Sigwart declares himself in agreement with Jevons; except that, being aware of the difference between hypothetical deduction and mathematical analysis, and seeing that, whereas analysis (*e.g.* in division) leads to certain conclusions, hypothetical deduction is not certain of the hypothesis, he arrives at the more definite view that induction is not analysis proper but hypothetical deduction, or "reduction," as he proposes to call it. Reduction he defines as "the framing of possible premises for given propositions, or the construction of a syllogism when the conclusion and one premise is given." On this view induction becomes a reduction in the form: all M is P (hypothesis), S is M (given), ∴ S is P (given). The views of Jevons and Sigwart are in agreement in two main points. According to both, induction, instead of inferring from A, B, C magnets the conclusion "Therefore all magnets attract iron," infers from the hypothesis, "Let every magnet attract iron," to A, B, C magnets, whose given attraction verifies the hypothesis. According to both, again, the hypothesis of a law with which the process starts contains more than is present in the particular data: according to Jevons, it is the hypothesis of a law of a cause from which induction deduces particular effects; and according to Sigwart, it is a hypothesis of the ground from which the particular data necessarily follow according to universal laws. Lastly, Wundt's view is an interesting piece of eclecticism, for he supposes that induction begins in the form of Aristotle's inductive syllogism, S-P, S-M, M-P, and becomes an inductive method in the form of Jevons's inverse deduction, or hypothetical deduction, or analysis, M-P, S-M, S-P. In detail, he supposes that, while an "inference by comparison," which he erroneously calls an affirmative syllogism in the second figure, is preliminary to induction, a second "inference by connexion," which he erroneously calls a syllogism in the third figure with an indeterminate conclusion, is the inductive syllogism itself. This is like Aristotle's inductive syllogism in the arrangement of terms; but, while on the one hand Aristotle did not, like Wundt, confuse it with the third figure, on the other hand Wundt does not, like Aristotle, suppose it to be practicable to get inductive data so wide as the convertible premise, "All S is M, and all M is S," which would at once establish the conclusion, "All M is P." Wundt's point is that the conclusion of the inductive syllogism is neither so much as all, nor so little as some, but rather the indeterminate "M and P are connected." The question therefore arises, how we are to discover "All M is P," and this question Wundt answers by adding an inductive method, which involves inverting the inductive syllogism in the style of Aristotle into a deductive syllogism from a hypothesis in the style of Jevons, thus:—

(1)	(2)
S is P.	Every M is P.

S is M.	S is M.
∴ M and P are connected.	∴ S is P.

He agrees with Jevons in calling this second syllogism analytical deduction, and with Jevons and Sigwart in calling it hypothetical deduction. It is, in fact, a common point of Jevons, Sigwart and Wundt that the universal is not really a conclusion inferred from given particulars, but a hypothetical major premise from which given particulars are inferred, and that this major contains presuppositions of causation not contained in the particulars.

It is noticeable that Wundt quotes Newton's discovery of the centripetal force of the planets to the sun as an instance of this supposed hypothetical, analytic, inductive method; as if Newton's analysis were a hypothesis of the centripetal force to the sun, a deduction of the given facts of planetary motion, and a verification of the hypothesis by the given facts, and as if such a process of hypothetical deduction could be identical with either analysis or induction. The abuse of this instance of Newtonian analysis betrays the whole origin of the current confusion of induction with deduction. One confusion has led to another. Mill confused Newton's analytical deduction with hypothetical deduction; and thereupon Jevons confused induction with both. The result is that both Sigwart and Wundt transform the inductive process of adducing particular examples to induce a universal law into a deductive process of presupposing a universal law as a ground to deduce particular consequences. But we can easily extricate ourselves from these confusions by comparing induction with different kinds of deduction. The point about induction is that it starts from experience, and that, though in most classes we can experience only some particulars individually, yet we infer all. Hence induction cannot be reduced to Aristotle's inductive syllogism, because experience cannot give the convertible premise, "Every S is M, and every M is S"; that "All A, B, C are magnets" is, but that "All magnets are A, B, C" is not, a fact of experience. For the same reason induction cannot be reduced to analytical deduction of the second kind in the form, S-P, M-S, ∴ M-P; because, though both end in a universal conclusion, the limits of experience prevent induction from such inference as:—

Every experienced magnet attracts iron.
Every magnet whatever is every experienced magnet.
∴ Every magnet whatever attracts iron.

Still less can induction be reduced to analytical deduction of the first kind in the form—P-M, S-P, ∴ S-M, of which Newton has left so conspicuous an example in his *Principia*. As the example shows, that analytic process starts from the scientific knowledge of a universal and convertible law (every M is P, and every P is M), *e.g.* a mechanical law of all centripetal force, and ends in a particular application, *e.g.* this centripetal force of planets to the sun. But induction cannot start from a known law. Hence it is that Jevons, followed by Sigwart and Wundt, reduces it to deduction from a hypothesis in the form "Let every M be P, S is M, ∴ S is P." There is a superficial resemblance between induction and this hypothetical deduction. Both in a way use given particulars as evidence. But in induction the given particulars are the evidence by which we discover the universal, *e.g.* particular magnets attracting iron are the origin of an inference that all do; in hypothetical deduction, the universal is the evidence by which we explain the given particulars, as when we suppose undulating aether to explain the facts of heat and light. In the former process, the given particulars are the data from which we infer the universal; in the latter, they are only the consequent facts by which we verify it. Or rather, there are two uses of induction: inductive discovery before deduction, and inductive verification after deduction. But neither use of induction is the same as the deduction itself: the former precedes, the latter follows it. Lastly, the theory of Mill, though frequently adopted, *e.g.* by B. Erdmann, need not detain us long. Most inductions are made without any assumption of the uniformity of nature; for, whether it is itself induced, or a priori or postulated, this like every assumption is a judgment, and most men are incapable of judgment on so universal a scale, when they are quite capable of induction. The fact is that the uniformity of nature stands to induction as the axioms of syllogism do to syllogism; they are not premises, but conditions of inference, which ordinary men use spontaneously, as was pointed out in *Physical Realism*, and afterwards in Venn's *Empirical Logic*. The axiom of contradiction is not a major premise of a judgment: the *dictum de omni et nullo* is not a major premise of a syllogism: the principle of uniformity is not a major premise of an induction. Induction, in fact, is no species of deduction; they are opposite processes, as Aristotle regarded them except in the one passage where he was reducing the former to the latter, and as Bacon always regarded them. But it is easy to confuse them by mistaking examples of deduction for inductions. Thus Whewell mistook Kepler's inference that Mars moves in an ellipse for an induction, though it required the combination of Tycho's and Kepler's observations, as a minor, with the laws of conic sections discovered by the Greeks, as a major, premise. Jevons, in his *Principles of Science*, constantly makes the same sort of mistake. For example, the inference from the similarity between solar spectra and the spectra of various gases on the earth to the existence of similar gases in the sun, is called by him an induction; but it really is an analytical deduction from effect to cause, thus:—

Such and such spectra are effects of various gases.
Solar spectra are such spectra.
∴ Solar spectra are effects of those gases.

In the same way, to infer a machine from hearing the regular tick of a clock, to infer a player from finding a pack of cards arranged in suits, to infer a human origin of stone implements, and all such inferences from patent effects to latent causes, though they appear to Jevons to be typical inductions, are really deductions which, besides the minor premise stating the particular effects, require a major premise discovered by a previous induction and stating the general kind of effects of a general kind of cause. B. Erdmann, again, has invented an induction from particular predicates to a totality of predicates which he calls "ergänzende Induction," giving as an example, "This body has the colour, extensibility and specific gravity of magnesium; therefore it is magnesium." But this inference contains the tacit major, "What has a given colour, &c., is magnesium," and is a syllogism of recognition. A deduction is often like an induction, in inferring from particulars; the difference is that deduction combines a law in the major with the particulars in the minor premise, and infers syllogistically that the particulars of the minor have the predicate of the major premise, whereas induction uses the particulars simply as instances to generalize a law. An infallible sign of an induction is that the subject and predicate of the universal conclusion are merely those of the particular instances generalized; *e.g.* "These magnets attract iron, ∴ all do."

This brings us to another source of error. As we have seen, Jevons, Sigwart and Wundt all think that induction contains a belief in causation, in a cause, or ground, which is not present in the particular facts of experience, but is contributed by a hypothesis added as a major premise to the particulars in order to explain them by the cause or ground. Not so; when an induction is causal, the particular instances are already beliefs in particular causes, *e.g.* "My right hand is exerting pressure reciprocally with my left," "A, B, C magnets attract iron"; and the problem is to generalize these causes, not to introduce them. Induction is not introduction. It would make no difference to the form of induction, if, as Kant thought, the notion of causality is a priori; for even Kant thought that it is already contained in

experience. But whether Kant be right or wrong, Wundt and his school are decidedly wrong in supposing "supplementary notions which are not contained in experience itself, but are gained by a process of logical treatment of this experience"; as if our behalf in causality could be neither a posteriori nor a priori, but beyond experience wake up in a hypothetical major premise of induction. Really, we first experience that particular causes have particular effects; then induce that causes similar to those have effects similar to these; finally, deduce that when a particular cause of the kind occurs it has a particular effect of the kind by synthetic deduction, and that when a particular effect of the kind occurs it has a particular cause of the kind by analytic deduction with a convertible premise, as when Newton from planetary motions, like terrestrial motions, analytically deduced a centripetal force to the sun like centripetal forces to the earth. Moreover, causal induction is itself both synthetic and analytic: according as experiment combines elements into a compound, or resolves a compound into elements, it is the origin of a synthetic or an analytic generalization. Not, however, that all induction is causal; but where it is not, there is still less reason for making it a deduction from hypothesis. When from the fact that the many crows in our experience are black, we induce the probability that all crows whatever are black, the belief in the particulars is quite independent of this universal. How then can this universal be called, as Sigwart, for example, calls it, the ground from which these particulars follow? I do not believe that the crows I have seen are black because all crows are black, but vice versa. Sigwart simply inverts the order of our knowledge. In all induction, as Aristotle said, the particulars are the evidence, or ground of our knowledge (*principium cognoscendi*), of the universal. In causal induction, the particulars further contain the cause, or ground of the being (*principium essendi*), of the effect, as well as the ground of our inducing the law. In all induction the universal is the conclusion, in none a major premise, and in none the ground of either the being or the knowing of the particulars. Induction is generalization. It is not syllogism in the form of Aristotle's or Wundt's inductive syllogism, because, though starting only from some particulars, it concludes with a universal; it is not syllogism in the form called inverse deduction by Jevons, reduction by Sigwart, inductive method by Wundt, because it often uses particular facts of causation to infer universal laws of causation; it is not syllogism in the form of Mill's syllogism from a belief in uniformity of nature, because few men have believed in uniformity, but all have induced from particulars to universals. Bacon alone was right in altogether opposing induction to syllogism, and in finding inductive rules for the inductive process from particular instances of presence, absence in similar circumstances, and comparison.

5. *Inference in General.*—There are, as we have seen (*ad init.*), three types—syllogism, induction and analogy. Different as they are, the three kinds have something in common: first, they are all processes from similar to similar; secondly, they all consist in combining two judgments so as to cause a third, whether expressed in so many propositions or not; thirdly, as a judgment is a belief in being, they all proceed from premises which are beliefs in being to a conclusion which is a belief in being. Nevertheless, simple as this account appears, it is opposed in every point to recent logic. In the first place, the point of Bradley's logic is that "similarity is not a principle which works. What operates is identity, and that identity is a universal." This view makes inference easy: induction is all over before it begins; for, according to Bradley, "every one of the instances is already a universal proposition; and it is not a particular fact or phenomenon at all," so that the moment you observe that this magnet attracts iron, you *ipso facto* know that every magnet does so, and all that remains for deduction is to identify a second magnet as the same with the first, and conclude that it attracts iron. In dealing with Bradley's works we feel inclined to repeat what Aristotle says of the discourses of Socrates: they all exhibit excellence, cleverness, novelty and inquiry, but their truth is a difficult matter; and the Socratic paradox that virtue is knowledge is not more difficult than the Bradleian paradox that as two different things are the same, inference is identification. The basis of Bradley's logic is the fallacious dialectic of Hegel's metaphysics, founded on the supposition that two things, which are different, but have something in common, are the same. For example, according to Hegel, being and not-being are both indeterminate and therefore the same. "If," says Bradley, "A and B, for instance, both have lungs or gills, they are so far the same." The answer to Hegel is that being and not-being are at most similarly indeterminate, and to Bradley that each animal has its own different lungs, whereby they are only similar. If they were the same, then in descending, two things, one of which has healthy and the other diseased lungs, would be the same; and in ascending, two things, one of which has lungs and the other has not, but both of which have life, *e.g.* plants and animals, would be so far the same. There would be no limit to identity either downwards or upwards; so that a man would be the same as a man-of-war, and all things would be the same thing, and not different parts of one universe. But a thing which has healthy lungs and a thing which has diseased lungs are only similar individuals numerically different. Each individual thing is the same only with itself, although related to other things; and each individual of a class has its own individual, though similar, attributes. The consequence of this true metaphysics to logic is twofold: on the one hand, one singular or particular judgment, *e.g.* "this magnet attracts iron," is not another, *e.g.* "that magnet attracts iron," and neither is universal; on the other hand, a universal judgment, *e.g.* "every magnet attracts iron," means, distributively, that each individual magnet exerts its individual attraction, though it is similar to other magnets exerting similar attractions. A universal is not "one identical point," but one distributive whole. Hence in a syllogism, a middle term, *e.g.* magnets, is "absolutely the same," not in the sense of "one identical point" making each individual the same as any other, as Bradley supposes, but only in the sense of one whole class, or total of many similar individuals, *e.g.* magnets, each of which is separately though similarly a magnet, not magnet in general. Hence also induction is a real process, because, when we know that this individual magnet attracts iron, we are very far from knowing that all alike do so similarly; and the question of inductive logic, how we get from some similars to all similars, remains, as before, a difficulty, but not to be solved by the fallacy that inference is identification.

Secondly, a subordinate point in Bradley's logic is that there are inferences which are not syllogisms; and this is true. But when he goes on to propose, as a complete independent inference, "A is to the right of B, B is to the right of C, therefore A is to the right of C," he confuses two different operations. When A, B and C are objects of sense, their relative positions are matters, not of inference, but of observation; when they are not, there is an inference, but a syllogistic inference with a major premise induced from previous observations, "whenever of three things the first is to the right of the second, and the second to the right of the third, the first is to the right of the third." To reply that this universal judgment is not expressed, or that its expression is cumbrous, is no answer, because, whether expressed or not, it is required for the thought. As Aristotle puts it, the syllogism is directed "not to the outer, but to the inner discourse," or as we should say, not to the expression but to the thought, not to the proposition but to the judgment, and to the inference not verbally but mentally. Bradley seems to suppose that the major premise of a syllogism must be explicit, or else is nothing at all. But it is often thought without being expressed, and to judge the syllogism by its mere explicit expression is to commit an *ignoratio elenchi*; for it has been known all along that we express less than we think, and the very purpose of syllogistic logic is to analyse the whole thought necessary to the conclusion. In this syllogistic analysis two points must always be considered: one, that we usually use premises in thought which we do not express; and the other, that we sometimes use them unconsciously, and therefore infer and reason unconsciously, in the manner excellently described by Zeller in his *Vorträge*, iii. pp. 249-255. Inference is a deeper thinking process from judgments to judgment, which only occasionally and partially emerges in the linguistic process from propositions to proposition. We may now then reassert two points about inference against Bradley's logic: the first, that it is a process from similar to similar, and not a process of identification, because two different things are not at all the same thing; the second, that it is the mental process from judgments to judgment rather than the linguistic process from

propositions to proposition, because, besides the judgments expressed in propositions, it requires judgments which are not always expressed, and are sometimes even unconscious.

Our third point is that, as a process of judgments, inference is a process of concluding from two beliefs in being to another belief in being, and not an ideal construction, because a judgment does not always require ideas, but is always a belief about things, existing or not. This point is challenged by all the many ideal theories of judgment already quoted. If, for example, judgment were an analysis of an aggregate idea as Wundt supposes, it would certainly be true with him to conclude that "as judgment is an *immediate*, inference is a *mediate*, reference of the members of an aggregate of ideas to one another." But really a judgment is a belief that something, existing, or thinkable, or nameable or what not, is (or is not) determined; and inference is a process from and to such beliefs in being. Hence the fallacy of those who, like Bosanquet, or like Paulsen in his *Einleitung in die Philosophie*, represent the realistic theory of inference as if it meant that knowledge starts from ideas and then infers that ideas are copies of things, and who then object, rightly enough, that we could not in that case compare the copy with the original, but only be able to infer from idea to idea. But there is another realism which holds that inference is a process neither from ideas to ideas, nor from ideas to things, but from beliefs to beliefs, from judgments about things in the premises to judgments about similar things in the conclusion. Logical inference never goes through the impossible process of premising nothing but ideas, and concluding that ideas are copies of things. Moreover, as we have shown, our primary judgments of sense are beliefs founded on sensations without requiring ideas, and are beliefs, not merely that something is determined, but that it is determined as existing; and, accordingly, our primary inferences from these sensory judgments of existence are inferences that other things beyond sense are similarly determined as existing. First press your lips together and then press a pen between them: you will not be conscious of perceiving any ideas: you will be conscious first of perceiving one existing lip exerting pressure reciprocally with the other existing lip; then, on putting the pen between your lips, of perceiving each lip similarly exerting pressure, but not with the other; and consequently of inferring that each existing lip is exerting pressure reciprocally with another existing body, the pen. Inference then, though it is accompanied by ideas, is not an ideal construction, nor a process from idea to idea, nor a process from idea to thing, but a process from direct to indirect beliefs in things, and originally in existing things. Logic cannot, it is true, decide what these things are, nor what the senses know about them, without appealing to metaphysics and psychology. But, as the science of inference, it can make sure that inference, on the one hand, starts from sensory judgments about sensible things and logically proceeds to inferential judgments about similar things beyond sense, and, on the other hand, cannot logically go beyond the similar. These are the limits within which logical inference works, because its nature essentially consists in proceeding from two judgments to another about similar things, existing or not.

6. *Truth.*—Finally, though sensory judgment is always true of its sensible object, inferential judgments are not always true, but are true so far as they are logically inferred, however indirectly, from sense; and knowledge consists of sense, memory after sense and logical inference from sense, which, we must remember, is not merely the outer sense of our five senses, but also the inner sense of ourselves as conscious thinking persons. We come then at last to the old question—what is truth? Truth proper, as Aristotle said in the *Metaphysics*, is in the mind: it is not being, but one's signification of being. Its requisites are that there are things to be known and powers of knowing things. It is an attribute of judgments and derivatively of propositions. That judgment is true which apprehends a thing as it is capable of being known to be; and that proposition is true which so asserts the thing to be. Or, to combine truth in thought and in speech, the true is what signifies a thing as it is capable of being known. Secondarily, the thing itself is ambiguously said to be true in the sense of being signified as it is. For example, as I am weary and am conscious of being weary, my judgment and proposition that I am weary are true because they signify what I am and know myself to be by direct consciousness; and my being weary is ambiguously said to be true because it is so signified. But it will be said that Kant has proved that real truth, in the sense of the "agreement of knowledge with the object," is unattainable, because we could compare knowledge with the object only by knowing both. Sigwart, indeed, adopting Kant's argument, concludes that we must be satisfied with consistency among the thoughts which presuppose an existent; this, too, is the reason why he thinks that induction is reduction, on the theory that we can show the necessary consequence of the given particular, but that truth of fact is unattainable. But Kant's criticism and Sigwart's corollary only derive plausibility from a false definition of truth. Truth is not the agreement of knowledge with an object beyond itself, and therefore *ex hypothesi* unknowable, but the agreement of our judgments with the objects of our knowledge. A judgment is true whenever it is a belief that a thing is determined as it is known to be by sense, or by memory after sense, or by inference from sense, however indirect the inference may be, and even when in the form of inference of non-existence it extends consequently from primary to secondary judgments. Thus the judgments "this sensible pressure exists," "that sensible pressure existed," "other similar pressures exist," "a conceivable centaur does not exist but is a figment," are all equally true, because they are in accordance with one or other of these kinds of knowledge. Consequently, as knowledge is attainable by sense, memory and inference, truth is also attainable, because, though we cannot test what we know by something else, we can test what we judge and assert by what we know. Not that all inference is knowledge, but it is sometimes. The aim of logic in general is to find the laws of all inference, which, so far as it obeys those laws, is always consistent, but is true or false according to its data as well as its consistency; and the aim of the special logic of knowledge is to find the laws of direct and indirect inferences from sense, because as sense produces sensory judgments which are always true of the sensible things actually perceived, inference from sense produces inferential judgments which, so far as they are consequent on sensory judgments, are always true of things similar to sensible things, by the very consistency of inference, or, as we say, by parity of reasoning. We return then to the old view of Aristotle, that truth is believing in being; that sense is true of its immediate objects, and reasoning from sense true of its mediate objects; and that logic is the science of reasoning with a view to truth, or *Logica est ars ratiocinandi, ut discernatur verum a falso*. All we aspire to add is that, in order to attain to real truth, we must proceed gradually from sense, memory and experience through analogical particular inference, to inductive and deductive universal inference or reasoning. Logic is the science of all inference, beginning from sense and ending in reason.

In conclusion, the logic of the last quarter of the 19th century may be said to be animated by a spirit of inquiry, marred by a love of paradox and a corresponding hatred of tradition. But we have found, on the whole, that logical tradition rises superior to logical innovation. There are two old logics which still remain indispensable, Aristotle's *Organon* and Bacon's *Novum Organum*. If, and only if, the study of deductive logic begins with Aristotle, and the study of inductive logic with Aristotle and Bacon, it will be profitable to add the works of the following recent German and English authors:—

Authorities.—J. Bergmann, *Reine Logik* (Berlin, 1879); *Die Grundprobleme der Logik* (2nd ed., Berlin, 1895); B. Bosanquet, *Logic* (Oxford, 1888); *The Essentials of Logic* (London, 1895); F. H. Bradley, *The Principles of Logic* (London, 1883); F. Brentano, *Psychologie vom empirischen Standpunkte* (Vienna, 1874); R. F. Clarke, *Logic* (London, 1889); W. L. Davidson, *The Logic of Definition* (London, 1885); E. Dühring, *Logik und Wissenschaftstheorie* (Leipzig, 1878); B. Erdmann, *Logik* (Halle, 1892); T. Fowler, *Bacon's Novum Organum*, edited, with introduction, notes, &c. (2nd ed., Oxford, 1889); T. H. Green, *Lectures on Logic*, in *Works*, vol. iii. (London, 1886); J. G. Hibben, *Inductive Logic* (Edinburgh and London, 1896); F. Hillebrand, *Die neuen Theorien der kategorischen Schlüsse* (Vienna, 1891); L. T. Hobhouse, *The Theory of Knowledge* (London, 1896); H. Hughes, *The Theory of Inference* (London, 1894); E. Husserl,

Logische Untersuchungen (Halle, 1891, 1901); W. Jerusalem, *Die Urtheilsfunction* (Vienna and Leipzig, 1895); W. Stanley Jevons, *The Principles of Science* (3rd ed., London, 1879); *Studies in Deductive Logic* (London, 1880); H. W. B. Joseph, *Introduction to Logic* (1906); E. E. Constance Jones, *Elements of Logic* (Edinburgh, 1890); G. H. Joyce, *Principles of Logic* (1908); J. N. Keynes, *Studies and Exercises in Formal Logic* (2nd ed., London, 1887); F. A. Lange, *Logische Studien* (2nd ed., Leipzig, 1894); T. Lipps, *Grundzüge der Logik* (Hamburg and Leipzig, 1893); R. H. Lotze, *Logik* (2nd ed., Leipzig, 1881, English translation edited by B. Bosanquet, Oxford, 1884); *Grundzüge der Logik (Diktate)* (3rd ed., Leipzig, 1891, English translation by G. T. Ladd, Boston, 1887); Werner Luthe, *Beiträge zur Logik* (Berlin, 1872, 1877); Members of Johns Hopkins University, *Studies in Logic* (edited by C. S. Peirce, Boston, 1883); J. B. Meyer, *Ueberweg's System der Logik*, fünfte vermehrte Auflage (Bonn, 1882); Max Müller, *Science of Thought* (London, 1887); Carveth Read, *On the Theory of Logic* (London, 1878); *Logic, Deductive and Inductive* (2nd ed., London, 1901); E. Schröder, *Vorlesungen über die Algebra der Logik* (Leipzig, 1890, 1891, 1895); W. Schuppe, *Erkenntnistheoretische Logik* (Bonn, 1878); *Grundriss der Erkenntnistheorie und Logik* (Berlin, 1894); R. Shute, *A Discourse on Truth* (London, 1877); Alfred Sidgwick, *Fallacies* (London, 1883); *The Use of Words in Reasoning* (London, 1901); C. Sigwart, *Logik* (2nd ed., Freiburg-i.-Br. and Leipzig, 1889-1893, English translation by Helen Dendy, London, 1895); K. Uphues, *Grundlehren der Logik* (Breslau, 1883); J. Veitch, *Institutes of Logic* (Edinburgh and London, 1885); J. Venn, *Symbolic Logic* (2nd ed., London, 1894); *The Principles of Empirical or Inductive Logic* (London, 1889); J. Volkelt, *Erfahren und Denken* (Hamburg and Leipzig, 1886); T. Welton, *A Manual of Logic* (London, 1891, 1896); W. Windelband, *Präludien* (Freiburg-i.-Br., 1884); W. Wundt, *Logik* (2nd ed., Stuttgart, 1893-1895). Text-books are not comprised in this list.

(T. Ca.)

II. History

Logic cannot dispense with the light afforded by its history so long as counter-solutions of the same fundamental problems continue to hold the field. A critical review of some of the chief types of logical theory, with a view to determine development, needs no further justification.

Logic arose, at least for the Western world, in the golden age of Greek speculation which culminated in Plato and Aristotle. There is an Indian logic, it is true, but its priority is more than disputable. In any case no influence upon Greek thought can be shown. The movement which ends in the logic of Aristotle is demonstrably self-contained. When we have shaken ourselves free of the prejudice that all stars are first seen in the East, Oriental attempts at analysis of the structure of thought may be treated as negligible.

It is with Aristotle that the bookish tradition begins to dominate the evolution of logic. The technical perfection of the analysis which he offers is, granted the circle of presuppositions within which it works, so decisive, that what precedes, even Plato's logic, is not unnaturally regarded as merely preliminary and subsidiary to it. What follows is inevitably, whether directly or indirectly, by sympathy or by antagonism, affected by the Aristotelian tradition.

A. Greek Logic

i. *Before Aristotle*

The physical philosophers.

Logic needs as its presuppositions that thought should distinguish itself from things and from sense, that the problem of validity should be seen to be raised in the field of thought itself, and that analysis of the structure of thought should be recognized as the one way of solution. Thought is somewhat late in coming to self-consciousness. Implied in every contrast of principle and fact, of rule and application, involved as we see after the event, most decisively when we react correctly upon a world incorrectly perceived, thought is yet not reflected on in the common experience. Its so-called natural logic is only the potentiality of logic. The same thing is true of the first stage of Greek philosophy. In seeking for a single material principle underlying the multiplicity of phenomena, the first nature-philosophers, Thales and the rest, did indeed raise the problem of the one and the many, the endeavour to answer which must at last lead to logic. But it is only from a point of view won by later speculation that it can be said that they sought to determine the predicates of the single subject-reality, or to establish the permanent subject of varied and varying predicates.[1] The direction of their inquiry is persistently outward. They hope to explain the opposed appearance and reality wholly within the world of things, and irrespective of the thought that thinks things. Their universal is still a material one. The level of thought on which they move is still clearly pre-logical. It is an advance on this when Heraclitus[2] opposes to the eyes and ears which are bad witnesses "for such as understand not their language" a common something which we would do well to follow; or again when in the incommensurability of the diagonal and side of a square the Pythagoreans stumbled upon what was clearly neither thing nor image of sense, but yet was endowed with meaning, and henceforth were increasingly at home with symbol and formula. So far, however, it might well be that thought, contradistinguished from sense with its illusions, was itself infallible. A further step, then, was necessary, and it was taken at any rate by the Eleatics, when they opposed their thought to the thought of others, as the way of truth in contrast to the way of opinion. If Eleatic thought stands over against Pythagorean thought as what is valid or grounded against what is ungrounded or invalid, we are embarked upon dialectic, or the debate in which thought is countered by thought. Claims to a favourable verdict must now be substantiated in this field and in this field alone. It was Zeno, the controversialist of the Eleatic school, who was regarded in after times as the "discoverer" of dialectic.[3]

Zeno's amazing skill in argumentation and his paradoxical conclusions, particular and general, inaugurate a new era. "The philosophical mind," says waiter Pater,[4] "will perhaps never be quite in health, quite sane or natural again." The give and take of thought had by a swift transformation of values come by something more than its own. Zeno's paradoxes, notably, for example, the puzzle of Achilles and the Tortoise, are still capable of amusing the modern world. In his own age they found him imitators. And there follows the sophistic movement.

The Sophists.

The sophists have other claims to consideration than their service to the development of logic. In the history of the origins of logic the sophistic age is simply the age of the free play of thought in which men were aware that in a sense anything can be debated and not yet aware of the sense in which all things cannot be so. It is the age of discussion used as a universal solvent, before it has been brought to book by a deliberate unfolding of the principles of the structure of thought determining and limiting the movement of thought itself. The sophists furthered the transition from dialectic to logic in two ways. In the first place they made it possible. Incessant questioning leads to answers. Hair-splitting, even when mischievous in intent, leads to distinctions of value. Paradoxical insistence on the accidents of speech-forms and thought-forms leads in the end to perception of the essentials. Secondly they made it necessary. The spirit of debate run riot evokes a counter-spirit to order and control it. The result is a self-limiting dialectic. This higher dialectic is a logic. It is no accident that the first of the philosophical sophists, Gorgias, on the one hand, is Eleatic in his affinities, and on the other raises in the characteristic formula of his intellectual nihilism[5] issues which are as much logical and epistemological as ontological. The meaning of the copula and the relation of thoughts to the objects of which they are the thoughts are as much involved as the nature of being. It is equally no accident that the name of Protagoras is to be connected, in Plato's view at least, with the rival school of

Heracliteans. The problems raised by the relativism of Protagoras are no less fundamentally problems of the nature of knowledge and of the structure of thought. The *Theaetetus* indeed, in which Plato essays to deal with them, is in the broad sense of the word logical, the first distinctively logical treatise that has come down to us. Other sophists, of course, with more practical interests, or of humbler attainments, were content to move on a lower plane of philosophical speculation. As presented to us, for example, in Plato's surely not altogether hostile caricature in the *Euthydemus*, they mark the intellectual preparation for, and the moral need for, the advance of the next generation.

Socrates.

Among the pioneers of the sophistic age Socrates stands apart. He has no other instrument than the dialectic of his compeers, and he is as far off as the rest from a criticism of the instrument, but he uses it differently and with a difference of aim. He construes the give and take of the debate-game with extreme rigour. The rhetorical element must be exorcised. The set harangue of teacher to pupil, in which steps in argument are slurred and the semblance of co-inquiry is rendered nugatory, must be eliminated. The interlocutors must in truth render an account under the stimulus of organized heckling from their equals or superiors in debating ability. And the aim is heuristic, though often enough the search ends in no overt positive conclusion. Something can be found and something is found. Common names are fitted for use by the would-be users being first delivered from abortive conceptions, and thereupon enabled to bring to the birth living and organic notions.

Aristotle would assign to Socrates the elaboration of two logical functions:—general definition and inductive method.[6] Rightly, if we add that he gives no theory of either, and that his practical use of the latter depends for its value on selection.[7] It is rather in virtue of his general faith in the possibility of construction, which he still does not undertake, and because of his consequent insistence on the elucidation of general concepts, which in common with some of his contemporaries, he may have thought of as endued with a certain objectivity, that he induces the controversies of what are called the Socratic schools as to the nature of predication. These result in the formulation of a new dialectic or logic by Plato. Manifestly Socrates' use of certain forms of argumentation, like their abuse by the sophists, tended to evoke their logical analysis. The use and abuse, confronted one with the other, could not but evoke it.

Antisthenes.

The one in the many, the formula which lies at the base of the possibility of predication, is involved in the Socratic doctrine of general concepts or ideas. The nihilism of Gorgias from the Eleatic point of view of bare identity, and the speechlessness of Cratylus from the Heraclitean ground of absolute difference, are alike disowned. But the one in the many, the identity in difference, is so far only postulated, not established. When the personality of Socrates is removed, the difficulty as to the nature of the Socratic universal, developed in the medium of the individual processes of individual minds, carries disciples of diverse general sympathies, united only through the practical inspiration of the master's life, towards the identity-formula or the difference-formula of other teachers. The paradox of predication, that it seems to deny identity, or to deny difference, becomes a *pons asinorum*. Knowledge involves synthesis or nexus. Yet from the points of view alike of an absolute pluralism, of a flux, and of a formula of bare identity—and *a fortiori* with any blending of these principles sufficiently within the bounds of plausibility to find an exponent—all knowledge, because all predication of unity, in difference, must be held to be impossible. Plato's problem was to find a way of escape from this impasse, and among his Socratic contemporaries he seems to have singled out Antisthenes[8] as most in need of refutation. Antisthenes, starting with the doctrine of identity without difference, recognizes as the only expression proper to anything its own peculiar sign, its name. This extreme of nominalism for which predication is impossible is, however, compromised by two concessions. A thing can be described as like something else. And a compound can have a λόγος or account given of it by the (literally) adequate enumeration of the names of its simple elements or πρῶτα.[9] This analytical λόγος he offers as his substitute for knowledge.[10] The simple elements still remain, sensed and named but not known. The expressions of them are simply the speech-signs for them. The account of the compound simply sets itself taken piecemeal as equivalent to itself taken as aggregate. The subject-predicate relation fails really to arise. Euclides[11] found no difficulty in fixing Antisthenes' mode of illustrating his simple elements by comparison, and therewith perhaps the "induction" of Socrates, with the dilemma; so far as the example is dissimilar, the comparison is invalid; so far as it is similar, it is useless. It is better to say what the thing is. Between Euclides and Antisthenes the Socratic induction and universal definition were alike discredited from the point of view of the Eleatic logic. It is with the other point of doctrine that Plato comes to grips, that which allows of a certainty or knowledge consisting in an analysis of a compound into simple elements themselves not known. The syllable or combination is, he shows, not known by resolution of it into letters or elements themselves not known. An aggregate analysed into its mechanical parts is as much and as little known as they. A whole which is more than its parts is from Antisthenes' point of view inconceivable. Propositions analytical of a combination in the sense alleged do not give knowledge. Yet knowledge is possible. The development of a positive theory of predication has become quite crucial.

Plato.

Plato's logic supplies a theory of universals in the doctrine of ideas. Upon this it bases a theory of predication, which, however, is compatible with more than one reading of the metaphysical import of the ideas. And it sets forth a dialectic with a twofold movement, towards differentiation and integration severally, which amounts to a formulation of inference. The more fully analysed movement, that which proceeds downward from less determinate to more determinate universals, is named Division. Its associations, accordingly, are to the modern ear almost inevitably those of a doctrine of classification only. Aristotle, however, treats it as a dialectical rival to syllogism, and it influenced Galilei and Bacon in their views of inference after the Renaissance. If we add to this logic of "idea," judgment and inference, a doctrine of categories in the modern sense of the word which makes the *Theaetetus*, in which it first occurs, a forerunner of Kant's *Critique of Pure Reason*, we have clearly a very significant contribution to logic even in technical regard. Its general philosophical setting may be said to enhance its value even as logic.

The "Idea."

(*a*) Of the idea we may say that whatever else it is, and apart from all puzzles as to ideas of relations such as smallness, of negative qualities such as injustice, or of human inventions such as beds, it is opposed to that of which it is the idea as its intelligible formula or law, the truth or validity—Herbart's word—of the phenomenon from the point of view of nexus or system. The thing of sense in its relative isolation is unstable. It is and is not. What gives stability is the insensible principle or principles which it holds, as it were, in solution. These are the ideas, and their mode of being is naturally quite other than that of the sensible phenomena which they order. The formula for an indefinite number of particular things in particular places at particular times, and all of them presentable in sensuous imagery of a given time and place, is not itself presentable in sensuous imagery side by side with the individual members of the group it orders. The law, *e.g.*, of the equality of the radii of a circle cannot be exhibited to sense, even if equal radii may be so exhibited. It is the wealth of illustration with which Plato expresses his meaning, and the range of application which he gives the idea—to the class-concepts of natural groups objectively regarded, to categories, to aesthetic and ethical ideals, to the concrete aims of the craftsman as well as to scientific laws—that have obscured his doctrine, viz. that wherever there is law, there is an idea.

The one in

(*b*) The paradox of the one in the many is none, if the idea may be regarded as supplying a principle of nexus or organization to an indefinite multiplicity of particulars. But if Antisthenes is to be answered, a further step must be taken. The principle of difference must be carried into the field of the ideas. Not only sense is a principle of difference. The ideas are many. The multiplicity in unity must be established within

the many. thought itself. Otherwise the objection stands: man is man and good is good, but to say that man is good is clearly to say the thing that is not. Plato replies with the doctrine of the interpenetration of ideas, obviously not of all with all, but of some with some, the formula of identity in difference within thought itself. Nor can the opponent fairly refuse to admit it, if he affirms the participation of the identical with being, and denies the participation of difference with being, or affirms it with not-being. The *Sophistes* shows among other things that an identity-philosophy breaks down into a dualism of thought and expression, when it applies the predicate of unity to the real, just as the absolute pluralism on the other hand collapses into unity if it affirms or admits any form of relation whatsoever. Identity and difference are all-pervasive categories, and the speech-form and the corresponding thought-form involve both. For proposition and judgment involve subject and predicate and exhibit what a modern writer calls "identity of reference with diversity of characterization." Plato proceeds to explain by his principle of difference both privative and negative predicates, and also the possibility of false predication. It is obvious that without the principle of difference error is inexplicable. Even Plato, however, perhaps scarcely shows that with it, and nothing else but it, error is explained.

(*c*) Plato's Division, or the articulation of a relatively indeterminate and generic concept into species and sub-species with resultant determinate judgments, presumes of course the doctrine of the interpenetration of ideas laid down in the *Sophistes* as the basis of predication, but its use precedes the positive development of that formula, though not, save very vaguely, the exhibition of it, negatively, in the antinomies of the one and the many in the *Parmenides*. It is its use, however, not the theory of it, that precedes. The latter is expounded in the *Politicus* (260 sqq.) and *Philebus* (16*c* sqq.). The ideal is progressively to determine a universe of discourse till true *infimae species* are reached, when no further distinction in the determinate many is possible, though there is still the numerical difference of the indefinite plurality of particulars. The process is to take as far as possible the form of a continuous disjunction of contraries. We must bisect as far as may be, but the division is after all to be into limbs, not parts. The later examples of the *Politicus* show that the permission of three or more co-ordinate species is not nugatory, and that the precept of dichotomy is merely in order to secure as little of a *saltus* as possible; to avoid *e.g.* the division of the animal world into men and brutes. It is the middle range of the μέσα of *Philebus* 17*a* that appeals to Bacon, not only this but their mediating quality that appeals to Aristotle. The *media axiomata* of the one and the *middle term* of the other lie in the phrase. Plato's division is nevertheless neither syllogism nor *exclusiva*. It is not syllogism because it is based on the disjunctive, not on the hypothetical relation, and so extends horizontally where syllogism strikes vertically downward. Again it is not syllogism because it is necessarily and finally dialectical. It brings in the choice of an interlocutor at each stage, and so depends on a concession for what it should prove.[12] Nor is it Bacon's method of exclusions, which escapes the imputation of being dialectical, if not that of being unduly cumbrous, in virtue of the cogency of the negative instance. The Platonic division was, however, offered as the scientific method of the school. A fragment of the comic poet Epicrates gives a picture of it at work.[13] And the movement of disjunction as truly has a place in the scientific specification of a concept in all its differences as the linking of lower to higher in syllogism. The two are complementary, and the reinstatement of the disjunctive judgment to the more honourable rôle in inference has been made by so notable a modern logician as Lotze.

Division.

(*d*) The correlative process of Combination is less elaborately sketched, but in a luminous passage in the *Politicus* (§ 278), in explaining by means of an example the nature and use of examples, Plato represents it as the bringing of one and the same element seen in diverse settings to conscious realization, with the result that it is viewed as a single truth of which the terms compared are now accepted as the differences. The learner is to be led forward to the unknown by being made to hark back to more familiar groupings of the alphabet of nature which he is coming to recognize with some certainty. To lead on, ἐπάγειν, is to refer back, ἀνάγειν,[14] to what has been correctly divined of the same elements in clearer cases. Introduction to unfamiliar collocations follows upon this, and, only so, is it possible finally to gather scattered examples into a conspectus as instances of one idea or law. This is not only of importance in the history of the terminology of logic, but supplies a philosophy of induction.

Combination.

(*e*) Back of Plato's illustration and explanation of predication and dialectical inference there lies not only the question of their metaphysical grounding in the interconnexion of ideas, but that of their epistemological presuppositions. This is dealt with in the Theaetetus (184*b* sqq.). The manifold affections of sense are not simply aggregated in the individual, like the heroes in the Trojan horse. There must be convergence in a unitary principle, soul or consciousness, which is that which really functions in perception, the senses and their organs being merely its instruments. It is this unity of apperception which enables us to combine the data of more than one sense, to affirm reality, unreality, identity, difference, unity, plurality and so forth, as also the good, the beautiful and their contraries. Plato calls these pervasive factors in knowledge κοινὰ, and describes them as developed by the soul in virtue of its own activity. They are objects of its reflection and made explicit in the few with pains and gradually.[15] That they are not, however, psychological or acquired categories, due to "the workmanship of the mind" as conceived by Locke, is obvious from their attribution to the structure of mind[16] and from their correlation with immanent principles of the objective order. Considered from the epistemological point of view, they are the implicit presuppositions of the construction or συλλογισμός[17] in which knowledge consists. But as ideas,[18] though of a type quite apart,[19] they have also a constitutive application to reality. Accordingly, of the selected "kinds" by means of which the interpenetration of ideas is expounded in the *Sophistes*, only motion and rest, the ultimate "kinds" in the physical world, have no counterparts in the "categories" of the *Theaetetus*. In his doctrine as to ἓν τὸ ποιοῦν or κρῖνον, as generally in that of the activity of the νοῦς ἀπαθής, Aristotle in the *de Anima*[20] is in the main but echoing the teaching of Plato.[21]

Mental synthesis.

ii. *Aristotle.*

Plato's episodic use of logical distinctions[22] is frequent. His recourse to such logical analysis as would meet the requirements of the problem in hand[23] is not rare. In the "dialectical" dialogues the question of method and of the justification of its postulates attains at least a like prominence with the ostensible subject matter. There is even formal recognition of the fact that to advance in dialectic is a greater thing than to bring any special inquiry to a successful issue.[24] But to the end there is a lack of interest in, and therefore a relative immaturity of, technique as such. In the forcing atmosphere, however, of that age of controversy, seed such as that sown in the master's treatment of the uttered λόγος[25] quickly germinated. Plato's successors in the Academy must have developed a system of grammatico-logical categories which Aristotle could make his own. Else much of his criticism of Platonic doctrine[26] does, indeed, miss fire. The gulf too, which the *Philebus*[27] apparently left unbridged between the sensuous apprehension of particulars and the knowledge of universals of even minimum generality led with Speusippus to a formula of knowledge in perception (ἐπιστημονικὴ αἴσθησις). These and like developments, which are to be divined from references in the Aristotelian writings, jejune, and, for the most part, of probable interpretation only, complete the material which Aristotle could utilize when he seceded from the Platonic school and embarked upon his own course of logical inquiry.

This is embodied in the group of treatises later known as the *Organon*[28] and culminates in the theory of syllogism and of demonstrative knowledge in the *Analytics*. All else is finally subsidiary. In the well-known sentences with which the *Organon* closes[29] Aristotle has been supposed to lay claim to the discovery of the principle of syllogism. He at least claims to have been the first to dissect the procedure of the debate-game, and the larger claim may be thought to follow. In the course of inquiry into the formal consequences from probable premises, the principle of mediation or linking was so laid bare that the advance to the analytic determination of the species and varieties of syllogism was natural. Once embarked upon such an analysis, where valid process from assured principles gave truth, Aristotle could find little difficulty in determining the formula of demonstrative knowledge or science. It must be grounded in principles of assured certainty and must demonstrate its conclusions with the use of such middle or linking terms only as it is possible to equate with the real ground or cause in the object of knowledge. Hence the account of axioms and of definitions, both of substances and of derivative attributes. Hence the importance of determining how first principles are established. It is, then, a fair working hypothesis as to the structure of the *Organon* to place the *Topics*, which deal with dialectical reasoning, before the *Analytics*.[30] Of the remaining treatises nothing of fundamental import depends on their order. One, however, the *Categories*, may be regarded with an ancient commentator,[31] as preliminary to the dialectical inquiry in the *Topics*. The other, on thought as expressed in language (Περὶ ἑρμηνείας) is possibly spurious, though in any case a compilation of the Aristotelian school. If genuine, its naïve theory that thought copies things and other features of its contents would tend to place it among the earliest works of the philosopher.

Syllogism.

Production in the form of a series of relatively self-contained treatises accounts for the absence of a name and general definition of their common field of inquiry. A more important lack which results is that of any clear intimation as to the relation in which Aristotle supposed it to stand to other disciplines. In his definite classification of the sciences,[32] into First Philosophy, Mathematics and Physics, it has no place. Its axioms, such as the law of contradiction, belong to first philosophy, but the doctrine as a whole falls neither under this head nor yet, though the thought has been entertained, under that of mathematics, since logic orders mathematical reasoning as well as all other. The speculative sciences, indeed, are classified according to their relation to form, pure, abstract or concrete, *i.e.* according to their objects. The logical inquiry seems to be conceived as dealing with the thought of which the objects are objects. It is to be regarded as a propaedeutic,[33] which, although it is in contact with reality in and through the metaphysical import of the axioms, or again in the fact that the categories, though primarily taken as forms of predication, must also be regarded as kinds of being, is not directly concerned with object-reality, but with the determination for the thinking subject of what constitutes the knowledge correlative to being. Logic, therefore, is not classed as one, still less as a branch of one, among the 'ologies, ontology not excepted.

The logical treatises.

The way in which logical doctrine is developed in the Aristotelian treatises fits in with this view. Doubtless what we have is in the main a reflex of the heuristic character of Aristotle's own work as pioneer. But it at least satisfies the requirement that the inquiry shall carry the plain man along with it. Actual modes of expression are shown to embody distinctions which average intelligence can easily recognize and will readily acknowledge, though they may tend by progressive rectification fundamentally to modify the assumption natural to the level of thought from which he begins. Thus we start[34] from the point of view of a world of separate persons and things, in which thought mirrors these concrete realities, taken as ultimate subjects of predicates. It is a world of communication of thought, where persons as thinkers need to utter in language truths objectively valid for the *mundus communis*. In these truths predicates are accepted or rejected by subjects, and therefore depend on the reflection of fact in λόγοι (propositions). These are combinatory of parts, attaching or detaching predicates, and so involving subject, predicate and copula.[35] At this stage we are as much concerned with speech-forms as the thought-forms of which they are conventional symbols, with Plato's analysis, for instance, into a noun and a verb, whose connotation of time is as yet a difficulty. The universal of this stage is the universal of fact, what is recognized as predicable of a plurality of subjects. The dialectical doctrine of judgment as the declaration of one member of a disjunction by contradiction, which is later so important, is struggling with one of its initial difficulties,[36] viz. the contingency of particular events future, the solution of which remains imperfect.[37]

The doctrine of the *Categories* is still on the same level of thought,[38] though its grammatico-logical analysis is the more advanced one which had probably been developed by the Academy before Aristotle came to think of his friends there as "them" rather than "us." It is what in one direction gave the now familiar classification of parts of speech, in the other that of thought-categories underlying them. If we abstract from any actual combination of subject and predicate and proceed to determine the types of predicate asserted in simple propositions of fact, we have on the one hand a subject which is never object, a "first substance" or concrete thing, of which may be predicated in the first place "second substance" expressing that it is a member of a concrete class, and in the second place quantity, quality, correlation, action and the like. The list follows the forms of the Greek language so closely that a category emerges appropriated to the use of the perfect tense of the middle voice to express the relation of the subject to a garb that it dons. In all this the individual is the sole self-subsistent reality. Truth and error are about the individual and attach or detach predicates correctly and incorrectly. There is no committal to the metaphysics in the light of which the logical inquiry is at last to find its complete justification. The point of view is to be modified profoundly by what follows—by the doctrine of the class-concept behind the class, of the form or idea as the constitutive formula of a substance, or, again, by the requirement that an essential attribute must be grounded in the nature or essence of the substance of which it is predicated, and that such attributes alone are admissible predicates from the point of view of the strict ideal of science. But we are still on the ground of common opinion, and these doctrines are not yet laid down as fundamental to the development.

The Categories.

Dialectic then, though it may prove to be the ultimate method of establishing principles in philosophy,[39] starts from probable and conceded premises,[40] and deals with them only in the light of common principles such as may be reasonably appealed to or easily established against challenge. To the expert, in any study which involves contingent matter, *i.e.* an irreducible element of indetermination, *e.g.* to the physician, there is a specific form of this, but the reflection that this is so is something of an afterthought. We start with what is prima facie given, to return upon it from the ground of principles clarified by the sifting process of dialectic[41] and certified by νοῦς. The *Topics* deal with dialectic and constitute an anatomy of argumentation, or, according to what seems to be Aristotle's own metaphor, a survey of the tactical vantage-points (τόποι) for the conflict of wits in which the prize is primarily victory, though it is a barren victory unless it is also knowledge. It is in this treatise that what have been called "the conceptual categories"[42] emerge, viz. the *predicables*, or heads of predication as it is analysed in relation to the provisional theory of definition that dialectic allows and requires. A predicate either is expressive of the essence or part of the essence of the subject, viz. that original group of mutually underivable attributes of which the absence of any one destroys its right to the class-name, or it is not. Either it is convertible with the subject or it is not. Here then judgment, though still viewed as combinatory, has the types which belong to coherent systems of implication discriminated from those that predicate coincidence or accident, *i.e.* any happening

The Topics.

not even derivatively essential from the point of view of the grouping in which the subject has found a place. In the theory of dialectic any predicate may be suggested for a subject, and if not affirmed of it, must be denied of it, if not denied must be affirmed. The development of a theory of the ground on which subjects claim their predicates and disown alien predicates could not be long postponed. In practical dialectic the unlimited possibility was reduced to manageable proportions in virtue of the groundwork of received opinion upon which the operation proceeded. It is in the *Topics*, further, that we clearly have a first treatment of syllogism as formal implication, with the suggestion that advance must be made to a view of its use for material implication from true and necessary principles. It is in the *Topics*,[43] again, that we have hints at the devices of an inductive process, which, as dialectical, throw the burden of producing contradictory instances upon the other party to the discussion. In virtue of the common-stock of opinion among the interlocutors and their potentially controlling audience, this process was more valuable than appears on the face of things. Obviously tentative, and with limits and ultimate interpretation to be determined elsewhere, it failed to bear fruit till the Renaissance, and then by the irony of fate to the discrediting of Aristotle. In any case, however, definition, syllogism, induction all invited further determination, especially if they were to take their place in a doctrine of truth or knowledge. The problem of analytic, *i.e.* of the resolution of the various forms of inference into their equivalents in that grouping of terms or premises which was most obviously cogent, was a legacy of the *Topics*. The debate-game had sought for diversion and found truth, and truth raised the logical problem on a different plane.

Class concept.

At first the problem of formal analysis only. We proceed with the talk of instances and concern ourselves first with relations of inclusion and exclusion. The question is as to membership of a class, and the dominant formula is the *dictum de omni et nullo*. Until the view of the individual units with which we are so far familiar has undergone radical revision, the primary inquiry must be into the forms of a class-calculus. Individuals fall into groups in virtue of the possession of certain predicates. Does one group include, or exclude, or intersect another with which it is compared? We are clearly in the field of the diagrams of the text-books, and much of the phraseology is based upon an original graphic representation in extension. The middle term, though conceived as an intermediary or linking term, gets its name as intermediate in a homogeneous scheme of quantity, where it cannot be of narrower extension than the subject nor wider than the predicate of the conclusion.[44] It is also, as Aristotle adds,[45] middle in position in the syllogism that concludes to a universal affirmative.[45] Again, so long as we keep to the syllogism as complete in itself and without reference to its place in the great structure of knowledge, the nerve of proof cannot be conceived in other than a formal manner. In analytic we work with an ethos different from that of dialectic. We presume truth and not probability or concession, but a true conclusion can follow from false premises, and it is only in the attempt to derive the premises in turn from their grounds that we unmask the deception. The passage to the conception of system is still required. The *Prior Analytics* then are concerned with a formal logic to be knit into a system of knowledge of the real only in virtue of a formula which is at this stage still to seek. The forms of syllogism, however, are tracked successfully through their figures, *i.e.* through the positions of the middle term that Aristotle recognizes as of actual employment, and all their moods, *i.e.* all differences of affirmative and negative, universal and particular within the figures, the cogent or legitimate forms are alone left standing, and the formal doctrine of syllogism is complete. Syllogism already defined[46] becomes through exhibition in its valid forms clear in its principle. It is a speech-and-thought-form (λόγος) in which certain matters being posited something other than the matters posited necessarily results because of them, and, though it still needs to receive a deeper meaning when presumed truth gives way to necessary truth of premises, the notion of the class to that of the class-concept, collective fact to universal law, its formal claim is manifest. “Certain matters being posited.” Subject and predicate not already seen to be conjoined must be severally known to be in relation with that which joins them, so that more than one direct conjunction must be given. “Of necessity.” If what are to be conjoined are severally in relation to a common third it does perforce relate or conjoin them. “Something other.” The conjunction was by hypothesis not given, and is a new result by no means to be reached, apart from direct perception save by use of at least two given conjunctions. “Because of them,” therefore. Yet so long as the class-view is prominent, there is a suggestion of a begging of the question. The class is either constituted by enumeration of its members, and, passing by the difficulty involved in the thought of “its” members, is an empirical universal of fact merely, or it is grounded in the class-concept. In the first case it is a formal scheme which helps knowledge and the theory of knowledge not at all. We need then to develop the alternative, and to pass from the external aspect of all-ness to the intrinsic ground of it in the universal καθ᾽ αὑτὸ καὶ ᾗ αὐτό, which, whatsoever the assistance it receives from induction in some sense of the word, in the course of its development for the individual mind, is secured against dependence on instances by the decisive fiat or guarantee of νοῦς, insight into the systematic nexus of things. The conception of linkage needs to be deepened by the realization of the middle term as the ground of nexus in a real order which is also rational.

The Prior Analytics.

Aristotle’s solution of the paradox of inference, viz. of the fact that in one sense to go beyond what is in the premises is fallacy, while in another sense not to go beyond them is futility, lies in his formula of implicit and explicit, potential and actual.[47] The real nexus underlying the thought-process is to be articulated in the light of the voucher by intelligence as to the truth of the principles of the various departments of knowledge which we call sciences, and at the ideal limit it is possible to transform syllogism into systematic presentation, so that, differently written down, it is definition. But for human thought sense, with its accidental setting in matter itself incognizable is always with us. The activity of νοῦς is never so perfectly realized as to merge implication in intuition. Syllogism must indeed be objective, *i.e.* valid for any thinker, but it is also a process in the medium of individual thinking, whereby new truth is reached. A man may know that mules are sterile and that the beast before him is a mule, and yet believe her to be in foal “not viewing the several truths in connexion.”[48] The doctrine, then, that the universal premise contains the conclusion not otherwise than potentially is with Aristotle cardinal. The datum of sense is only retained through the universal.[49] It is possible to take a universal view with some at least of the particular instances left uninvestigated.[50] Recognition that the class-concept is applicable may be independent of knowledge of much that it involves. Knowledge of the implications of it does not depend on observation of all members of the class. Syllogism as formula for the exhibition of truth attained, and construction or what not as the instrumental process by which we reach the truth, have with writers since Hegel and Herbart tended to fall apart. Aristotle’s view is other. Both are syllogisms, though in different points of view. For this reason, if for no other, the conception of movement from the potential possession of knowledge to its actualization remains indispensable. Whether this is explanation or description, a problem or its solution, is of course another matter.

Problem of inference.

Nous.

In the *Posterior Analytics* the syllogism is brought into decisive connexion with the real by being set within a system in which its function is that of material implication from principles which are primary, immediate and necessary truths. Hitherto the assumption of the probable as true rather than as what will be conceded in debate[51] has been the main distinction of the standpoint of analytic from that of dialectic. But the true is true only in reference to a coherent system in which it is an immediate ascertainment of νοῦς, or to be deduced from a ground which is such. The ideal of science or demonstrative knowledge is to exhibit as flowing from the definitions and postulates of a science, from its special principles, by the help only of axioms or

Posterior Analytics.

principles common to all knowledge, and these not as premises but as guiding rules, all the properties of the subject-matter, *i.e.* all the predicates that belong to it in its own nature. In the case of any subject-kind, its definition and its existence being avouched by νοῦς, "heavenly body" for example, the problem is, given the fact of a non-self-subsistent characteristic of it, such as the eclipse of the said body, to find a ground, a μέσον which expressed the αἴτιον, in virtue of which the adjectival concept can be exhibited as belonging to the subject-concept καθ᾽ αὐτὸ in the strictly adequate sense of the phrase in which it means also ᾗ αὐτὸ.[52] We are under the necessity then of revising the point of view of the syllogism of all-ness. We discard the conception of the universal as a predicate applicable to a plurality, or even to all, of the members of a group. To know merely κατὰ παντὸς is not to know, save accidentally. The exhaustive judgment, if attainable, could not be known to be exhaustive. The universal is the ground of the empirical "all" and not conversely. A formula such as the equality of the interior angles of a triangle to two right angles is only scientifically known when it is not of isosceles or scalene triangle that it is known, nor even of all the several types of triangle collectively, but as a predicate of triangle recognized as the widest class-concept of which it is true, the first stage in the progressive differentiation of figure at which it can be asserted.[53]

Three points obviously need development, the nature of definition, its connexion with the syllogism in which the middle term is cause or ground, and the way in which we have assurance of our principles.

Definition.

Definition is either of the subject-kind or of the property that is grounded in it. Of the self-subsistent definition is οὐσίας τις γνωρισμός[54] by exposition of genus and differentia.[55] It is indemonstrable. It presumes the reality of its subject in a postulate of existence. It belongs to the principles of demonstration. *Summa genera* and groups below *infimae species* are indefinable. The former are susceptible of elucidation by indication of what falls under them. The latter are only describable by their accidents. There can here be no true differentia. The artificiality of the limit to the articulation of species was one of the points to which the downfall of Aristotle's influence was largely due. Of a non-self-subsistent or attributive conception definition in its highest attainable form is a recasting of the syllogism, in which it was shown that the attribute was grounded in the substance or self-subsistent subject of which it is. Eclipse of the moon, *e.g.* is privation of light from the moon by the interposition of the earth between it and the sun. In the scientific syllogism the interposition of the earth is the middle term, the cause or "because" (διότι), the residue of the definition is conclusion. The difference then is in verbal expression, way of putting, inflexion.[56] If we pluck the fruit of the conclusion, severing its nexus with the stock from which it springs, we have an imperfect form of definition, while, if further we abandon all idea of making it adequate by exhibition of its ground, we have, with still the same form of words, a definition merely nominal or lexicographical. In the aporematic treatment of the relation of definition and syllogism identical as to one form and in one view, distinct as to another form and in another view, much of Aristotle's discussion consists. The rest is a consideration of scientific inquiry as converging in μέσου ζήτησις, the investigation of the link or "because" as ground in the nature of things. Τὸ γὰρ αἴτιον τὸ μέσον[57] real ground and thought link fall together. The advance from syllogism as formal implication is a notable one. It is not enough to have for middle term a *causa cognoscendi* merely. We must have a *causa essendi*. The planets are near, and we know it by their not twinkling,[58] but science must conceive their nearness as the cause of their not twinkling and make the *prius* in the real order the middle term of its syllogism. In this irreversible catena proceeding from ground to consequent, we have left far behind such things as the formal parity of genus and differentia considered as falling under the same predicable,[59] and hence justified in part Porphyry's divergence from the scheme of predicables. We need devices, indeed, to determine priority or superior claim to be "better known absolutely or in the order of nature," but on the whole the problem is fairly faced.[60]

The middle term.

Of science Aristotle takes for his examples sometimes celestial physics, more often geometry or arithmetic, sometimes a concrete science, *e.g.* botany.[61] In the field of pure form, free from the disconcerting surprises of sensible matter and so of absolute necessity, no difficulty arises as to the deducibility of the whole body of a science from its first principles. In the sphere of abstract form, mathematics, the like may be allowed, abstraction being treated as an elimination of matter from the σύνολον by one act. When we take into account relative matter, however, and traces of a conception of abstraction as admitting of degree,[62] the question is not free from difficulty. In the sphere of the concrete sciences where law obtains only ὡς ἐπὶ τὸ πολὺ this ideal of science can clearly find only a relative satisfaction with large reserves. In any case, however, the problem as to first principles remains fundamental.

Formal and scientific principles.

If we reject the infinite regress and the circle in proof (*circulus in probando*) which resolves itself ultimately into proving A by B and B by A,[63] we are confronted by the need for principles of two kinds, those which condition all search for truth, and those which are the peculiar or proper principles of special sciences, their "positions," viz. the definitions of their subjects and the postulates of the existence of these. All are indemonstrable and cannot be less sure than the body of doctrine that flows from them. They must indeed be recognized as true, primary, causative and the like. But[64] they are not congenitally present in the individual in a determinate shape. The doctrine of latency is mystical and savours of Plato's reminiscence (*anamnesis*). Yet they must have something to develop from, and thereupon Aristotle gives an account of a process in the psychological mechanism which he illustrates by comparative psychology, wherein a λόγος or meaning emerges, a "first" universal recognized by induction. Yet νοῦς, intelligence, is the principle of first principles. It is infallible, while, whatever the case with perception of the special sensibles,[65] the process which combines particulars is not. On the side of induction we find that experience is said to give the specific principles,[66] "the phenomena being apprehended in sufficiency." On the side of intuition, self-evidence of scientific principles is spoken of.[67] Yet dialectic is auxiliary and of methodological importance in their establishment.[68] Mutually limiting statements occur almost or quite side by side. We cannot take first principles "as the bare precipitate of a progressively refined analysis"[69] nor on the other as constitutive a priori forms. The solution seems to lie in the conception of a process that has a double aspect. On the one hand we have confrontation with fact, in which, in virtue of the rational principle which is the final cause of the phenomenal order, intelligence will find satisfaction. On the other we have a stage at which the rational but as yet not reasoned concepts developed in the medium of the psychological mechanism are subjected to processes of reflective comparison and analysis, and, with some modification, maintained against challenge, till at length the ultimate universals emerge, which rational insight can posit as certain, and the whole hierarchy of concepts from the "first" universals to τὰ ἀμερῆ are intuited in a coherent system. Aristotle's terminology is highly technical, but, as has often been observed, not therefore clear. Here two words at least are ambiguous, "principle" and "induction." By the first he means any starting-point, "that from which the matter in question is primarily to be known,"[70] particular facts therefore, premises, and what not. What then is meant by principles when we ask in the closing chapter of his logic how they become known? The data of sense are clearly not the principles in question here. The premises of scientific syllogisms may equally be dismissed. Where they are not derivative they clearly are definitions or immediate transcripts from definitions. There remain, then, primary definitions and the postulates of their realization, and the axioms or common principles, "which he must needs have who is to reach any knowledge."[71] In the case of the former, special each to its own science, Aristotle may be thought to hold that they are the product of the psychological mechanism, but are

Induction and dialectic.

ascertained only when they have faced the fire of a critical dialectic and have been accepted from the point of view of the integral rationality of the system of concepts. Axioms, on the other hand, in which the sciences interconnect[72] through the employment of them in a parity of relation, seem to be implicit indeed in the psychological mechanism, but to come to a kind of explicitness in the first reflective reaction upon it, and without reference to any particular content of it. They are not to be used as premises but as immanent laws of thought, save only when an inference from true or admitted premises and correct in form is challenged. The challenge must be countered in a *reductio ad impossibile* in which the dilemma is put. Either this conclusion or the denial of rationality. Even these principles, however, may get a greater explicitness by dialectical treatment.[73] The relation, then, of the two orders of principle to the psychological mechanism is different. The kind of warrant that intelligence can give to specific principles falls short of infallibility. Celestial physics, with its pure forms and void of all matter save extension, is not such an exemplary science after all. Rationality is continuous throughout. A λόγος emerges with some beings in direct sequence upon the persistence of impressions.[74] Sense is of the "first" universal, the form, though not of the ultimate universal. The rally from the rout in Aristotle's famous metaphor is of units that already belong together, that are of the same regiment or order. On the other hand, rationality has two stages. In the one it is relatively immersed in sense, in the other relatively free. The same break is to be found in the conception of the relation of receptive to active mind in the treatise *Of the Soul*.[75] The one is impressed by things and receives their form without their matter. The other is free from impression. It thinks its system of concepts freely on the occasion of the affections of the receptivity. Aristotle is fond of declaring that knowledge is of the universal, while existence or reality is individual. It seems to follow that the cleavage between knowledge and reality is not bridged by the function of νοῦς in relation to "induction." What is known is not real, and what is real is not known. The *nodus*[76] has its cause in the double sense of the word "universal" and a possible solution in the doctrine of εἶδος. The "form" of a thing constitutes it what it is, and at the same time, therefore, is constitutive of the group to which it belongs. It has both individual and universal reference. The individual is known in the εἶδος, which is also the first universal in which by analysis higher universals are discoverable. These are predicates of the object known, ways of knowing it, rather than the object itself. The suggested solution removes certain difficulties, but scarcely all. On seeing Callias my perception is of man, not Callias, or even man-Callias. The recognition of the individual is a matter of his accidents, to which even sex belongs, and the gap from lowest universal to individual may still be conceived as unbridged. It is in induction, which claims to start from particulars and end in universals,[77] that we must, if anywhere within the confines of logical inquiry, expect to find the required bridge. The Aristotelian conception of induction, however, is somewhat ambiguous. He had abandoned for the most part the Platonic sense of the corresponding verb, viz. to lead forward to the as yet unknown, and his substitute is not quite clear. It is scarcely the military metaphor. The adducing of a witness for which he uses the verb[78] is not an idea that covers all the uses.[79] Perhaps confrontation with facts is the general meaning. But how does he conceive of its operation? There is in the first place the action of the psychological mechanism in the process from discriminative sense upwards wherein we realize "first" universals.[80] This is clearly an unreflective, pre-logical process, not altogether lighted up by our retrojection upon it of our view of dialectical induction based thereon. The immanent rationality of this first form, in virtue of which at the stage when intelligence acts freely on the occasion of the datum supplied it recognizes continuity with its own self-conscious process, is what gives the dialectical type its meaning. Secondly we have this dialectical "induction as to particulars by grouping of similars"[81] whose liability to rebuttal by an exception has been already noted in connexion with the limits of dialectic. This is the incomplete induction by simple enumeration which has so often been laughed to scorn. It is a heuristic process liable to failure, and its application by a nation of talkers even to physics where non-expert opinion is worthless somewhat discredited it. Yet it was the fundamental form of induction as it was conceived throughout the scholastic period. Thirdly we have the limiting cases of this in the inductive syllogism διὰ πάντων,[82] a syllogism in the third figure concluding universally, and yet valid because the copula expresses equivalence, and in analogy[83] in which, it has been well said, instances are weighed and not counted. In the former it has been noted[84] that Aristotle's illustration does not combine particular facts into a lowest concept, but specific concepts into a generic concept, and[85] that in the construction of definite inductions the ruling thought with Aristotle is already, though vaguely, that of causal relation. It appears safer, notwithstanding, to take the less subtle interpretation[86] that dialectical induction struggling with instances is formally justified only at the limit, and that this, where we have exhausted and know that we have exhausted the cases, is in regard to individual subjects rarely and accidentally reached, so that we perforce illustrate rather from the definite class-concepts falling under a higher notion. After all, Aristotle must have had means by which he reached the conclusions that horses are long-lived and lack gall. It is only then in the rather mystical relation of νοῦς to the first type of induction as the process of the psychological mechanism that an indication of the direction in which the bridge from individual being to universal knowledge is to be found can be held to lie.

Knowledge and reality.

Conclusions as to induction.

Enough has been said to justify the great place assigned to Aristotle in the history of logic. Without pressing metaphysical formulae in logic proper, he analysed formal implication grounded implication as a mode of knowledge in the rationality of the real, and developed a justificatory metaphysic. He laid down the programme which the after history of logic was to carry out. We have of course abandoned particular logical positions. This is especially to be noted in the theory of the proposition. The individualism with which he starts, howsoever afterwards mitigated by his doctrine of τὸ τὶ ἦν εἶναι or εἶδος constituting the individual in a system of intelligible relations, confined him in an inadmissible way to the subject-attribute formula. He could not recognize such vocables as the impersonals for what they were, and had perforce to ignore the logical significance of purely reciprocal judgments, such as those of equality. There was necessarily a "sense" or direction in every proposition, with more than the purely psychological import that the advance was from the already mastered and familiar taken as relatively stable, to the new and strange. Many attributes, too, were predicable, even to the end, in an external and accidental way, not being derivable from the essence of the subject. The thought of contingency was too easily applied to these attributes, and an unsatisfactory treatment of modality followed. It is indeed the doctrine of the intractability of matter to form that lies at the base of the paradox as to the disparateness of knowledge and the real already noted. On the one hand Aristotle by his doctrine of matter admitted a surd into his system. On the other, he assigned to νοῦς with its insight into rationality too high a function with regard to the concrete in which the surd was present, a power to certify the truth of scientific principles. The example of Aristotle's view of celestial physics as a science of pure forms exhibits both points. On the Copernican change the heavenly bodies were recognized as concrete and yet subject to calculable law. Intelligence had warranted false principles. The moral is that of the story of the heel of Achilles.

Summary.

To return to logic proper. The Aristotelian theory of the universal of science as secure from dependence on its instances and the theory of linking in syllogism remain a heritage for all later logic, whether accepted in precisely Aristotle's formula or no. It is because the intervening centuries had the Aristotelian basis to work on, sometimes in reduced quantity and corrupt form, but always in some quantity and some form, that the rest of our logical tradition is what it is. We stand upon his shoulders.

After Aristotle we have, as regards logic, what the verdict of after times has rightly characterized as an age of *Epigoni*. So far as the Aristotelian framework is accepted we meet only minor corrections and extensions of a formal kind. If there is conscious and purposed divergence from Aristotle, inquiry moves, on the whole, within the circle of ideas where Aristotelianism had fought its fight and won its victory. Where new conceptions emerge, the imperfection of the instruments, mechanical and methodological, of the sciences renders them unfruitful, until their rediscovery in a later age. We have activity without advance, diversity without development. Attempts at comprehensiveness end in the compromises of eclecticism.

The Peripatetics.

Illustrations are not far to seek. Theophrastus and in general the elder Peripatetics, before the rise of new schools with new lines of cleavage and new interests had led to new antagonisms and new alliances, do not break away from the Aristotelian metaphysic. Their interests, however, lie in the sublunary sciences in which the substantive achievement of the school was to be found. With Theophrastus, accordingly, in his botanical inquiries, for example, the alternatives of classification, the normal sequence of such and such a character upon such another, the conclusion of rational probability, are what counts. It is perhaps not wholly fanciful to connect with this attitude the fact that Aristotle's pupils dealt with a surer hand than the master with the conclusions from premises of unlike modality, and that a formal advance of some significance attributable to Theophrastus and Eudemus is the doctrine of the hypothetical and disjunctive syllogisms.

The Stoics.

The Stoics are of more importance. Despite the fact that their philosophic interests lay rather in ethics and physics, their activity in what they classified as the third department of speculation was enormous and has at least left ineffaceable traces on the terminology of philosophy. Logic is their word, and consciousness, impression and other technical words come to us, at least as technical words, from Roman Stoicism. Even inference, though apparently not a classical word, throws back to the Stoic name for a conclusion.[87] In the second place, it is in the form in which it was raised in connexion with the individualistic theory of perception with which the Stoics started, that one question of fundamental importance, viz. that of the criterion of truth, exercised its influence on the individualists of the Renaissance. Perception, in the view of the Stoics, at its highest both revealed and guaranteed the being of its object. Its hold upon the object involved the discernment that it could but be that which it purported to be. Such "psychological certainty" was denied by their agnostic opponents, and in the history of Stoicism we have apparently a modification of the doctrine of φαντασία καταληπτικὴ with a view to meet the critics, an approximation to a recognition that the primary conviction might meet with a counter-conviction, and must then persist undissipated in face of the challenge and in the last resort find verification in the haphazard instance, under varying conditions, in actual working. The controversy as to the self-evidence of perception in which the New Academy effected some sort of conversion of the younger Stoics, and in which the Sceptics opposed both, is one of the really vital issues of the decadence.

Another doctrine of the Stoics which has interest in the light of certain modern developments is their insistence on the place of the λεκτόν in knowledge. Distinct alike from thing and mental happening, it seems to correspond to "meaning" as it is used as a technical phrase now-a-days. This anticipation was apparently sterile. Along the same lines is their use of the hypothetical form for the universal judgment, and their treatment of the hypothetical form as the typical form of inference.

The Stoical categories, too, have an historical significance. They are apparently offered in place of those of Aristotle, an acquaintance with whose distinctions they clearly presume. Recognizing a linguistic side to "logical" theory with a natural development in rhetoric, the Stoics endeavour to exorcise considerations of language from the contrasted side. They offer pure categories arising in series, each successive one presupposing those that have gone before. Yet the substance, quality, condition absolute (πῶς ἔχον) and condition relative of Stoicism have no enduring influence outside the school, though they recur with eclectics like Galen. The Stoics were too "scholastic" in their speculations.

Epicureans.

In Epicureanism logic is still less in honour. The practical end, freedom from the bondage of things with the peace it brings, is all in all, and even scientific inquiry is only in place as a means to this end. Of the apparatus of method the less the better. We are in the presence of a necessary evil. Yet, in falling back, with a difference, upon the atomism of Democritus, Epicurus had to face some questions of logic. In the inference from phenomena to further phenomena positive verification must be insisted on. In the inference from phenomena to their non-phenomenal causes, the atoms with their inaccessibility to sense, a different canon of validity obtains, that of non-contradiction.[88] He distinguishes too between the inference to combination of atoms as universal cause, and inference to special causes beyond the range of sense. In the latter case alternatives may be acquiesced in.[89] The practical aim of science is as well achieved if we set forth possible causes as in showing the actual cause. This pococurantism might easily be interpreted as an insight into the limitations of inverse method as such or as a belief in the plurality of causes in Mill's sense of the phrase. More probably it reflects the fact that Epicurus was, according to tradition through Nausiphanes, on the whole dominated by the influences that produced Pyrrhonism. Democritean physics without a calculus had necessarily proved sterile of determinate concrete results, and this was more than enough to ripen the naturalism of the utilitarian school into scepticism. Some reading between the lines of Lucretius has led the "logic" of Epicurus to have an effect on the modern world, but scarcely because of its deserts.

The Sceptics.

The school of Pyrrho has exercised a more legitimate influence. Many of the arguments by which the Sceptics enforced their advocacy of a suspense of judgment are antiquated in type, but many also are, within the limits of the individualistic theory of knowledge, quite unanswerable. Hume had constant recourse to this armoury. The major premise of syllogism, says the Pyrrhonist, is established inductively from the particular instances. If there be but one of these uncovered by the generalization, this cannot be sound. If the crocodile moves its upper, not its lower, jaw, we may not say that all animals move the lower jaw. The conclusion then is really used to establish the major premise, and if we still will infer it therefrom we fall into the circular proof.[90] Could Mill say more? But again. The inductive enumeration is either of all cases or of some only. The former is in an indeterminate or infinite subject-matter impossible. The latter is invalid.[91] Less familiar to modern ears is the contention that proof needs a standard or criterion, while this standard or criterion in turn needs proof. Or still more the dialectical device by which the sceptic claims to escape the riposte that his very argument presumes the validity of this or that principle, viz. the doctrine of the equipollence of counter-arguments. Of course the counter-contention is no less valid! So too when the reflection is made that scepticism is after all a medicine that purges out itself with the disease, the disciple of Pyrrho and Aenesidemus bows and says, Precisely! The sceptical suspension of judgment has its limits, however. The Pyrrhonist will act upon a basis of probabilities. Nay, he even treats the idea of cause[92] as probable enough so long as nothing more than action upon expectation is in question. He adds, however, that any attempt to establish it is involved in some sort of dilemma. That, for instance, cause as the correlate of effect only exists with it, and accordingly, cause which is come while effect is still to come is inconceivable.[93] From the subjectivist point of view, which is manifestly fundamental through most of this, such arguments suasory of the Pyrrhonist suspense of judgment (ἐποχή) are indeed hard to answer. It is natural, then, that the central contribution of the Sceptics to the knowledge controversy lies in the modes (τρόποι) in which the relativity of phenomena is made good, that these are elaborated with extreme care, and that they have a modern ring and are full of instruction even to-day. Scepticism, it must be confessed, was at the least well equipped to expose the bankruptcy of the post-Aristotelian

dogmatism.

It was only gradually that the Sceptic's art of fence was developed. From the time of Pyrrho overlapping Aristotle himself, who seems to have been well content to use the feints of more than one school among his predecessors, while showing that none of them could claim to get past his guard, down through a period in which the decadent academy under Carneades, otherwise dogmatic in its negations, supplied new thrusts and parries, to Aenesidemus in the late Ciceronian age, and again to Sextus Empiricus, there seems to have been something of plasticity and continuous progress. In this matter the dogmatic schools offer a marked contrast. In especial it is an outstanding characteristic of the younger rivals to Aristotelianism that as they sprang up suddenly into being to contest the claims of the Aristotelian system in the moment of its triumph, so they reached maturity very suddenly, and thereafter persisted for the most part in a stereotyped tradition, modified only when convicted of indefensible weakness. The 3rd century B.C. saw in its first half the close of Epicurus' activity, and the life-work of Chrysippus, the refounder of Stoicism, is complete before its close. And subsequent variations seem to have been of a negligible where not of an eclectic character. In the case of Epicureanism we can happily judge of the tyranny of the literal tradition by a comparison of Lucretius with the recorded doctrine of the master. But the rule apparently obtains throughout that stereotype and compromise offer themselves as the exhaustive alternative. This is perhaps fortunate for the history of doctrine, for it produces the commentator, your Aspasius or Alexander of Aphrodisias, and the substitute for the critic, your Cicero, or your Galen with his attempt at comprehension of the Stoic categories and the like while starting from Aristotelianism. Cicero in particular is important as showing the effect or philosophical eclecticism upon Roman cultivation, and as the often author and always popularizer of the Latin terminology of philosophy.

The cause of the stereotyping of the systems, apart from political conditions, seems to have been the barrenness of science. Logic and theory of knowledge go together, and without living science, theory of knowledge loses touch with life, and logic becomes a perfunctory thing. Under such circumstances speculative interest fritters itself and sooner or later the sceptic has his way. Plato is full of the faith of mathematical physics. Aristotle is optimistic of achievement over the whole range of the sciences. But the divorce of science of nature from mathematics, the failure of biological inquiry to reach so elementary a conception as that of the nerves, the absence of chemistry from the circle of the sciences, disappointed the promise of the dawn and the relative achievement of the noon-day. There is no development. Physical science remains dialectical, and a physical experiment is as rare in the age of Lucretius as in that of Empedocles. The cause of eclecticism is the unsatisfying character of the creeds of such science, in conjunction with the familiar law that, in triangular or plusquam-triangular controversies a common hatred will produce an alliance based on compromise. A bastard Platonism through hostility to Stoicism may become agnostic. Stoicism through hostility to its sceptical critics may prefer to accept some of the positions of the dogmatic nihilist.

Of the later schools the last to arise was Neoplatonism. The mathematical sciences, at least, had not proved disappointing. For those of the school of Plato who refused the apostasy of the new academy, there was hope either in the mathematical side of the Pythagoreo-Platonic tradition, or in its ritual and theological side. ***Neoplatonism.*** Neoplatonism is philosophy become theosophy, or it is the sermon on the text that God geometrizes. It is of significance in the general history of thought as the one great school that developed after the decadence had set in. In its metaphysic it showed no failure in dialectical constructiveness. In the history of logic it is of importance because of its production of a whole series of commentators on the Aristotelian logic. Not only the *Introduction* of Porphyry, which had lasting effects on the Scholastic tradition, but the commentaries of Themistius, and Simplicius. It was the acceptance of the Aristotelian logic by Neoplatonism that determined the Aristotelian complexion of the logic of the next age. If Alexander is responsible for such doctrines as that of the *intellectus acquisitus*, it is to Porphyry, with his characteristically Platonist preference for the doctrine of universals, and for classification, that we owe the scholastic preoccupation with the realist controversy, and with the *quinque voces*, *i.e.* the Aristotelian predicables as restated by Porphyry.

B. Scholasticism

The living force in the spiritual life of the Roman empire was, after all, not philosophy, but religion, and specifically Christianity. With the extension of Christianity to the Gentile world it at length became necessary for it to orientate itself towards what was best in Greek culture. There is a Stoic element in the ethic of the Pauline epistles, but the theological affinity that the Johannine gospel, with its background of philosophic ideas, exhibits to Platonic and Neoplatonist teaching caused the effort at absorption to be directed rather in that direction. Neoplatonism had accepted the Aristotelian logic with its sharper definition than anything handed down from Plato, and, except the logic of the Sceptics, there was no longer any rival discipline of the like prestige. The logic of the Stoics had been discredited by the sceptical onset, but in any case there was no organon of a fitness even comparable to Aristotle's for the task of drawing out the implications of dogmatic premises. Aristotelian logic secured the imprimatur of the revived Platonism, and it was primarily because of this that it passed into the service of Christian theology. The contact of the Church with Platonism was on the mystical side. Orthodoxy needed to counter heretical logic not with mysticism, itself the fruitful mother of heresies, but with argument. Aristotelianism approved itself as the controversial instrument, and in due course held the field alone. The upshot is what is called Scholasticism. Scholasticism is the Aristotelianism of medieval orthodoxy as taught in the "schools" or universities of Western Europe. It takes form as a body of doctrine drawing its premises from authority, sometimes in secular matters from that of Aristotle, but normally from that of the documents and traditions of systematic theology, while its method it draws from Aristotle, as known in the Latin versions,[94] mainly by Boethius, of some few treatises of the *Organon* together with the *Isagoge* of Porphyry. It dominates the centres of intellectual life in the West because, despite its claim to finality in its principles or premises, and to universality for its method, it represents the only culture of a philosophic kind available to the adolescent peoples of the Western nations just becoming conscious of their ignorance. Christianity was the one organizing principle that pulsed with spiritual life. The vocation of the student could find fulfilment only in the religious orders. Scholasticism embodied what the Christian community had saved from the wreckage of Greek dialectic. Yet with all its effective manipulation of the formal technique of its translated and mutilated Aristotle, Scholasticism would have gone under long before it did through the weakness intrinsic to its divorce of the form and the matter of knowledge, but for two reasons. The first is the filtering through of some science and some new Aristotelian learning from the Arabs. The second is the spread of Greek scholarship and Greek manuscripts westward, which was consequent on the Latin occupation of Constantinople in 1204. It was respited by the opportunity which was afforded it of fresh draughts from the Aristotle of a less partial and purer tradition, and we have, accordingly, a golden age of revived Scholasticism beginning in the 13th century, admitting now within itself more differences than before. It is to the schoolmen of the two centuries preceding the Turkish capture of Constantinople that the controversial refinements usually associated with the name of Scholasticism are attributable. The *Analytics* of Aristotle now entered quite definitely into the logical thought of Scholasticism and we have the contrast of a *logica vetus* and *logica nova*. That other matters, the *parva logicalia* and Mnemonics adapted from Psellus and possibly of Stoic origin, entered too did not outweigh this advantage. Confrontation with the historical Aristotle may have brought but little comfort to the orthodox system, but it was a stimulus to dialectical activity within the schools. It provoked the distinction of what was true *secundum fidem* and what was true *secundum rationem* among even sincere champions of orthodoxy, and their opponents accepted

with a smile so admirable a mask for that thinking for themselves to which the revival of hope of progress had spurred them. The pioneers of the Renaissance owe something of their strength to their training in the developments which the system that they overthrew underwent during this period. The respite, however, was short. The flight of Byzantine scholarship westward in the 15th century revealed, and finally, that the philosophic content of the Scholastic teaching was as alien from Aristotle as from the spirit of the contemporary revolt of science, with its cry for a new medicine, a new nautical astronomy and the like. The doom of the Scholastic Aristotle was nevertheless not the rehabilitation of the Greek Aristotle. Between him and the tide of feeling at the Renaissance lay the whole achievement of Arab science. That impatience of authority to which we owe the Renaissance, the Reformation and the birth of Nationalism, is not stilled by the downfall of Aristotle as the *nomen appellativum* of the schools. The appeal is to experience, somewhat vaguely defined, as against all authority, to the book of nature and no other. At last the world undertakes to enlarge the circle of its ideas.

C. The Renaissance

Accordingly what is in one sense the revival of classical learning is in another a recourse to what inspired that learning, and so is a new beginning. There is no place for a reformed Aristotelian logic, though the genius of Zabarella was there to attempt it. Nor for revivals of the competing systems, though all have their advocates. Scientific discovery was in the air. The tradition of the old world was too heavily weighted with the Ptolemaic astronomy and the like to be regarded as other than a bar to progress. But from the new point of view its method was inadequate too, its contentment with an induction that merely leaves an opponent silent, when experiment and the application of a calculus were within the possibilities. The transformation of logic lay with the man of science, hindered though he might be by the enthusiasm of some of the philosophers of nature. Henceforth the Aristotelian logic, the genuine no less than the traditional, was to lie on the other side of the Copernican change.

The demand is for a new organon, a scientific method which shall face the facts of experience and justify itself by its achievement in the reduction of them to control. It is a notable feature of the new movement, that except verbally, in a certain licence of nominalist expression, due to the swing of the pendulum away from the realist doctrine of universals, there is little that we can characterize as Empiricism. Facts are opposed to abstract universals. Yes. Particulars to controlling formulae. No. Experience is appealed to as fruitful where the formal employment of syllogism is barren. But it is not mere induction, with its "unanalysed concretes taken as ultimate" that is set up as the substitute for deduction. Rather a scientific process, which as experiential may be called inductive, but which is to other regards deductive as syllogism, is set up in contrast to syllogism and enumeration alike. This is to be seen in Zabarella,[95] in 906
Galilei,[96] and in Bacon. The reformed Aristotelian logic of the first-named with its *inductio demonstrativa*, the mathematico-physical analysis followed by synthesis of the second, the *exclusiva*, or method of exclusions of the last, agree at least in this, that the method of science is one and indivisible, while containing both an inductive and a deductive moment. That what, *e.g.*, Bacon says of his method may run counter to this is an accident of the tradition of the quarrel with realism. So, too, with the scholastic universals. Aristotle's forms had been correlated, though inadequately, with the idea of function. Divorced from this they are fairly stigmatized as mental figments or branded as ghostly entities that can but block the path. But consider Bacon's own doctrine of forms. Or watch the mathematical physicist with his formulae. The faith of science looks outward as in the dawn of Greek philosophy, and subjectivism such as Hume's has as yet no hold. Bacon summing up the movement so far as he understood it, in a rather belated way, has no theory of knowledge beyond the metaphor of the mirror held up to nature. Yet he offers an ambitious logic of science, and the case is typical.

The science of the Renaissance differs from that of the false dawn in Greek times in the fact of fruitfulness. It had the achievement of the old world in the field of mathematics upon which to build. It was in reaction against a dialectic and not immediately to be again entrapped. In scientific method, then, it could but advance, provided physics and mathematics did not again fail of accord. Kepler and Galilei secured it against that disaster. The *ubi materia ibi geometria* of the one is the battle-cry of the mathematico-physical advance. The scientific instrument of the other, with its moments of analysis and construction, *metodo risolutivo* and *metodo compositivo*, engineers the road for the advance. The new method of physics is verifiable by its fruitfulness, and so free of any immediate danger from dialectic. Its germinal thought may not have been new, but, if not new, it had at least needed rediscovery from the beginning. For it was to be at once certain and experiential. A mathematico-physical calculus that would work was in question. The epistemological problem as such was out of the purview. The relation of physical laws to the mind that thought them was for the time a negligible constant. When Descartes, having faithfully and successfully followed the mathematico-physical inquiry of his more strictly scientific predecessors, found himself compelled to raise the question how it was possible for him to know what in truth he seemed to know so certainly, the problem entered on a new phase. The scientific movement had happily been content for the time with a half which, then and there at least, was more than the whole.

Galilei.

Bacon was no mathematician, and so was out of touch with the main army of progress. By temperament he was rather with the Humanists. He was content to voice the cry for the overthrow of the dominant system as such, and to call for a new beginning, with no realist presuppositions. He is with the nominalists of the later Scholasticism and the naturalists of the early Renaissance. He echoes the cry for recourse to nature, for induction, for experiment. He calls for a logic of discovery. But at first sight there is little sign of any greater contribution to the reconstruction than is to be found in Ramus or many another dead thinker. The syllogism is ineffective, belonging to argumentation, and constraining assent where what we want is control of things. It is a mechanical combination of propositions as these of terms which are counters to express concepts often ill-defined. The flight from a cursory survey of facts to wide so-called principles must give way to a gradual progress upward from propositions of minimum to those of medium generality, and in these consists the fruitfulness of science. Yet the induction of the Aristotelians, the dialectical induction of the *Topics*, content with imperfect enumeration and with showing the burden of disproof upon the critic, is puerile, and at the mercy of a single instance to the contrary. In all this there is but little promise for a new organon. It is neither novel nor instrumental. On a sudden Bacon's conception of a new method begins to unfold itself. It is inductive only in the sense that it is identical in purpose with the ascent from particulars. It were better called exclusiva or elimination of the alternative, which Bacon proposes to achieve, and thereby guarantee his conclusion against the possibility of instance to the contrary.

Bacon.

Bacon's method begins with a digest into three tables of the facts relevant to any inquiry. The first contains cases of the occurrence of the quality under investigation, colour, *e.g.*, or heat, in varying combinations. The second notes its absence in combinations so allied to certain of these that its presence might fairly have been looked for. The third registers its quantitative variation according to quantitative changes in its concomitants. The method now proceeds on the basis of the first table to set forth the possible suggestions as to a general explanatory formula for the quality in question. In virtue of the remaining tables it rejects any suggestion qualitatively or quantitatively inadequate. If one suggestion, and one alone, survives the process of attempted rejection it is the explanatory formula required. If none, we must begin afresh. If more than one,

His three Methods.

recourse is to be had to certain devices of method, in the enumeration of which the methods of agreement, difference and concomitant variations[97] find a place, beside the crucial experiment, the glaring instance and the like. An appeal, however, to such devices, though a permissible "first vintage" is relatively an imperfection of method, and a proof that the tables need revision. The positive procedure by hypothesis and verification is rejected by Bacon, who thinks of hypothesis as the will o' the wisp of science, and prefers the cumbrous machinery of negative reasoning.

Historically he appears to have been under the dominance of the Platonic metaphor of an alphabet of nature, with a consequent belief in the relatively small number of ultimate principles to be determined, and of Plato's conception of Division, cleared of its dialectical associations and used experientially in application to his own molecular physics. True it is that the rejection of all the cospecies is a long process, but what if therein their simultaneous or subsequent determination is helped forward? They, too, must fall to be determined sometime, and the ideal of science is fully to determine all the species of the genus. This will need co-operative effort as described in the account of Solomon's House in the *New Atlantis*.[98] But once introduce the conception of division of labour as between the collector of data on the one hand and the expert of method, the interpreter of nature at headquarters, on the other, and Bacon's attitude to hypothesis and to negative reasoning is at least in part explained. The hypothesis of the collector, the man who keeps a rain-gauge, or the missionary among savages, is to be discounted from as a source of error. The expert on the other hand may be supposed, in the case of facts over which he has not himself brooded in the course of their acquisition, to approach them without any presumption this way or that. He will, too, have no interest in the isolation of any one of several co-ordinate inquiries. That Bacon underestimates the importance of selective and of provisional explanatory hypotheses even in such fields as that of chemistry, and that technically he is open to some criticism from the point of view that negative judgment is derivate as necessarily resting on positive presuppositions, may be true enough. It seems, however, no less true that the greatness of his conception of organized common effort in science has but rarely met with due appreciation.

In his doctrine of *forms*, too, the "universals" of his logic, Bacon must at least be held to have been on a path which led forward and not back. His forms are principles whose function falls entirely within knowledge. They are formulae for the control of the activities and the production of the qualities of bodies. Forms are qualities and activities expressed in terms of the ultimates of nature, *i.e.* normally in terms of collocations of matter or modes of motion. (The human soul is still an exception.) Form is bound up with the molecular structure and change of structure of a body, one of whose qualities or activities it expresses in wider relations. A mode of motion, for instance, of a certain definite kind, is the form of heat. It is the recipe for, and at the same time is, heat, much as H_2O is the formula for and is water. Had Bacon analysed bodies into their elements, instead of their qualities and ways of behaviour, he would have been the logician of the chemical formula. Here, too, he has scarcely received his meed of appreciation.

Forms.

His influence on his successors has rather lain in the general stimulus of his enthusiasm for experience, or in the success with which he represents the cause of nominalism and in certain special devices of method handed down till, through Hume or Herschel, they affected the thought of Mill. For the rest he was too Aristotelian, if we take the word broadly enough, or, as the result of his Cambridge studies, too Ramist,[99] when the interest in scholastic issues was fading, to bring his original ideas to a successful market.

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Bacon's Logic, then, like Galilei's, intended as a contribution to scientific method, a systematization of discovery by which, given the fact of knowledge, new items of knowledge may be acquired, failed to convince contemporaries and successors alike of its efficiency as an instrument. It was an ideal that failed to embody itself and justify itself by its fruits. It was otherwise with the mathematical instrument of Galilei.

Descartes stands in the following of Galilei. It is concurrently with signal success in the work of a pioneer in the mathematical advance that he comes to reflect on method, generalizes the method of mathematics to embrace knowledge as a whole, and raises the ultimate issues of its presuppositions. In the mathematics we determine complex problems by a construction link by link from axioms and simple data clearly and distinctly conceived. Three moments are involved. The first is an *induction*, *i.e.* an exhaustive enumeration of the simple elements in the complex phenomenon under investigation. This resolution or analysis into simple, because clear and distinct, elements may be brought to a standstill again and again by obscurity and indistinctness, but patient and repeated revision of all that is included in the problem should bring the analytic process to fruition. It is impatience, a perversity of will, that is the cause of error. Upon the analysis there results *intuition* of the simple data. With Descartes intuition does not connote givenness, but its objects are evident at a glance when induction has brought them to light. Lastly we have *deduction* the determination of the most complex phenomena by a continuous synthesis or combination of the simple elements. Synthesis is demonstrative and complete. It is in virtue of this view of derived or mediate knowledge that Descartes speaks of the (subsumptive) syllogism as "of avail rather in the communication of what we already know." Syllogism is not the synthesis which together with analysis goes to constitute the new instrument of science. The celebrated *Regulae* of Descartes are precepts directed to the achievement of the new methodological ideal in any and every subject matter, however reluctant.

Descartes.

It is the paradox involved in the function of intuition, the acceptance of the psychological characters of clearness and distinctness as warranty of a truth presumed to be trans-subjective, that leads to Descartes's distinctive contribution to the theory of knowledge. In order to lay bare the ground of certainty he raises the universal doubt, and, although, following Augustine,[100] he finds its limit in the thought of the doubter, this of itself is not enough. *Cogito, ergo sum. That* I think may be admitted. *What* I think may still need validation. Descartes's guarantee of the validity of my clear and distinct perceptions is the veracity of God.[101] Does the existence of God in turn call for proof? An effect cannot contain more than its cause, nor the idea of a perfect Being find adequate source save in the actuality of such a Being. Thus the intuition of the casual axiom is used to prove the existence of that which alone gives validity to intuitions. Though the logical method of Descartes has a great and enduring influence, it is the dualism and the need of God to bridge it, the doctrine of "innate" ideas, *i.e.* of ideas not due to external causes nor to volition but only to our capacity to think, our disposition to develop them, and finally the ontological proof, that affect the thought of the next age most deeply. That essence in the supreme case involves existence is a thought which comes to Spinoza more easily, together with the tradition of the *ordo geometricus*.

D. Modern Logic

i. *The Logic of Empiricism*

The path followed by English thought was a different one. Hobbes developed the nominalism which had been the hallmark of revolt against scholastic orthodoxy, and, when he brings this into relation with the analysis and synthesis of scientific method, it is at the expense of the latter.[102] Locke, when Cartesianism had raised the problem of the contents of consciousness, and the spirit of Baconian positivism could not accept of anything that bore the ill-omened name of innate ideas, elaborated a theory of knowledge which is psychological in the sense that its problem is how the simple data with which the individual is in contact in sensation are worked up into a system. Though he makes his bow to mathematical method, he, even more than Hobbes, misses its constructive character. The clue of mathematical

certainty is discarded in substance in the English form of "the new way of ideas."

Hobbes.

With Hobbes logic is a calculus of marks and signs in the form of names. Naming is what distinguishes man from the brutes. It enables him to fix fleeting memories and to communicate with his fellows. He alone is capable of truth in the due conjunction or disjunction of names in propositions. Syllogism is simply summation of propositions, its function being communication merely. Analysis is the sole way of invention or discovery. There is more, however, in Hobbes, than the paradox of nominalism. Spinoza could draw upon him for the notion of genetic definition.[103] Leibnitz probably owes to him the thought of a calculus of symbols, and the conception of demonstration as essentially a chain of definitions.[104] His psychological account of syllogism[105] is taken over by Locke. Hume derived from him the explanatory formula of the association of ideas,[106] which is, however, still with Hobbes a fact to be accounted for, not a theory to account for facts, being grounded physically in "coherence of the matter moved." Finally Mill took from him his definition of cause as sum of conditions,[107] which played no small part in the applied logic of the 19th century.

Locke.

Locke is of more importance, if not for his logical doctrine, at least for the theory of knowledge from which it flows. With Locke the mind is comparable to white paper on which the world of things records itself in ideas of sensation. Simple ideas of sensation are the only points of contact we have with things. They are the atomic elements which "the workmanship of the understanding" can thereafter do no more than systematically compound and the like. It is Locke's initial attribution of the primary rôle in mental process to the simple ideas of sensation that precludes him from the development of the conception of another sort of ideas, or mental contents that he notes, which are produced by reflection on "the operations of our own mind within us." It is in the latter group that we have the explanation of all that marks Locke as a forerunner of the critical philosophy. It contains in germ a doctrine of categories discovered but not generated in the psychological processes of the individual. Locke, however, fails to "deduce" his categories. He has read Plato's *Theaetetus* in the light of Baconian and individualist preconceptions. Reflection remains a sort of "internal sense," whose ideas are of later origin than those of the external sense. His successors emphasize the sensationist elements, not the workmanship of the mind. When Berkeley has eliminated the literal materialism of Locke's metaphors of sense-perception, Hume finds no difficulty in accepting the sensations as present virtually in their own right, any nonsensible ground being altogether unknown. From a point of view purely subjectivist he is prepared to explain all that is to be left standing of what Locke ascribes to the workmanship of the mind by the principle of association or customary conjunction of ideas, which Locke had added a chapter to a later edition of his *Essay* explicitly to reject as an explanatory formula. Condillac goes a step farther, and sees no necessity for the superstructure at all, with its need of explanation valid or invalid. Drawing upon Gassendi for his psychological atomism and upon Hobbes for a thoroughgoing nominalism, he reproduces, as the logical conclusion from Locke's premises, the position of Antisthenes. The last word is that "une science bien traitée n'est qu'une langue bien faite."[108]

Locke's logic comprises, amid much else, a theory of general terms[109] and of definition, a view of syllogism[110] and a declaration as to the possibility of inference from particular to particular,[111] a distinction between propositions which are certain but trifling, and those which add to our knowledge though uncertain, and a doctrine of mathematical certainty.[112] As to the first, "words become general by being made the signs of general ideas, and ideas become general by separating from them" all "that may determine them to this or that particular existence. By this way of abstraction they are made capable of representing more individuals than one." This doctrine has found no acceptance. Not from the point of view for which idea means image. Berkeley, though at length the *notions* of spirits, acts and relations[113] give him pause, prefers the formula which Hume expresses in the phrase that "some ideas are particular in their nature but general in their representation,"[114] and the after-history of "abstraction" is a discussion of the conditions under which one idea "stands for" a group. Not from those for whom general ideas mean schematic concepts, not imageable. The critic from this side has little difficulty in showing that abstraction of the kind alleged still leave the residuum particular *this* redness, *e.g.* not *redness*. It is, however, of the sorts constituted by the representation which his abstraction makes possible that definition is given, either by enumeration of the simple ideas combined in the significance of the sortal name, or "to save the labour of enumerating," and "for quickness and despatch sake," by giving the next wider general name and the proximate difference. We define essences of course in a sense, but the essences of which men talk are abstractions, "creatures of the understanding." Man determines the sorts or nominal essences, nature the similitudes. The fundamentally enumerative character of the process is clearly not cancelled by the recognition that it is possible to abbreviate it by means of technique. So long as the relation of the nominal to the real essence has no other background than Locke's doctrine of perception, the conclusion that what Kant afterwards calls analytical judgments a priori and synthetic judgments a posteriori exhaust the field follows inevitably, with its corollary, which Locke himself has the courage to draw, that the natural sciences are in strictness impossible. Mathematical knowledge is not involved in the same condemnation, solely because of the "archetypal" character, which, not without indebtedness to Cumberland, Locke attributes to its ideas. The reality of mathematics, equally with that of the ideals of morals drawn from within, does not extend to the "ectypes" of the outer world. The view of reasoning which Locke enunciates coheres with these views. Reasoning from particular to particular, *i.e.* without the necessity of a general premise, must be possible, and the possibility finds warranty in a consideration of the psychological order of the terms in syllogism. As to syllogism specifically, Locke in a passage,[115] which has an obviously Cartesian ring, lays down four stages or degrees of reasoning, and points out that syllogism serves us in but one of these, and that not the all-important one of finding the intermediate ideas. He is prepared readily to "own that all right reasoning may be reduced to Aristotle's forms of syllogism," yet holds that "a man knows first, and then he is able to prove syllogistically." The distance from Locke to Stuart Mill along this line of thought is obviously but small.

Hume.

Apart from the adoption by Hume of the association of ideas as the explanatory formula of the school—it had been allowed by Malebranche within the framework of his mysticism and employed by Berkeley in his theory of vision—there are few fresh notes struck in the logic of sensationalism. The most notable of these are Berkeley's treatment of "abstract" ideas and Hume's change of front as to mathematical certainty. What, however, Hume describes as "all the *logic* I think proper to employ in my reasoning," viz. his "rules by which to judge cause and effects,"[116] had, perhaps, farther-reaching historical effects than either. In these the single method of Bacon is already split up into separate modes. We have Mill's inductive methods in the germ, though with an emphasis quite older than Mill's. Bacon's *form* has already in transmission through Hobbes been transmuted into *cause* as antecedent in the time series. It may, perhaps, be accounted to Hume for righteousness that he declares—whether consistently or not is another matter—that "the same effect never arises but from the same cause," and that he still follows Bacon in the conception of *absentia in proximo*. It is "when in any instance we find our expectation disappointed" that the effect of one of "two resembling objects" will be like that of the other that Hume proposes to apply his method of difference.

No scientific discipline, however, with the doubtful exception of descriptive psychology, stands to gain anything from a temper like that of Hume. The whittling away of its formal or organizing rubrics, as *e.g.*, sameness into likeness, is disconcerting to science wherever the significance of the process is realized. It was because the aftermath of

Newtonian science was so rich that the scientific faith of naturalism was able to retain a place besides its epistemological creed that a logician of the school could arise whose spirit was in some sort Baconian, but who, unlike Bacon, had entered the modern world, and faced the problems stated for it by Hume and by Newton.

Stuart Mill's *System of Logic* marked a fresh stage in the history of empiricism, for the reason that it made the effort to hold an even balance between the two moments in the thought of the school. Agreement in the use of a common watchword had masked as it seems a real divergence of meaning and purpose. The apostles of inductive method had preached recourse to experience, but had meant thereby nature as a constituted order. They had devised canons for the investigation of the concrete problems of this, but had either ignored altogether the need to give an account of the mirroring mind, or, in the alternative had been, with some naïveté, content to assume that their nominalist friends, consistently their allies in the long struggle with traditionalism, had adequately supplied or could adequately supply the need. The exponents of psychological atomism, on the other hand, with the association of ideas for their one principle of agglutination had come to mean by experience the mental phantasmagoria of the individual. They had undermined the foundations of scientific certainty, and so far as the fecundity of contemporary science did not give them pause, were ready, notwithstanding the difference of their starting-point, to acquiesce in the formula as well as the temper of Pyrrhonism. They could concede the triumphant achievement of science only with the proviso that it must be assumed to fall within the framework of their nominalism. Mill aspired after a doctrine of method such as should satisfy the needs of the natural sciences, notably experimental physics and chemistry as understood in the first half of the 19th century and, *mutatis mutandis*, of the moral sciences naturalistically construed. In uniting with this the Associationism which he inherited, through his father, from Hume, he revealed at once the strength and weakness of the dual conception of naturalism. His rare thoroughness and rarer candour made it at once unnecessary and impossible that the work should be done again.

J. S. Mill.

If judged by what he denies, viz. the formal logic of Hamilton and Mansel, whose Aristotelian and scholastic learning did but accentuate their traditionalism, and whose acquiescence in consistency constituted in Mill's view a discouragement of research, such as men now incline to attribute at the least equally to Hume's idealism, Mill is only negatively justified. If judged by his positive contribution to the theory of method he may claim to find a more than negative justification for his teaching in its success. In the field covered by scholastic logic Mill is frankly associationist. He aims at describing what he finds given, without reference to insensible implications of doubtful validity and value. The upshot is a psychological account of what from one aspect is evidence, from the other, belief. So he explains "concepts or general notions"[117] by an abstraction which he represents as a sort of alt-relief operated by attention and fixed by naming, association with the name giving to a set of attributes a unity they otherwise lack. This is manifestly, when all is said, a particular psychological event, a collective fact of the associative consciousness. It can exercise no organizing or controlling function in knowledge. So again in determining the "import" of propositions, it is no accident that in all save existential propositions it is to the familiar rubrics of associationism—co-existence, sequence, causation and resemblance—that he refers for classification, while his general formula as to the conjunctions of connotations is associationist through and through. It follows consistently enough that inference is from particular to particular. Mill holds even the ideas of mathematics to be hypothetical, and in theory knows nothing of a non-enumerative or non-associative universal. A premise that has the utmost universality consistent with this view can clearly be of no service for the establishment of a proposition that has gone to the making of it. Nor again of one that has not. Its use, then, can only be as a memorandum. It is a shorthand formula of registration. Mill's view of ratiocinative process clearly stands and falls with the presumed impossibility of establishing the necessity for universals of another type than his, for what may be called principles of construction. His critics incline to press the point that association itself is only intelligible so far as it is seen to depend on universals of the kind that he denies.

In Mill's inductive logic, the nominalistic convention has, through his tendency to think in relatively watertight compartments,[118] faded somewhat into the background. Normally he thinks of what he calls phenomena no longer as psychological groupings of sensations, as "states of mind," but as things and events in a physical world howsoever constituted and apprehended. His free use of relating concepts, that of sameness, for instance, bears no impress of his theory of the general notion, and it is possible to put out of sight the fact that, taken in conjunction with his nominalism, it raises the whole issue of the possibility of the equivocal generation of formative principles from the given contents of the individual consciousness, in any manipulation of which they are already implied. Equally, too, the deductive character, apparently in intention as well as in actual fact, of Mill's experimental methods fails to recall the point of theory that the process is essentially one from particular to particular. The nerve of proof in the processes by which he establishes causal conjunctions of unlimited application is naturally thought to lie in the special canons of the several processes and the axioms of universal and uniform causation which form their background. The conclusions seem not merely to fall within, but to depend on these organic and controlling formulae. They follow not merely according to them but from them. The reference to the rule is not one which may be made and normally is made as a safeguard, but one which must be made, if thought is engaged in a forward and constructive movement at all. Yet Mill's view of the function of "universal" propositions had been historically suggested by a theory—Dugald Stewart's—of the use of axioms![119] Once more, it would be possible to forget that Mill's ultimate laws or axioms are not in his view intuitions, nor forms constitutive of the rational order, nor postulates of all rational construction, were it not that he has made the endeavour to establish them on associationist lines. It is because of the failure of this endeavour to bring the technique of induction within the setting of his Humian psychology of belief that the separation of his contribution to the applied logic of science from his sensationism became necessary, as it happily was easy. Mill's device rested special inductions of causation upon the laws that every event has a cause, and every cause has always the same effect. It rested these in turn upon a general induction enumerative in character of enormous and practically infinite range and always uncontradicted. Though obviously not exhaustive, the unique extent of this induction was held to render it competent to give practical certainty or psychological necessity. A vicious circle is obviously involved. It is true, of course, that ultimate laws need discovery, that they are discovered in some sense in the medium of the psychological mechanism, and that they are nevertheless the grounds of all specific inferences. But that truth is not what Mill expounds, nor is it capable of development within the limits imposed by the associationist formula.

It is deservedly, nevertheless, that Mill's applied logic has retained its pride of place amid what has been handed on, if in modified shape, by writers, *e.g.*, Sigwart, and Professor Bosanquet, whose theory of knowledge is quite alien from his. He prescribed regulative or limiting formulae for research as it was actually conducted in his world. His grasp of the procedure by which the man of science manipulated his particular concrete problems was admirable. In especial he showed clear understanding of the functions of hypothesis and verification in the investigations of the solitary worker, with his facts still in course of accumulation and needing to be lighted up by the scientific imagination. He was therefore enabled to formulate the method of what Bacon had tended to despise as merely the "first vintage." Bacon spent his strength upon a dream of organization for all future discovery. Mill was content to codify. The difference between Bacon and Mill lies chiefly in this, and it is because of this difference that Mill's contribution, spite of its debt to the Baconian tradition, remains both characteristic and valuable. It is of course possible to criticise even the experimental canons with some severity. The caveats, however, which are relevant within the circle of ideas within

which Mill's lesson can be learned and improved on,[120] seem to admit of being satisfied by relatively slight modifications in detail, or by explanations often supplied or easily to be supplied from points brought out amid the wealth of illustration with which Mill accompanied his formal or systematic exposition of method. The critic has the right of it when he points out, for example, that the practical difficulty in the Method of Agreement is not due to plurality of causes, as Mill states, but rather to intermixture of effects, while, if the canon could be satisfied exactly, the result would not be rendered uncertain in the manner or to the extent which he supposes. Again the formula of the Joint-Method, which contemplates the enumeration of cases "which have nothing in common but the absence of one circumstance," is ridiculously unsound as it stands. Or, on rather a different line of criticism, the use of corresponding letters in the two series of antecedents and consequents raises, it is said, a false presumption of correlation. Nay, even the use of letters at all suggests that the sort of analysis that actually breaks up its subject-matter is universally or all but universally applicable in nature, and this is not the case. Finally, the conditions of the methods are either realized or not. If they are realized, the work of the scientist falls entirely within the field of the processes preliminary to the satisfaction of the canon. The latter becomes a mere memorandum or formula of registration. So is it possible "to have the enginer hoist with his own petar." But the conditions are not realized, and in an experiential subject-matter are not realizable. Not one circumstance only in common but "apparently one relevant circumstance only in common" is what we are able to assert. If we add the qualification of relevance we destroy the cogency of the method. If we fail to add it, we destroy the applicability.

The objections turn on two main issues. One is the exaggeration of the possibilities of resolution into separate elements that is due to the acceptance of the postulate of an alphabet of nature. This so soon as noted can be allowed for. It is to the combination of this doctrine with a tendency to think chiefly of experiment, of the controlled addition or 910
subtraction of these elements one at a time, that we owe the theoretically premature linking of *a* as effect to *A* as cause. This too can be met by a modification of form. The other issue is perhaps of more significance. It is the oscillation which Mill manifests between the conception of his formula as it is actually applicable to concrete problems in practice, and the conception of it as an expression of a theoretical limit to practical procedure. Mill seems most often to think of the former, while tending to formulate in terms of the latter. At any rate, if relevance *in proximo* is interpolated in the peccant clause of the canon of the Joint-Method, the practical utility of the method is rehabilitated. So too, if the canon of the Method of Agreement is never more than approximately satisfied, intermixture of effects will in practice mean that we at least often do not know the cause or antecedent equivalent of a given effect, without the possibility of an alternative. Finally, it is on the whole in keeping with Mill's presuppositions to admit even in the case of the method of difference that in practice it is approximative and instructive, while the theoretical formula, to which it aims at approaching asymptotically as limit, if exact, is in some sense sterile. Mill may well have himself conceived his methods as practically fruitful and normally convincing with the limiting formula in each case more cogent in form but therewith merely the skeleton of the process that but now pulsed with life.

Enough has been said to show why the advance beyond the letter of Mill was inevitable while much in the spirit of Mill must necessarily affect deeply all later experientialism. After Mill experientialism takes essentially new forms. In part because of what Mill had done. In part also because of what he had left undone. After Mill means after Kant and Hegel and Herbart, and it means after the emergence of evolutionary naturalism. Mill, then, marks the final stage in the achievement of a great school of thought.

ii. *The Logic of Rationalism.*

A fundamental contrast to the school of Bacon and of Locke is afforded by the great systems of reason, owning Cartesian inspiration, which are identified with the names of Spinoza and Leibnitz. In the history of logic the latter thinker is of the more importance. Spinoza's philosophy is expounded *ordine geometrico* and with Euclidean cogency from a relatively small number of definitions, axioms and postulates. But how we reach our assurance of the necessity of these principles is not made specifically clear. The invaluable tractate *De Intellectus emendatione*, in which the agreement with and divergence from Descartes on the question of method could have been fully elucidated, is unhappily not finished. We know that we need to pass from what Spinoza terms *experientia vaga*,[121] where imagination with its fragmentary apprehension is liable to error and neither necessity nor impossibility can be predicated, right up to that which *fictionem terminat*—namely, *intellectio*. And what Spinoza has to say of the requisites of definition and the marks of intellection makes it clear that insight comes with coherence, and that the work of method on the "inductive" side is by means of the unravelling of all that makes for artificial limitation to lay bare what can then be seen to exhibit nexus in the one great system. When all is said, however, the geometric method as universalized in philosophy is rather used by Spinoza than expounded.

Spinoza.

With Leibnitz, on the other hand, the logical problem holds the foremost place in philosophical inquiry.[122] From the purely logical thesis, developed at quite an early stage of his thinking,[123] that in any true proposition the predicate is contained in the subject, the main principles of his doctrine of Monads are derivable with the minimum of help from his philosophy of dynamics. *Praedicatum inest subjecto.* All valid propositions express in the last resort the relation of predicate or predicates to a subject, and this Leibnitz holds after considering the case of relational propositions where either term may hold the position of grammatical subject, A = B and the like. There is a subject then, or there are subjects which must be recognized as not possible to be predicated, but as absolute. For reasons not purely logical Leibnitz declares for the plurality of such subjects. Each contains all its predicates: and this is true not only in the case of truths of reason, which are necessary, and ultimately to be exhibited as coming under the law of contradiction, "or, what comes to the same thing, that of identity," but also in the case of truths of fact which are contingent, though a sufficient reason can be given for them which "inclines" without importing necessity. The extreme case of course is the human subject. "The individual notion of each person includes once for all what is to befall it, world without end," and "it would not have been our Adam but another, if he had had other events." Existent subjects, containing eternally all their successive predicates in the time-series, are substances, which when the problems connected with their activity, or dynamically speaking their force, have been resolved, demand—and supply—the metaphysic of the Monadology.

Leibnitz.

Complex truths of reason or essence raise the problem of definition, which consists in their analysis into simpler truths and ultimately into simple—*i.e.* indefinable ideas, with primary principles of another kind—axioms, and postulates that neither need nor admit of proof. These are identical in the sense that the opposite contains an express contradiction.[124] In the case of non-identical truths, too, there is a priori proof drawn from the notion of the terms, "though it is not always in our power to arrive at this analysis,"[125] so that the question arises, specially in connexion with the possibility of a calculus, whether the contingent is reducible to the necessary or identical at the ideal limit. With much that suggests an affirmative answer, Leibnitz gives the negative. Even in the case of the Divine will, though it be always for the best possible, the sufficient reason will "incline without necessitating." The propositions which deal with actual existence are still of a unique type, with whatever limitation to the calculus.

Leibnitz's treatment of the primary principles among truths of reason as identities, and his examples drawn *inter alia*

from the "first principles" of mathematics, influenced Kant by antagonism. Identities some of them manifestly were not. The formula of identity passed in another form to Herbart and therefore to Lotze. In recognizing, further, that the relation of an actual individual fact to its sufficient ground was not reducible to identity, he set a problem diversely treated by Kant and Herbart. He brought existential propositions, indeed, within a rational system through the principle that it must be feasible to assign a sufficient reason for them, but he refused to bring them under the conception of identity or necessity, *i.e.* to treat their opposites as formally self-contradictory. This bore interest in the Kantian age in the treatment alike of cause and effect, and of the ontological proof of existence from essence. Not that the Law of Sufficient Reason is quite free from equivoque. Propositions concerning the *possible* existence of individuals put Leibnitz to some shifts, and the difficulty accounts for the close connexion established in regard to our actual world between the law of sufficient reason and the doctrine of the final cause. This connexion is something of an afterthought to distinguish from the potential contingency of the objectively possible the real contingency of the actual, for which the "cause or reason" of Spinoza[126] could not account. The law, however, is not invalidated by these considerations, and with the degree of emphasis and the special setting that Leibnitz gives the law, it is definitely his own.

If we may pass by the doctrine of the Identity of Indiscernibles, which played a part of some importance in subsequent philosophy, and the Law of Continuity, which as Leibnitz represents it is, if not sheer dogma, reached by something very like a fallacy, we have as Leibnitz's remaining legacy to later logicians the conception of *Characteristica Universalis* and *Ars Combinatoria*, a universal denoting by symbols and a calculus working by substitutions and the like. The two positions that a subject contains all its predicates and that all non-contingent propositions—*i.e.* all propositions not concerned with the existence of individual facts ultimately analyse out into identities—obviously lend themselves to the design of this algebra of thought, though the mathematician in Leibnitz should have been aware that a significant equation is never an identity. Leibnitz, fresh from the battle of the calculus in the mathematical field, and with his conception of logic, at least in some of its aspects, as a generalized mathematic,[127] found a fruitful inspiration, harmonizing well with his own metaphysic, in Bacon's alphabet of nature. He, too, was prepared to offer a new instrument. That the most important section, the list of forms of combination, was never achieved—this too was after the Baconian example while the mode of symbolization was crude with $a = ab$ and the like—matters little. A new technique of manipulation—it is, of course, no more—had been evolved.

It may be said that among Leibnitz's successors there is no Leibnitzian. The system as a whole is something too artificial to secure whole-hearted allegiance. Wolff's formalism is the bastard outcome of the speculation of Leibnitz, and is related to it as remotely as Scholasticism is to Aristotle. Wolff found a sufficient reason for everything and embodied the results of his inquiries in systematic treatises, sometimes in the vernacular. He also, by a transparent *petitio principii*, brought the law of the sufficient reason under that of non-contradiction. Wolff and his numerous followers account for the charge of dogmatism against "the Leibnitzio-Wolffian school." They are of importance in the history of logic for two reasons only: they affected strongly the German vocabulary of philosophy and they constituted the intellectual environment in which Kant grew to manhood.

A truer continuator of Leibnitz in the spirit was Herbart.

iii. *Kant's Logic.*

Herbart's admitted allegiance, however, was Kantian with the qualification, at a relatively advanced stage of his thinking, that it was "of the year 1828"—that is, after controversy had brought out implications of Kant's teaching not wholly contemplated by Kant himself. The critical philosophy had indeed made it impossible to hark back to Leibnitz or any other master otherwise than with a difference.

Yet it is not a single and unambiguous logical movement that derives from Kant. Kant's lesson was variously understood. Different moments in it were emphasized, with a large diversity of result. As interpreted it was acquiesced in or revolted from and revolt ranged from a desire for some modifications of detail or expression to the call for a radical transformation. Grounds for a variety of developments are to be found in the imperfect harmonization of the rationalistic heritage from the Wolffian tradition which still dominates Kant's pure general logic with the manifest epistemological intention of his transcendental theory. Or again, within the latter in his admission of a duality of thought and "the given" in knowledge, which within knowledge was apparently irreducible, concurrently with hints as to the possibility, upon a wider view, of the sublation of their disparateness at least hypothetically and speculatively. The sense in which there must be a ground of the unity of the supersensible[128] while yet the transcendent use of Reason—*i.e.* its use beyond the limits of experience was denied theoretical validity—was not unnaturally regarded as obscure.

Formal Logic.

Kant's treatment of technical logic was wholly traditional, and in itself is almost negligible. It is comprised[129] in an early essay on the mistaken subtlety of the syllogistic figures, and a late compilation by a pupil from the introductory matter and running annotations with which the master had enriched his interleaved lecture-room copy of Meyer's *Compendium* of 1752. Wolff's general logic, "the best," said Kant, "that we possess," had been abridged by Baumgarten and the abridgment then subjected to commentation by Meyer. With this traditional body of doctrine Kant was, save for matters of minor detail, quite content. Logic was of necessity formal, dealing as it must with those rules without which no exercise of the understanding would be possible at all. Upon abstraction from all particular methods of thought these rules were to be discerned a priori or without dependence on experience by reflection solely upon the use of the understanding in general. The science of the form of thought abstracted in this way from its matter or content was regarded as of value both as propaedeutic and as canon. It was manifestly one of the disciplines in which a position of finality was attainable. Aristotle might be allowed, indeed, to have omitted no essential point of the understanding, what the moderns had achieved consisted in an advance in accuracy and methodical completeness. "Indeed, we do not require any new discoverers in logic,"[130] said the discoverer of a priori synthesis, "since it contains merely the form of thought." Applied logic is merely psychology, and not properly to be called logic at all. The technical logic of Kant, then, justifies literally a movement among his successors in favour of a formal conception of logic with the law of contradiction and the doctrine of formal implication for its equipment. Unless the doctrine of Kant's "transcendental logic" must be held to supply a point of view from which a logical development of quite another kind is inevitable, Kant's mantle, so far as logic is concerned, must be regarded as having fallen upon the formal logicians.

Definition of "Transcendental."

Kant's transcendental teaching is summarily as follows: "Transcendental" is his epithet for what is neither empirical—*i.e.* to be derived from experience—nor yet transcendent—*i.e.* applicable beyond the limits of experience, the mark of experience being the implication of sense or of something which thought contra-distinguishes from its own spontaneous activity as in some sense "the given." Those features in our organized experience are to be regarded as transcendentally established which are the presuppositions of our having that experience at all. Since they are not empirical they must be structural and belong to "the mind"—*i.e.* the normal human intelligence, and to like intelligence so far as like. If we set aside such transcendental conditions as belong to sensibility or to the receptive phase of mind and are the presuppositions of juxtaposition of parts, the

remainder are ascribable to spontaneity or understanding, to thought with its unifying, organizing or focussing function, and their elucidation is the problem of transcendental analytic. It is still logic, indeed, when we are occupied with the transcendent objects of the discursive faculty as it is employed beyond the limits of experience where it cannot validate its ideas. Such a logic, however, is a dialectic of illusion, perplexed by paralogisms and helpless in the face of antinomies. In transcendental analytic on the other hand we concern ourselves only with the transcendental "deduction" or vindication of the conditions of experience, and we have a logic of cognition in which we may establish our epistemological categories with complete validity. Categories are the forms according to which the combining unity of self-consciousness (synthetic unity of apperception) pluralizes itself through the various functions involved in the constitution of objectivity in different types of the one act of thought, viz. judgment. The clue to the discovery of transcendental conditions Kant finds in the existence of judgments, most manifest in mathematics and in the pure science of nature, which are certain, yet not trifling, necessary and yet not reducible to identities, synthetic therefore and a priori, and so accounted for neither by Locke nor by Leibnitz. "There lies a transcendental condition at the basis of every necessity."

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Form of Matter of Thought.

Kant's mode of conceiving the activity of thought in the constitution of objects and of their connexion in experience was thought to lie open to an interpretation in conformity with the spirit of his logic, in the sense that the form and the content in knowledge are not merely distinguishable functions within an organic whole, but either separable, or at least indifferent one to the other in such a way as to be clearly independent. Thought as form would thus be a factor or an element in a composite unit. It would clearly have its own laws. It would be the whole concern of logic, which, since in it thought has itself for object, would have no reference to the other term of the antithesis, nor properly and immediately to the knowledge which is compact of thought in conjunction with something which, whatever it may be, is prima facie other than thought. There is too much textual warrant for this interpretation of Kant's meaning. Doubtless there are passages which make against an extreme dualistic interpretation. Even in his "logic" Kant speaks of abstraction from all particular objects of thought rather than of a resolution of concrete thinking into thought and its "other" as separable co-operating factors in a joint product. He spoke throughout, however, as if form and content were mutually indifferent, so that the abstraction of form from content implied nothing of falsification or mutilation. The reserve, therefore, that it was abstraction and not a decomposing that was in question remained to the admirers of his logic quite nugatory. They failed to realize that permissible abstraction from specific contents or methods of knowledge does not obliterate reference to matter or content. They passed easily from the acceptance of a priori forms of thinking to that of forms of a priori thinking, and could plead the example of Kant's logic.

Kant's theory of knowledge, then, needed to be pressed to other consequences for logic which were more consonant with the spirit of the *Critique*. The forms of thought and what gives thought its particular content in concrete acts of thinking could not be regarded as subsisting in a purely external and indifferent relation one to the other. "Laws according to which the subject thinks" and "laws according to which the object is known" cannot be the concern of separate departments of inquiry. As soon divorce the investigation of the shape and material of a mirror from the laws of the incidence of the rays that form images in it, and call it a science of reflection! An important group of writers developed the conception of an adaptation between the two sides of Kant's antithesis, and made the endeavour to establish some kind of correlation between logical forms and the process of "the given." There was a tendency to fall back upon the conception of some kind of parallelism, whether it was taken to be interpretative or rather corrective of Kant's meaning. This device was never remote from the constructions of writers for whom the teaching of Spinoza and Leibnitz was an integral part of their intellectual equipment. Other modes of correlation, however, find favour also, and in some variety. Kant is seldom the sole source of inspiration. His unresolved antithesis[131] is interpreted either diversely or with a difference of emphasis. And the light that later writers bring to bear on Kant's logic and epistemology from other sides of his speculation varies in kind and in degree.

Another logical movement springs from those whom a correlation of fact within the unity of a system altogether failed to satisfy. There must also be development of the correlated terms from a single principle. Form and content must not only correspond one to the other. They must be exhibited as distinguishable moments within a unity which can at one and the same time be seen to be the ground from which the distinction springs and the ground in virtue of which it is over-ruled. Along this line of speculation we have a logic which claims that whatsoever is in one plane or at one stage in the development of thought a residuum that apparently defies analysis must at another stage and on a higher plane be shown so to be absorbed as to fall altogether within thought. This is the view of Hegel upon which logic comes to coincide with the progressive self-unfolding of thought in that type of metaphysic which is known as absolute, *i.e.* all-inclusive idealism. The exponent of logic as metaphysic, for whom the rational is the real is necessarily in revolt against all that is characteristically Kantian in the theory of knowledge, against the transcendental method itself and against the doctrine of limits which constitutes the nerve of "criticism." Stress was to be laid upon the constructive character of the act of thought which Kant had recognized, and without Kant's qualifications of it. In all else the claim is made to have left the Kantian teaching behind as a cancelled level of speculation.

Limitation of Transcendental Method.

Transcendental method is indeed not invulnerable. A principle is transcendentally "deduced" when it and only it can explain the validity of some phase of experience, some order of truths. The order of truths, the phase of experience and its certainty had to be taken for granted. The sense, for example, in which the irreversibility of sequence which is the more known *in ordine ad hominem* in the case of the causal principle differs from merely psychological conviction is not made fully clear. Even so the inference to the a priori ground of its necessity is, it has been often pointed out, subject to the limitation inherent in any process of reduction, in any regress, that is, from conditionate to condition, viz. that in theory an alternative is still possible. The inferred principle may hold the field as explanation without obvious competitor potential or actual. Nevertheless its claim to be the sole possible explanation can in nowise be validated. It has been established after all by dialectic in the Aristotelian sense of the word. But if transcendental method has no special pride of place, Kant's conclusion as to the limits of the competence of intellectual faculty falls with it. Cognition manifestly needs the help of Reason even in its theoretical use. Its speculation can no longer be stigmatized as vaticination *in vacuo*, nor its results as illusory.

Logic and Psychology.

Finally, to logic as metaphysic the polar antithesis is psychology as logic. The turn of this also was to come again. If logic were treated as merely formal, the stress of the problem of knowledge fell upon the determination of the processes of the psychological mechanism. If alleged a priori constituents of knowledge—such rubrics as substance, property, relation—come to be explained psychologically, the formal logic that has perforce to ignore all that belongs to psychology is confined within too narrow a range to be able to maintain its place as an independent discipline, and tends to be merged in psychology. This tendency is to be seen in the activity of Fries and Herbart and Beneke, and was actualized as the aftermath of their speculation. It is no accident that it was the psychology of apperception and the voluntaryist theory or practice of Herbart, whose logical theory was so closely allied to that of the formal logicians proper, that contributed most to the development of the post-Kantian psychological logic. Another movement helped also; the exponents of naturalistic evolution were

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prepared with Spencer to explain the so-called *a priori* in knowledge as in truth *a posteriori*, if not to the individual at any rate to the race. It is of course a newer type of psychological logic that is in question, one that is aware of Kant's "answer to Hume." Stuart Mill, despite of his relation of antagonism to Hamilton and Mansel, who held themselves to be Kantian in spirit, is still wholly pre-Kantian in his outlook.

Summary.

Kant's influence, then, upon subsequent logic is least of all to be measured by his achievement in his professed contribution to technical logic. It may be attributed in some slight degree, perhaps, to incidental flashes of logical insight where his thought is least of what he himself calls logic, *e.g.* his exposition of the significance of synthetic judgments *a priori*, or his explanation of the function of imagery in relation to thought, whereby he offers a solution of the problem of the conditions under which one member of a group unified through a concept can be taken to stand for the rest, or again the way in which he puts his finger on the vital issue in regard to the alleged proof from essence to existence, and illustrations could be multiplied. But much more it belongs to his transformation of the epistemological problem, and to the suggestiveness of his philosophy as a whole for an advance in the direction of a speculative construction which should be able to cancel all Kant's surds, and in particular vindicate a "ground of the unity of the supersensible which lies back of nature with that which the concept of freedom implies in the sphere of practice,"[132] which is what Kant finally asserts.

iv. *After Kant.*

Starting from the obvious antithesis of thought and that of which it is the thought, it is possible to view the ultimate relation of its term as that of mutual indifference or, secondly, as that of a correspondence such that while they retain their distinct character modification of the one implies modification of the other, or thirdly and lastly, as that of a mergence of one in the other of such a nature that the merged term, whichever it be, is fully accounted for in a complete theory of that in which it is merged.

The Formal Logicians.

The first way is that of the purely formal logicians, of whom Twesten[133] and in England H. L. Mansel may be regarded as typical. They take thought and "the given" as self-contained units which, if not in fact separable, are at any rate susceptible of an abstraction the one from the other so decisive as to constitute an ideal separation. The laws of the pure activity of thought must be independently determined, and since the contribution of thought to knowledge is form they must be formal only. They cannot go beyond the limits of formal consistency or analytic correctness. They are confined to the determination of what the truth of any matter of thought, taken for granted upon grounds psychological or other, which are extraneous to logic, includes or excludes. The unit for logic is the concept taken for granted. The function of logic is to exhibit its formal implications and repulsions. It is questionable whether even this modest task could be really achieved without other reference to the content abstracted from than Mansel, for example, allows. The analogy of the resolution of a chemical compound with its elements which is often on the lips of those who would justify the independence of thought and the real world, with an agnostic conclusion as to non-phenomenal or trans-subjective reality, is not really applicable. The oxygen and hydrogen, for example, into which water may be resolved are not in strictness indifferent one to the other, since both are members of an order regulated according to laws of combination in definite ratios. Or, if applicable, it is double-edged. Suppose oxygen to be found only in water. Were it to become conscious, would it therefore follow that it could infer the laws of a separate or independent activity of its own? Similarly forms of thinking, the law of contradiction not excepted, have their meaning only in reference to determinate content, even though distributively all determinate contents are dispensable. The extreme formalist is guilty of a fallacy of composition in regard to abstraction.

It does not follow, however, that the laws asserted by the formal logicians are invalid or unimportant. There is a permissible abstraction, and in general they practise this, and although they narrow its range unduly, it is legitimately to be applied to certain characters of thinking. As the living organism includes something of mechanism—the skeleton, for example—so an organic logic doubtless includes determinations of formal consistency. The skeleton is meaningless apart from reference to its function in the life of an organism, yet there are laws of skeleton structure which can be studied with most advantage if other characters of the organism are relegated to the background. To allow, however, that abstraction admits of degrees, and that it never obliterates all reference to that from which it is abstracted, is to take a step forward in the direction of the correlation of logical forms with the concrete processes of actual thinking. What was true in formal logic tended to be absorbed in the correlationist theories.

Those formal logicians of the Kantian school, then, may be summarily dismissed, though their undertaking was a necessary one, who failed to raise the epistemological issue at all, or who, raising it, acquiesced in a naïve dualism agnostic of the real world as Kant's essential lesson. They failed to develop any view which could serve either in fact or in theory as a corrective to the effect of their formalism. What they said with justice was said as well or better elsewhere.

Among them it is on the whole impossible not to include the names of Hamilton and Mansel. The former, while his erudition in respect to the history of philosophical opinion has rarely been equalled, was not a clear thinker. His general theory of knowledge deriving from Kant and Reid, and including among other things a *contaminatio* of their theories of perception,[134] in no way sustains or mitigates his narrow view of logic. He makes no effective use of his general formula that to think is to condition. He appeals to the direct testimony of consciousness in the sense in which the appeal involves a fallacy. He accepts an ultimate antinomy as to the finiteness or infinity of "the unconditioned," yet applies the law of the excluded middle to insist that one of the two alternatives must be true, wherefore we must make the choice. And what is to be said of the judgment of a writer who considers the relativity of thought demonstrated by the fact that every judgment unites two members? Hamilton's significance for the history of logic lies in the stimulus that he gave to the development of symbolic logic in England by his new analytic based upon his discovery or adoption of the principle of the quantification of the predicate. Mansel, too, was learned, specially in matters of Aristotelian exegesis, and much that is of value lies buried in his commentation of the dry bones of the *Artis Logicae Rudimenta* of Locke's contemporary Aldrich. And he was a clearer thinker than Hamilton. Formal logic of the extremest rigour is nowhere to be found more adequately expressed in all its strength, and it must be added in all its weakness, than in the writings of Mansel. But if the view maintained above that formal logic must compromise or mitigate its rigour and so fail to maintain its independence, be correct, the logical consistency of Mansel's logic of consistency does but emphasize its barrenness. It contains no germ for further development. It is the end of a movement.

Herbart.

The brief logic of Herbart[135] is altogether formal too. Logical forms have for him neither psychological nor metaphysical reference, we are concerned in logic solely with the systematic clarification of concepts which are wholly abstract, so that they are not merely not ultimate realities, but also in no sense actual moments of our concrete thinking. The first task of logic is to distinguish and group such concepts according to their marks, and from their classification there naturally follows their connexion in judgment. It is in the logic of judgment that Herbart inaugurates a new era. He is not, of course, the first to note that even categorical

judgments do not assert the realization of their subject. That is a thought which lies very near the surface for formal logic. He had been preceded too by Maimon in the attempt at a reduction of the traditional types of judgment. He was, however, the first whose analysis was sufficiently convincing to exorcise the tyranny of grammatical forms. The categorical and disjunctive judgment reduce to the hypothetical. By means of the doctrine of the quantification of the predicate, in which with his Leibnitzian conception of identity he anticipated Beneke and Hamilton alike, universal and particular judgments are made to pull together. Modal, impersonal, existential judgments are all accounted for. Only the distinction of affirmative and negative judgments remains unresolved, and the exception is a natural one from the point of view of a philosophy of pluralism. There was little left to be done here save in the way of an inevitable *mutatis mutandis*, even by Lotze and F. H. Bradley. From the judgment viewed as hypothetical we pass by affirmation of the antecedent or denial of the consequent to inference. This point of departure is noteworthy, as also is the treatment of the inductive syllogism as one in which the middle term is resoluble into a group or series (*Reihe*). In indicating specifically, too, the case of conclusion from a copulative major premise with a disjunctive minor, Herbart seems to have suggested the cue for Sigwart's exposition of Bacon's method of exclusions.

That it was the formal character of Herbart's logic which was ultimately fatal to its acceptance outside the school as an independent discipline is not to be doubted. It stands, however, on a different footing from that of the formal logic hitherto discussed, and is not to be condemned upon quite the same grounds. In the first place, Herbart is quite aware of the nature of abstraction. In the second, there is no claim that thought at one and the same time imposes form on "the given" and is susceptible of treatment in isolation by logic. With Herbart the forms of common experience, and indeed all that we can regard as his categories, are products of the psychological mechanism and destitute of logical import. And lastly, Herbart's logic conforms to the exigencies of his system as a whole and the principle of the bare or absolute self-identity of the ultimate "reals" in particular. It is for this reason that it finally lacks real affinity to the "pure logic" of Fries. For at the basis of Herbart's speculation there lies a conception of identity foreign to the thought of Kant with his stress on synthesis, in his thoroughgoing metaphysical use of which Herbart goes back not merely to Wolff but to Leibnitz. It is no mere coincidence that his treatment of all forms of continuance and even his positive metaphysic of "reals" show affinity to Leibnitz. It was in the pressing to its extreme consequences of the conception of uncompromising identity which is to be found in Leibnitz, that the contradictions took their rise which Herbart aimed at solving, by the method of relations and his doctrine of the ultimate plurality of "reals." The logic of relations between conceptual units, themselves unaltered by the relation, seems a kind of reflection of his metaphysical method. To those, of course, for whom the only real identity is identity in difference, while identity without difference, like difference without identity, is simply a limit or a vanishing point, Herbart's logic and metaphysic will alike lack plausibility.

The setting of Herbart's logic in his thought as a whole might of itself perhaps justify separate treatment. His far-reaching influence in the development of later logic must certainly do so. Directly he affected a school of thought which contained one logician of first-rate importance in Moritz Wilhelm Drobisch (1802-1896), professor at Leipzig. In less direct relation stands Lotze, who, although under other influences he developed a different view even in logic, certainly let no point in the doctrine of his great predecessor at Göttingen escape him. A Herbartian strain is to be met with also in the thought of writers much further afield, for example F. H. Bradley, far though his metaphysic is removed from Herbart's. Herbart's influence is surely to be found too in the evolution of what is called *Gegenstandstheorie*. Nor did he affect the logic of his successors through his logic alone. Reference has been made above to the effect upon the rise of the later psychological logic produced by Herbart's psychology of apperception, when disengaged from the background of his metaphysic taken in conjunction with his treatment in his practical philosophy of the judgment of value or what he calls the aesthetic judgment. Emerson's verdict upon a greater thinker —that his was "not a mind to nestle in"—may be true of Herbart, but there can be no doubt as to the stimulating force of this master.

Logic as the rationale of knowledge.

The second way of interpreting the antithesis of thought to what is thought of, was taken by a group of thinkers among whom a central and inspiring figure was Schleiermacher. They in no sense constitute a school and manifest radical differences among themselves. They are agreed, however, in the rejection, on the one hand, of the subjectivist logic with its intrinsic implication that knowledge veils rather than reveals the real world, and, on the other hand, of the logic of the speculative construction with its pretension to "deduce," to determine, and finally at once to cancel and conserve any antithesis in its all-embracing dialectic. They agree, then, in a maintenance of the critical point of view, while all alike recognize the necessity of bringing the thought-function in knowledge into more intimate relation with its "other" than Kant had done, by means of some formula of correlation or parallelism. Such an advance might have taken its cue directly from Kant himself. As an historical fact it tended rather to formulate itself as a reaction towards Kant in view of the course taken by the speculative movement. Thus Schleiermacher's posthumously published *Dialektik* (1839) may be characterized as an appeal from the absolutist element in Schelling's philosophy to the conception of that correlation or parallelism which Schelling had exhibited as flowing from and subsisting within his absolute, and therein as a return upon Kant's doctrine of limits. Schleiermacher's conception of dialectic is to the effect that it is concerned with the principles of the art of philosophizing, as these are susceptible of a relatively independent treatment by a permissible abstraction. Pure thinking or philosophizing is with a view to philosophy or knowledge as an interconnected system of all sciences or departmental forms of knowledge, the mark of knowledge being its identity for all thinking minds. Dialectic then investigates the nexus which must be held to obtain between all thoughts, but also that agreement with the nexus in being which is the condition of the validity of the thought-nexus. In knowing there are two functions involved, the "organic" or animal function of sensuous experience in virtue of which we are in touch with being, directly in inner perception, mediately in outer experience, and the "intellectual" function of construction. Either is indispensable, though in different departments of knowledge the predominant rôle falls to one or other, *e.g.* we are more dependent in physics, less so in ethics. The idea of a perfect harmony of thinking and being is a presupposition that underlies all knowing but cannot itself be realized in knowledge. In terms of the agreement of thought and being, the logical forms of the part of dialectic correspondent to knowledge statically considered have parallels and analogies in being, the concept being correlated to substance, the judgment to causal nexus. Inference, curiously enough, falls under the technical side of dialectic concerned with knowledge in process or becoming, a line of cleavage which Ueberweg has rightly characterized as constituting a rift within Schleiermacher's parallelism.

Schleiermacher.

Schleiermacher's formula obviously ascribes a function in knowledge to thought as such, and describes in a suggestive manner a duality of the intellectual and organic functions, resting on a parallelism of thought and being whose collapse into identity it is beyond human capacity to grasp. It is rather, however, a statement of a way in which the relations of the terms of the problem may be conceived than a system of necessity. It may indeed be permitted to doubt whether its influence upon subsequent theory would have been a great one apart from the spiritual force of Schleiermacher's personality. Some sort of correlationist conception, however, was an inevitable development, and the list[136] of those who accepted it in something of the spirit of Schleiermacher is a long one and contains many distinguished names, notably those of Trendelenburg and Ueberweg. The group is loosely constituted however. There

was scope for diversity of view and there was diversity of view, according as the vital issue of the formula was held to lie in the relation of intellectual function to organic function or in the not quite equivalent relation of thinking to being. Moreover, few of the writers who, whatsoever it was that they baptized with the name of logic, were at least earnestly engaged in an endeavour to solve the problem of knowledge within a circle of ideas which was on the whole Kantian, were under the dominance of a single inspiration. Beneke's philosophy is a striking instance of this, with application to Fries and affinity to Herbart conjoined with obligations to Schelling both directly and through Schleiermacher. Lotze again wove together many threads of earlier thought, though the web was assuredly his own. Finally it must not be forgotten that the host of writers who were in reaction against Hegelianism tended to take refuge in some formula of correlation, as a half-way house between that and formalism or psychologism or both, without reference to, and often perhaps without consciousness of, the way in which historically it had taken shape to meet the problem held to have been left unresolved by Kant.

Lotze.

Lotze on the one hand held the Hegelian "deduction" to be untenable, and classed himself with those who in his own phrase "passed to the order of the day," while on the other hand he definitely raised the question, how an "object" could be brought into forms to which it was not in some sense adapted. Accordingly, though he regards logic as formal, its forms come into relation to objectivity in some sort even within the logical field itself, while when taken in the setting of his system as a whole, its formal character is not of a kind that ultimately excludes psychological and metaphysical reference, at least speculatively. As a logician Lotze stands among the masters. His *flair* for the essentials in his problem, his subtlety of analysis, his patient willingness to return upon a difficulty from a fresh and still a fresh point of view, and finally his fineness of judgment, make his logic[137] so essentially logic of the present, and of its kind not soon to be superseded, that nothing more than an indication of the historical significance of some of its characteristic features need be attempted here.

In Lotze's pure logic it is the Herbartian element that tends to be disconcerting. Logic is formal. Its unit, the logical concept, is a manipulated product and the process of manipulation may be called abstraction. Processes of the psychological mechanism lie below it. The paradox of the theory of judgment is due to the ideal of identity, and the way in which this is evaded by supplementation to produce a non-judgmental identity, followed by translation of the introduced accessories with conditions in the hypothetical judgment, is thoroughly in Herbart's manner. The reduction of judgments is on lines already familiar. Syllogism is no instrumental method by which we compose our knowledge, but an ideal to the form of which it should be brought. It is, as it were, a schedule to be filled in, and is connected with the disjunctive judgment as a schematic setting forth of alternatives, not with the hypothetical, and ultimately the apodictic judgment with their suggestion that it is the real movement of thought that is subjected to analysis. Yet the resultant impression left by the whole treatment is not Herbartian. The concept is accounted for in Kantian terms. There is no discontinuity between the pre-logical or sub-logical conversion of impressions into "first universals" and the formation of the logical concept. Abstraction proves to be synthesis with compensatory universal marks in the place of the particular marks abstracted from. Synthesis as the work of thought always supplies, beside the mere conjunction or disjunction of ideas, a ground of their coherence or non-coherence. It is evident that thought, even as dealt with in pure logic, has an objectifying function. Its universals have objective validity, though this does not involve direct real reference. The formal conception of pure logic, then, is modified by Lotze in such a way as not only to be compatible with a view of the structural and functional adequacy of thought to that which at every point at which we take thinking is still distinguishable from thought, but even inevitably to suggest it. That the unit for logic is the concept and not the judgment has proved a stumbling-block to those of Lotze's critics who are accustomed to think in terms of the act of thought as unit. Lotze's procedure is, indeed, analogous to the way in which, in his philosophy of nature, he starts from a plurality of real beings, but by means of a reductive movement, an application of Kant's transcendental method, arrives at the postulate or fact of a law of their reciprocal action which calls for a monistic and idealist interpretation. He starts, that is in logic, with conceptual units apparently self-contained and admitting of nothing but external relation, but proceeds to justify the intrinsic relation between the matter of his units by an appeal to the fact of the coherence of all contents of thought. Indeed, if thought admits irreducible units, what can unite? Yet he is left committed to his puzzle as to a reduction of judgment to identity, which partially vitiates his treatment of the theory of judgment. The outstanding feature of this is, nevertheless, not affected, viz. the attempt that he makes, inspired clearly by Hegel, "to develop the various forms of judgment systematically as members of a series of operations, each of which leaves a part of its problem unmastered and thereby gives rise to the next."[138] As to inference, finally, the ideal of the articulation of the universe of discourse, as it is for complete knowledge, when its disjunctions have been thoroughly followed out and it is exhaustively determined, carried the day with him against the view that the organon for gaining knowledge is syllogism. The Aristotelian formula is "merely the expression, formally expanded and complete, of the truth already embodied in disjunctive judgment, namely, that every S which is a specific form of M possesses as its predicate a particular modification of each of the universal predicates of M to the exclusion of the rest." Schleiermacher's separation of inference from judgment and his attribution of the power to knowledge in process cannot find acceptance with Lotze. The psychologist and the formal logician do indeed join hands in the denial of a real movement of thought in syllogism. Lotze's logic then, is formal in a sense in which a logic which does not find the conception of synthetic truth embarrassing is not so. It is canon and not organon. In the one case, however, where it recognizes what is truly synthesis, *i.e.* in its account of the concept, it brings the statics of knowledge, so to speak, into integral relation with the dynamics. And throughout, wherever the survival from 1843, the identity bug-bear, is for the moment got rid of in what is really a more liberal conception, the statical doctrine is developed in a brilliant and informing manner. Yet it is in the detail of his logical investigations, something too volatile to fix in summary, that Lotze's greatness as a logician more especially lies.

With Lotze the ideal that at last the forms of thought shall be realized to be adequate to that which at any stage of actual knowledge always proves relatively intractable is an illuminating projection of faith. He takes courage from the reflection that to accept scepticism is to presume the competence of the thought that accepts. He will, however, take no easy way of parallelism. Our human thought pursues devious and circuitous methods. Its forms are not unseldom scaffolding for the house of knowledge rather than the framework of the house itself. Our task is not to realise correspondence with something other than thought, but to make explicit those justificatory notions which condition the form of our apprehension. "However much we may presuppose an original reference of the forms of thought to that nature of things which is the goal of knowledge, we must be prepared to find in them many elements which do not directly reproduce the actual reality to the knowledge of which they are to lead us."[139] The impulse of thought to reduce coincidence to coherence reaches immediately only to objectivity or validity. The sense in which the presupposition of a further reference is to be interpreted and in which justificatory notions for it can be adduced is only determinable in a philosophic system as a whole, where feeling has a place as well as thought, value equally with validity.

Lotze's logic then represents the statical aspect of the function of thought in knowledge, while, so far as we go in knowledge thought is always engaged in the unification of a manifold, which remains contradistinguished from it, though not, of course, completely alien to and unadapted to it. The further step to the determination of the ground of harmony is not to be taken in logic, where limits are present and untranscended.

The position of the search for truth, for which knowledge is a growing organism in which thought needs, so to speak, to feed on something other than itself, is conditioned in the post-Kantian period by antagonism to the speculative movement which culminated in the dialectic of Hegel. The radical thought of this movement was voiced in the demand of Reinhold[140] that philosophy should "deduce" it all from a single principle and by a single method. Kant's limits that must needs be thought and yet cannot be thought must be thought away. An earnest attempt to satisfy this demand was made by Fichte whose single principle was the activity of the pure Ego, while his single method was the assertion of a truth revealed by reflection on the content of conscious experience, the characterization of this as a half truth and the supplementation of it by its other, and finally the harmonization of both. The pure ego is inferred from the fact that the non-ego is realized only in the act of the ego in positing it. The ego posits itself, but reflection on the given shows that we must add that it posits also the non-ego. The two positions are to be conciliated in the thought of reciprocal limitation of the posited ego and non-ego. And so forth. Fichte cannot be said to have developed a logic, but this rhythm of thesis, antithesis and synthesis, foreshadowed in part for Fichte in Spinoza's formula, "omnis determinatio est negatio" and significantly in Kant's triadic grouping of his categories, gave a cue to the thought of Hegel. Schelling, too, called for a single principle and claimed to have found it in his Absolute, "the night" said Hegel, "in which all cows are black," but his historical influence lay, as we have seen, in the direction of a parallelism within the unity, and he also developed no logic. It is altogether otherwise with Hegel.

Logic as Metaphysic.

Hegel's logic,[141] though it involves inquiries which custom regards as metaphysical, is not to be characterized as a metaphysic with a method. It is logic or a rationale of thought by thought, with a full development among other matters of all that the most separatist of logicians regards as thought forms. It offers a solution of what has throughout appeared as the logical problem. That solution lies doubtless in the evolution of the Idea, *i.e.* an all-inclusive in which mere or pure thought is cancelled in its separateness by a transfiguration, while logic is nothing but the science of the Idea viewed in the medium of pure thought. But, whatever else it be, this *Panlogismus*, to use the word of J. E. Erdmann, is at least a logic. Thought in its progressive unfolding, of which the history of philosophy taken in its broad outline offers a pageant, necessarily cannot find anything external to or alien from itself, though that there is something external for it is another matter. As Fichte's Ego finds that its *non-ego* springs from and has its home within its very self, so with Hegel thought finds itself in its "other," both subsisting in the Idea which is both and neither. Either of the two is the all, as, for example, the law of the convexity of the curve is the law of the curve and the law of its concavity. The process of the development of the Idea or Absolute is in one regard the immanent process of the all. Logically regarded, *i.e.* "in the medium of mere thought," it is dialectical method. Any abstract and limited point of view carries necessarily to its contradictory. This can only be atoned with the original determination by fresh negation in which a new thought-determination is born, which is yet in a sense the old, though enriched, and valid on a higher plane. The limitations of this in turn cause a contradiction to emerge, and the process needs repetition. At last, however, no swing into the opposite, with its primarily conflicting, if ultimately complementary function, is any longer possible. That in which no further contradiction is possible is the absolute Idea. Bare or indeterminate being, for instance, the first of the determinations of Hegel's logic, as the being of that which is not anything determinate, of Kant's thing-in-itself, for example, positively understood, implicated at once the notion of not-being, which negates it, and is one with it, yet with a difference, so that we have the transition to determinate being, the transition being baptized as becoming. And so forth. It is easy to raise difficulties not only in regard to the detail in Hegel's development of his categories, especially the higher ones, but also in regard to the essential rhythm of his method. The consideration that mere double negation leaves us precisely where we were and not upon a higher plane where the dominant concept is richer, is, of course, fatal only to certain verbal expressions of Hegel's intent. There is a differentiation in type between the two negations. But if we grant this it is no longer obviously the simple logical operation indicated. It is inferred then that Hegel complements from the stuff of experience, and fails to make good the pretension of his method to be by itself and of itself the means of advance to higher and still higher concepts till it can rest in the Absolute. He discards, as it were, and takes in from the stock while professing to play from what he has originally in his hand. He postulates his unity in senses and at stages in which it is inadmissible, and so supplies only a schema of relations otherwise won, a view supported by the way in which he injects certain determinations in the process, *e.g.* the category of chemism. Has he not cooked the process in the light of the result? In truth the Hegelian logic suffers from the fact that the good to be reached is presupposed in the beginning. Nature, *e.g.*, is not deduced as real because rational, but being real its rationality is presumed and, very imperfectly, exhibited in a way to make it possible to conceive it as in its essence the reflex of Reason. It is a vision rather than a construction. It is a "theosophical logic." Consider the rational-real in the unity that must be, and this is the way of it, or an approximation to the way of it! It was inevitable that the epistemologists of the search for truth would have none of it. The ideal in whatsoever sense real still needs to be realized. It is from the human standpoint regulative and only hypothetically or formally constitutive. We must not confuse οὐσία with εἶναι, nor εἶναι with γίγνεσθαι.

Hegel.

Yet in a less ambitious form the fundamental contentions of Hegel's method tend to find a qualified acceptance. In any piece of presumed knowledge its partial or abstract character involves the presence of loose edges which force the conviction of inadequacy and the development of contradictions. Contradictions must be annulled by complementation, with resultant increasing coherence in ascending stages. At each successive stage in our progress fresh contradictions break out, but the ideal of a station at which the thought-process and its other, if not one, are at one, is permissible as a limiting conception. Yet if Hegel meant only this he has indeed succeeded in concealing his meaning.

Hegel's treatment of the categories or thought determinations which arise in the development of the immanent dialectic is rich in flashes of insight, but most of them are in the ordinary view of logic wholly metaphysical. In the stage, however, of his process in which he is concerned with the notion are to be found concept, judgment, syllogism. Of the last he declares that it "is the reasonable and everything reasonable" (*Encyk.* § 181), and has the phantasy to speak of the definition of the Absolute as being "at this stage" simply the syllogism. It is, of course, the rhythm of the syllogism that attracts him. The concept goes out from or utters itself in judgment to return to an enhanced unity in syllogism. Ueberweg (*System* § 101) is, on the whole, justified in exclaiming that Hegel's rehabilitation of syllogism "did but slight service to the Aristotelian theory of syllogism," yet his treatment of syllogism must be regarded as an acute contribution to logical criticism in the technical sense. He insists on its objectivity. The transition from judgment is not brought about by our subjective action. The syllogism of "all-ness" is convicted of a *petitio principii* (*Encyk.* § 190), with consequent lapse into the inductive syllogism, and, finally, since inductive syllogism is involved in the infinite process, into analogy. "The syllogism of necessity," on the contrary, does not presuppose its conclusion in its premises. The detail, too, of the whole discussion is rich in suggestion, and subsequent logicians—Ueberweg himself perhaps, Lotze certainly in his genetic scale of types of judgment and inference, Professor Bosanquet notably in his systematic development of "the morphology of knowledge," and others—have with reason exploited it.

Hegel's logic as a whole, however, stands and falls not with his thoughts on syllogism, but with the claim made for the dialectical method that it exhibits logic in its integral unity with metaphysic, the thought-process as the self-revelation of the Idea. The claim was disallowed. To the formalist proper it was self-condemned in its pretension to

develop the content of thought and its rejection of the formula of bare-identity. To the epistemologist it seemed to confuse foundation and keystone, and to suppose itself to build upon the latter in a construction illegitimately appropriative of materials otherwise accumulated. At most it was thought to establish a schema of formal unity which might serve as a regulative ideal. To the methodologist of science in genesis it appeared altogether to fail to satisfy any practical interest. Finally, to the psychologist it spelt the failure of intellectualism, and encouraged, therefore, some form of rehabilitated experientialism.

In the Hegelian school in the narrower sense the logic of the master receives some exegesis and defence upon single points of doctrine rather than as a whole. Its effect upon logic is rather to be seen in the rethinking of the traditional body of logical doctrine in the light of an absolute presupposed as ideal, with the postulate that a regulative ideal must ultimately exhibit itself as constitutive, the justification of the postulate being held to lie in the coherence and all-inclusiveness of the result. In such a logic, if and so far as coherence should be attained, would be found something akin to the spirit of what Hegel achieves, though doubtless alien to the letter of what it is his pretension to have achieved. There is perhaps no serious misrepresentation involved in regarding a key-thought of this type, though not necessarily expressed in those verbal forms, as pervading such logic of the present as coheres with a philosophy of the absolute conceived from a point of view that is intellectualist throughout. All other contemporary movements may be said to be in revolt from Hegel.

v. *Logic from 1880-1910*

Logic in the present exhibits, though in characteristically modified shapes, all the main types that have been found in its past history. There is an intellectualist logic coalescent with an absolutist metaphysic as aforesaid. There is an epistemological logic with sometimes formalist, sometimes methodological leanings. There is a formal-symbolic logic engaged with the elaboration of a relational calculus. Finally, there is what may be termed psychological-voluntaryist logic. It is in the rapidity of development of logical investigations of the third and fourth types and the growing number of their exponents that the present shows most clearly the history of logic in the making. All these movements are logic of the present, and a very brief indication may be added of points of historical significance.

Of intellectualist logic Francis Herbert Bradley[142] (b. 1846) and Bernard Bosanquet[143] (1848) may be taken as typical exponents. The philosophy of the former concludes to an Absolute by the annulment of contradictions, though the ladder of Hegel is conspicuous by its absence. His metaphysical method, however, is like Herbart's, not identifiable with his logic, and the latter has for its central characteristic its thorough restatement of the logical forms traditional in language and the text-books, in such a way as to harmonize with the doctrine of a reality whose organic unity is all-inclusive. The thorough recasting that this involves, even of the thought of the masters when it occasionally echoes them, has resulted in a phrasing uncouth to the ear of the plain man with his world of persons and things in which the former simply think about the latter, but it is fundamentally necessary for Bradley's purpose. The negative judgment, for example, cannot be held in one and the same undivided act to presuppose the unity of the real, project an adjective as conceivably applicable to it and assert its rejection. We need, therefore, a restatement of it. With Bradley reality is the one subject of all judgment immediate or mediate. The act of judgment "which refers an ideal content (recognized as such) to a reality beyond the act" is the unit for logic. Grammatical subject and predicate necessarily both fall under the rubric of the adjectival, that is, within the logical idea or ideal content asserted. This is a meaning or universal, which can have no detached or abstract self-subsistence. As found in judgment it may exhibit differences within itself, but it is not two, but one, an articulation of unity, not a fusion, which could only be a confusion, of differences. With a brilliant subtlety Bradley analyses the various types of judgment in his own way, with results that must be taken into account by all subsequent logicians of this type. The view of inference with which he complements it is only less satisfactory because of a failure to distinguish the principle of nexus in syllogism from its traditional formulation and rules, and because he is hampered by the intractability which he finds in certain forms of relational construction.

Bosanquet had the advantage that his logic was a work of a slightly later date. He is, perhaps, more able than Bradley has shown himself, to use material from alien sources and to penetrate to what is of value in the thought of writers from whom, whether on the whole or on particular issues, he disagrees. He treats the book-tradition, however, a debt to which, nowadays inevitable, he is generous in acknowledging,[144] with a judicious exercise of freedom in adaptation, *i.e.* constructively as datum, never eclectically. In his fundamental theory of judgment his obligation is to Bradley. It is to Lotze, however, that he owes most in the characteristic feature of his logic, viz., the systematic development of the types of judgment, and inference from less adequate to more adequate forms. His fundamental continuity with Bradley may be illustrated by his definition of inference. "Inference is the indirect reference to reality of differences within a universal, by means of the exhibition of this universal in differences directly referred to reality."[145] Bosanquet's *Logic* will long retain its place as an authoritative exposition of logic of this type.

Of epistemological logic in one sense of the phrase Lotze is still to be regarded as a typical exponent. Of another type Chr. Sigwart (*q.v.*) may be named as representative. Sigwart's aim was "to reconstruct logic from the point of view of methodology." His problem was the claim to arrive at propositions universally valid, and so true of the object, whosoever the individual thinker. His solution, within the Kantian circle of ideas, was that such principles as the Kantian principle of causality were justified as "postulates of the endeavour after complete knowledge." "What Kant has shown is not that irregular fleeting changes can never be the object of consciousness, but only that the ideal consciousness of complete science would be impossible without the knowledge of the necessity of all events."[146] "The universal presuppositions which form the outline of our ideal of knowledge are not so much laws which the understanding prescribes to nature ... as laws which the understanding lays down for its own regulation in its investigation and consideration of nature. They are a priori because no experience is sufficient to reveal or confirm them in unconditional universality; but they are a priori ... only in the sense of presuppositions without which we should work with no hope of success and merely at random and which therefore we must believe." Finally they are akin to our ethical principles. With this coheres his dictum, with its far-reaching consequences for the philosophy of induction, that "the logical justification of the inductive process rests upon the fact that it is an inevitable postulate of our effort after knowledge, that the given is necessary, and can be known as proceeding from its grounds according to universal laws."[147] It is characteristic of Sigwart's point of view that he acknowledges obligation to Mill as well as to Ueberweg. The transmutation of Mill's induction of inductions into a postulate is an advance of which the psychological school of logicians have not been slow to make use. The comparison of Sigwart with Lotze is instructive, in regard both to their agreement and their divergence as showing the range of the epistemological formula.

Of the formal-symbolic logic all that falls to be said here is, that from the point of view of logic as a whole, it is to be regarded as a legitimate praxis as long as it shows itself aware of the sense in which alone form is susceptible of abstraction, and is aware that in itself it offers no solution of the logical problem. "It is not an algebra," said Kant[148] of his technical logic, and the kind of support lent recently to symbolic logic by the *Gegenstandstheorie* identified with the name of Alexius Meinong (b. 1853)[149] is qualified by the warning that the real activity of thought tends to fall outside the calculus of relations and to attach rather to the subsidiary function of denoting. The future of symbolic

logic as coherent with the rest of logic, in the sense which the word has borne throughout its history seems to be bound up with the question of the nature of the analysis that lies behind the symbolism, and of the way in which this is justified in the setting of a doctrine of validity. The "theory of the object," itself, while affecting logic alike in the formal and in the psychological conception of it very deeply, does not claim to be regarded as logic or a logic, apart from a setting supplied from elsewhere.

Finally we have a logic of a type fundamentally psychological, if it be not more properly characterized as a psychology which claims to cover the whole field of philosophy, including the logical field. The central and organizing principle of this is that knowledge is in genesis, that the genesis takes place in the medium of individual minds, and that this fact implies that there is a necessary reference throughout to interests or purposes of the subject which thinks because it wills and acts. Historically this doctrine was formulated as the declaration of independence of the insurgents in revolt against the pretensions of absolutist logic. It drew for support upon the psychological movement that begins with Fries and Herbart. It has been chiefly indebted to writers, who were not, or were not primarily, logicians, to Avenarius, for example, for the law of the economy of thought, to Wundt, whose system, and therewith his logic,[150] is a pendant to his psychology, for the volitional character of judgment, to Herbert Spencer and others. A judgment is practical, and not to be divorced without improper abstraction from the purpose and will that informs it. A concept is instrumental to an end beyond itself, without any validity other than its value for action. A situation involving a need of adaptation to environment arises and the problem it sets must be solved that the will may control environment and be justified by success. Truth is the improvised machinery that is interjected, so far as this works. It is clear that we are in the presence of what is at least an important half-truth, which intellectuallism with its statics of the rational order viewed as a completely articulate system has tended to ignore. It throws light on many phases of the search for truth, upon the plain man's claim to start with a subject which he knows whose predicate which he does not know is still to be developed, or again upon his use of the negative form of judgment, when the further determination of his purposive system is served by a positive judgment from without, the positive content of which is yet to be dropped as irrelevant to the matter in hand. The movement has, however, scarcely developed its logic[151] except as polemic. What seems clear is that it cannot be the whole solution. While man must confront nature from the human and largely the practical standpoint, yet his control is achieved only by the increasing recognition of objective controls. He conquers by obedience. So truth works and is economical because it is truth. Working is proportioned to inner coherence. It is well that the view should be developed into all its consequences. The result will be to limit it, though perhaps also to justify it, save in its claim to reign alone.

There is, perhaps, an increasing tendency to recognize that the organism of knowledge is a thing which from any single viewpoint must be seen in perspective. It is of course a postulate that all truths harmonize, but to give the harmonious whole in a projection in one plane is an undertaking whose adequacy in one sense involves an inadequacy in another. No human architect can hope to take up in succession all essential points of view in regard to the form of knowledge or to logic. "The great campanile is still to finish."

BIBLIOGRAPHY.—Historical: No complete history of logic in the sense in which it is to be distinguished from theoretical philosophy in general has as yet been written. The history of logic is indeed so little intelligible apart from constant reference to tendencies in philosophical development as a whole, that the historian, when he has made the requisite preparatory studies, inclines to essay the more ambitious task. Yet there are, of course, works devoted to the history of logic proper.

Of these Prantl's *Geschichte der Logik im Abendlande* (4 vols., 1855-1870), which traces the rise, development and fortunes of the Aristotelian logic to the close of the middle ages, is monumental. Next in importance are the works of L. Rabus, *Logik und Metaphysik*, i. (1868) (pp. 123-242 historical, pp. 453-518 bibliographical, pp. 514 sqq. a section on apparatus for the study of the history of logic), *Die neuesten Bestrebungen auf dem Gebiete der Logik bei den Deutschen* (1880), *Logik* (1895), especially for later writers § 17. Ueberweg's *System der Logik und Geschichte der logischen Lehren* (4th ed. and last revised by the author, 1874, though it has been reissued later, Eng. trans., 1871) is alone to be named with these. Harms' posthumously published *Geschichte der Logik* (1881) (*Die Philosophie in ihrer Geschichte*, ii.) was completed by the author only so far as Leibnitz. Blakey's *Historical Sketch of Logic* (1851), though, like all this writer's works, closing with a bibliography of some pretensions, is now negligible. Franck, *Esquisse d'une histoire de la logique* (1838) is the chief French contribution to the subject as a whole.

Of contributions towards the history of special periods or schools of logical thought the list, from the opening chapters of Ramus's *Scholae Dialecticae* (1569) downwards (v. Rabus *loc. cit.*) would be endless. What is of value in the earlier works has now been absorbed. The *System der Logik* (1828) of Bachmann (a Kantian logician of distinction) contains a historical survey (pp. 569-644), as does the *Denklehre* (1822) of van Calker (allied in thought to Fries) pp. 12 sqq.; Eberstein's *Geschichte der Logik und Metaphysik bei den Deutschen von Leibniz bis auf gegenwärtige Zeit* (latest edition, 1799) is still of importance in regard to logicians of the school of Wolff and the origines of Kant's logical thought. Hoffmann, the editor and disciple of von Baader, published *Grundzüge einer Geschichte der Begriffe der Logik in Deutschland von Kant bis Baader* (1851). Wallace's prolegomena and notes to his *Logic of Hegel* (1874, revised and augmented 1892-1894) are of use for the history and terminology, as well as the theory. Riehl's article entitled *Logik in Die Kultur der Gegenwart*, vi. 1. *Systematische Philosophie* (1907), is excellent, and touches on quite modern developments. Liard, *Les Logiciens Anglais Contemporains* (5th ed., 1907), deals only with the 19th-century inductive and formal-symbolic logicians down to Jevons, to whom the book was originally dedicated. Venn's *Symbolic Logic* (1881) gave a careful history and bibliography of that development. The history of the more recent changes is as yet to be found only in the form of unshaped material in the pages of review and *Jahresbericht*.

(H. W. B.*)

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1 Cf. Heidel, "The Logic of the Pre-Socratic Philosophy," in Dewey's *Studies in Logical Theory* (Chicago, 1903).

2 Heraclitus, *Fragmm.* 107 (Diels, *Fragmente der Vorsokratiker*) and 2, on which see Burnet, *Early Greek Philosophy*, p. 153 note (ed. 2).

3 *e.g.* Diog. Laërt. ix. 25, from the lost *Sophistes* of Aristotle.

4 *Plato and Platonism*, p. 24.

5 Nothing is. If anything is, it cannot be known. If anything is known it cannot be communicated.

6 *Metaphys. μ. 1078b* 28 sqq.

7 Cf. Arist. *Top. θ.* i. 1 *ad fin.*

8 For whom see Dümmler, *Antisthenica* (1882, reprinted in his *Kleine Schriften*, 1901).

9 Aristotle, *Metaphys.* 1024*b* 32 sqq.

10 Plato, *Theaetetus*, 201 E. sqq., where, however, Antisthenes is not named, and the reference to him is sometimes doubted. But cf. Aristotle, *Met.* H 3. 1043*b* 24-28.

11 Diog. Laërt. ii. 107.

12 Aristotle, *An. Pr.* i. 31, 46*a* 32 sqq.; cf. 91*b* 12 sqq.

13 Athenaeus ii. 59c. See Usener, *Organisation der wissenschaftl. Arbeit* (1884; reprinted in his *Vorträge und Aufsätze*, 1907).

14 Socrates' reference of a discussion to its presuppositions (Xenophon, *Mem.* iv. 6, 13) is not relevant for the history of the terminology of induction.

15 *Theaetetus*, 186*c*.

16 Timaeus, 37*a*, *b* (quoted in H. F. Carlill's translation of the *Theaetetus*, p. 60).

17 *Theaetetus*, 186*d*.

18 Sophistes, 253d.

19 *Ib. id.*; cf. *Theaetetus*, 197*d*.

20 Aristotle, *de An.* 430*b* 5, and generally iii. 2, iii. 5.

21 For Plato's Logic, the controversies as to the genuineness of the dialogues may be treated summarily. The *Theaetetus* labours under no suspicion. The *Sophistes* is apparently matter for animadversion by Aristotle in the *Metaphysics* and elsewhere, but derives stronger support from the testimonies to the *Politicus* which presumes it. The *Politicus* and *Philebus* are guaranteed by the use made of them in Aristotle's Ethics. The rejection of the *Parmenides* would involve the paradox of a nameless contemporary of Plato and Aristotle who was inferior as a metaphysician to neither. No other dialogue adds anything to the *logical* content of these.

Granted their genuineness, the relative dating of three of them is given, viz. *Theaetetus*, *Sophistes* and *Politicus* in the order named. The *Philebus* seems to presuppose *Politicus*, 283-284, but if this be an error, it will affect the logical theory not at all. There remains the *Parmenides*. It can scarcely be later than the *Sophistes*. The antinomies with which it concludes are more naturally taken as a prelude to the discussion of the *Sophistes* than as an unnecessary retreatment of the doctrine of the one and the many in a more negative form. It may well be earlier than the *Theaetetus* in its present form. The stylistic argument shows the *Theaetetus* relatively early. The maturity of its philosophic outlook tends to give it a place relatively advanced in the Platonic canon. To meet the problem here raised, the theory has been devised of an earlier and a later version. The first may have linked on to the series of Plato's dialogues of search, and to put the *Parmenides* before it is impossible. The second, though it might still have preceded the *Parmenides* might equally well have followed the negative criticism of that dialogue, as the beginning of reconstruction. For Plato's logic this question only has interest on account of the introduction of an Ἀριστοτέλης in a non-speaking part in the *Parmenides*. If this be pressed as suggesting that the philosopher Aristotle was already in full activity at the date of writing, it is of importance to know what Platonic dialogues were later than the début of his critical pupil.

On the stylistic argument as applied to Platonic controversies Janell's *Quaestiones Platonicae* (1901) is important. On the whole question of genuineness and dates of the dialogues, H. Raeder, *Platons philosophische Entwickelung* (1905), gives an excellent conspectus of the views held and the grounds alleged. See also PLATO.

22 E.g. that of essence and accident. Republic, 454.

23 E.g. the discussion of correlation, ib. 437 sqq.

24 *Politicus*, 285*d*.

25 *Sophistes*, 261*c* sqq.

26 E.g. in *Nic. Eth.* i. 6.

27 *Philebus*, 16*d*.

28 Principal edition still that of Waitz, with Latin commentary, (2 vols., 1844-1846). Among the innumerable writers who have thrown light upon Aristotle's logical doctrine, St Hilaire, Trendelenburg, Ueberweg, Hamilton, Mansel, G. Grote may be named. There are, however, others of equal distinction. Reference to Prantl, op. cit., is indispensable. Zeller, *Die philosophie der Griechen*, ii. 2, "Aristoteles" (3rd ed., 1879), pp. 185-257 (there is an Eng. trans.), and Maier, *Die Syllogistik des Aristoteles* (2 vols., 1896, 1900) (some 900 pp.), are also of first-rate importance.

29 *Sophist. Elench.* 184, espec. *b* 1-3, but see Maier, *loc. cit.* i. 1.

30 References such as 18*b* 12 are the result of subsequent editing and prove nothing. See, however, ARISTOTLE.

31 Adrastus is said to have called them πρὸ τῶν τοπικῶν.

32 *Metaphys.* E. 1.

33 *De Part. Animal.* A. 1, 639*a* 1 sqq.; cf. *Metaphys.* 1005*b* 2 sqq.

34 *De Interpretatione* 16*a* sqq.

35 *De Interpretatione* 16*a* 24-25.

36 *Ib.* 18*a* 28 sqq.

37 *Ib.* 19*a* 28-29.

38 As shown *e.g.* by the way in which the relativity of sense and the object of sense is conceived, 7*b* 35-37.

39 *Topics* 101*a* 27 and 36-*b* 4.

40 *Topics* 100.

41 *Politics* 1282*a* 1 sqq.

42 103*b* 21.

43 *Topics* 160*a* 37-*b* 5.

44 This is the explanation of the formal definition of induction, *Prior Analytics*, ii. 23, 68*b* 15 sqq.

45 25*b* 36.

46 *Prior Analytics*, i. 1. 24*a* 18-20, Συλλογισμὸς δὲ ἐστὶ λόγος ἐν ᾧ τεθέντων τινῶν ἕτερόν τι τῶν κειμένων ἐξ ἀνάγκης συμβαίνει τῷ ταῦτα εἶναι. The equivalent previously in *Topics* 100*a* 25 sqq.

47 *Prior Analytics*, ii. 21; *Posterior Analytics*, i. 1.

48 67*a* 33-37, μὴ συνθεωρῶν τὸ καθ' ἑκάτερον.

49 67*a* 39-63.

50 79*a* 4-5.

51 24*b* 10-11.

52 *Posterior Analytics*, i. 4 καθ' αὐτὸ means (1) contained in the definition of the subject; (2) having the subject contained in its definition, as being an alternative determination of the subject, crooked, *e.g.* is *per se* of line; (3) self-subsistent; (4) connected

with the subject as consequent to ground. Its needs stricter determination therefore.

53 73*b* 26 sqq., 74*a* 37 sqq.

54 90*b* 16.

55 *Metaphys. Z.* 12, H. 6 ground this formula metaphysically.

56 94*a* 12, 75*b* 32.

57 90*a* 6. Cf. Ueberweg, *System der Logik*, § 101.

58 78*a* 30 sqq.

59 *Topics*, 101*b* 18, 19.

60 *Posterior Analytics*, ii. 13.

61 *Posterior Analytics*, ii. 16.

62 *Posterior Analytics*, i. 13 ad. fin., and i. 27. The form which a mathematical science treats as relatively self-subsistent is certainly not the constitutive idea.

63 *Posterior Analytics*, i. 3.

64 *Posterior Analytics*, ii. 19.

65 *De Anima*, 428*b* 18, 19.

66 *Prior Analytics*, i. 30, 46*a* 18.

67 *Topics*, 100*b* 20, 21.

68 *Topics*, 101*a* 25, 36-37, *b*1-4, &c.

69 Zeller (*loc. cit.* p. 194), who puts this formula in order to reject it.

70 *Metaphys.* Δ 1, 1013*a* 14.

71 *Posterior Analytics*, 72*a* 16 seq.

72 *Posterior Analytics*, 77*a* 26, 76*a* 37 sqq.

73 *Metaphys.* Γ.

74 *Posterior Analytics*, ii. 19.

75 *de Anima*, iii. 4-6.

76 *Metaphys.* M. 1087*a* 10-12; Zeller loc. cit. 304 sqq.; McLeod Innes, *The Universal and Particular in Aristotle's Theory of Knowledge* (1886).

77 *Topics*, 105*a* 13.

78 *Metaphys.* 995*a* 8.

79 E.g., *Topics*, 108*b* 10, "to induce" the universal.

80 *Posterior Analytics*, ii. 19, 100b 3, 4.

81 *Topics*, i. 18, 108*b* 10.

82 *Prior Analytics*, ii. 23.

83 Παράδειγμα, Prior Analytics, ii. 24.

84 Sigwart, *Logik*, Eng. trans. vol. ii. p. 292 and elsewhere.

85 Ueberweg, *System*, § 127, with a ref. to *de Partibus Animalium*, 667*a*.

86 See 67*a* 17 ἐξ ἁπάντων τῶν ἀτόμων.

87 Ἐπιφορά. Ἐπι = "in" as in ἐπαγωγὴ, inductio, and -φορὰ = -ferentia, as in διαφορὰ, dif*ferentia*.

88 Diog. Laërt. x. 33 seq.; Sext. Emp. Adv. Math. vii. 211.

89 Diog. Laërt. x. 87; cf. Lucretius, vi. 703 sq., v. 526 sqq. (ed. Munro).

90 Sextus Empiricus, *Pyrrhon. Hypotyp.* ii. 195, 196.

91 Sextus, *op. cit.* ii. 204.

92 *Op. cit.* iii. 17 sqq., and especially 28.

93 The point is raised by Aristotle, 95A.

94 See Jourdain, *Recherches critiques sur l'âge et l'origine des traductions latines d'Aristote* (1843).

95 See E. Cassirer, *Das Erkenntnisproblem*, i. 134 seq., and the justificatory excerpts, pp. 539 sqq.

96 See Riehl in *Vierteljahrschr. f. wiss. Philos.* (1893).

97 Bacon, *Novum Organum*, ii. 22, 23; cf. also Aristotle, *Topics* i. 12. 13, ii. 10. 11 (Stewart, ad *Nic. Eth.* 1139*b* 27) and Sextus Empiricus, *Pyrr. Hypot.* iii. 15.

98 Bacon's *Works*, ed. Ellis and Spedding, iii. 164-165.

99 A notable formula of Bacon's *Novum Organum* ii. 4 § 3 turns out, *Valerius Terminus*, cap. 11, to come from Aristotle, *Post. An.* i. 4 *via* Ramus. See Ellis in Bacon's *Works*, iii. 203 sqq.

100 *De Civitate Dei*, xi. 26. "Certum est me esse, si fallor."

101 Cf. Plato, *Republic*, 381E seq.

102 *Elementa Philosophiæ*, i. 3. 20, i. 6. 17 seq.

103 Hobbes, *Elementa Philosophiæ*, i. 1. 5.

104 *Id. ib.* i. 6. 16.

105 *Id. ib.* i. 4. 8; cf. Locke's *Essay of Human Understanding*, iv. 17.

106 *Id. Leviathan*, i. 3.

107 *Id. Elem. Philos.* i. 6. 10.

108 Condillac, *Langue des Calculs*, p. 7.

109 Locke, *Essay*, iii. 3.

110 *Id. ib.* iv. 17.

111 *Loc. cit.* § 8.

112 *Id. ib.* iv. 4, §§ 6 sqq.

113 Berkeley, *Of the Principles of Human Knowledge*, § 142.

114 Hume, *Treatise of Human Nature*, i. 1. 7 (from Berkeley, *op. cit.*, introd., §§ 15-16).

115 *Essay*, iv. 17, § 3.

116 Hume, *Treatise of Human Nature*, i. 3. 15.

117 Mill, *Examination of Sir William Hamilton's Philosophy*, cap. 17.

118 Cf. Mill, *Autobiography*, p. 159. "I grappled at once with the problem of Induction, postponing that of Reasoning." *Ib.* p. 182 (when he is preoccupied with syllogism), "I could make nothing satisfactory of Induction at this time."

119 *Autobiography*, p. 181.

120 The insight, for instance, of F. H. Bradley's criticism, *Principles of Logic*, II. ii. 3, is somewhat dimmed by a lack of sympathy due to extreme difference in the point of view adopted.

121 Bacon, *Novum organum*, i. 100.

122 Russell's *Philosophy of Leibnitz*, capp. 1-5.

123 See especially remarks on the letter of M. Arnauld (Gerhardt's edition of the philosophical works, ii. 37 sqq.).

124 Gerhardt, vi. 612, quoted by Russell, *loc. cit.*, p. 19.

125 Ibid., ii. 62, Russell, p. 33.

126 Spinoza, ed. van Vloten and Land, i. 46 (*Ethica*, i. 11).

127 *Nouveaux essais*, iv. 2 § 9, 17 § 4 (Gerhardt v. 351, 460).

128 *Critique of Judgment*, Introd. § 2, *ad. fin.* (*Werke*, Berlin Academy edition, vol. v. p. 176, l. 10).

129 *Kant's Introduction to Logic and his Essay on the Mistaken Subtlety of the Four Figures*, trans. T. K. Abbott (1885).

130 *Loc. cit.*, p. 11.

131 Or antitheses. Kant follows, for example, a different line of cleavage between form and content from that developed between thought and the "given." And these are not his only unresolved dualities, even in the *Critique of Pure Reason*. For the logical inquiry, however, it is permissible to ignore or reduce these differences.

The determination too of the sense in which Kant's theory of knowledge involves an unresolved antithesis is for the logical purpose necessary so far only as it throws light upon his logic and his influence upon logical developments. Historically the question of the extent to which writers adopted the dualistic interpretation or one that had the like consequences is of greater importance.

It may be said summarily that Kant holds the antithesis between thought and "the given" to be unresolved and within the limits of theory of knowledge irreducible. The dove of thought falls lifeless if the resistant atmosphere of "the given" be withdrawn (*Critique of Pure Reason*, ed. 2 Introd. Kant's *Werke*, ed. of the Prussian Academy, vol. iii. p. 32, ll. 10 sqq.). Nevertheless the thing-in-itself is a problematic conception and of a limiting or negative use merely. He "had woven," according to an often quoted phrase of Goethe, "a certain sly element of irony into his method; ... he pointed as it were with a side gesture beyond the limits which he himself had drawn." Thus (*loc. cit.* p. 46, ll. 8, 9) he declares that "there are two lineages united in human knowledge, which perhaps spring from a common stock, though to us unknown—namely sense and understanding." Some indication of the way in which he would hypothetically and speculatively mitigate the antithesis is perhaps afforded by the reflection that the distinction of the mental and what appears as material is an external distinction in which the one appears outside to the other. "Yet what as thing-in-itself lies back of the phenomenon may perhaps not be so wholly disparate after all" (ib. p. 278, ll. 26 sqq.).

132 *Critique of Judgment*, Introd. § 2 (*Werke*, v., 276 ll. 9 sqq.); cf. Bernard's "Prolegomena" to his translation of this, (pp. xxxviii. sqq.).

133 *Die Logik, insbesondere die Analytik* (Schleswig, 1825). August Detlev Christian Twesten (1789-1876), a Protestant theologian, succeeded Schleiermacher as professor in Berlin in 1835.

134 See *Sir William Hamilton: The Philosophy of Perception*, by J. Hutchison Stirling.

135 *Hauptpunkte der Logik*, 1808 (*Werke*, ed. Hartenstein, i. 465 sqq.), and specially *Lehrbuch der Einleitung in die Philosophie* (1813), and subsequently §§ 34 sqq. (*Werke*, i. 77 sqq.).

136 See Ueberweg, *System of Logic and History of Logical Doctrines*, § 34.

137 *Drei Bücher der Logik*, 1874 (E.T., 1884). The Book on Pure Logic follows in essentials the line of thought of an earlier work (1843).

138 *Logic*, Eng. trans. 35 *ad. fin.*

139 *Logic*, Introd. § ix.

140 For whom see Höffding, *History of Modern Philosophy*, Eng. trans., vol. ii. pp. 122 sqq.; invaluable for the logical methods of modern philosophers.

141 *Wissenschaft der Logik* (1812-1816), in course of revision at Hegel's death in 1831 (*Werke*, vols. iii.-v.), and *Encyklopädie der philosophischen Wissenschaften*, i.; *Die Logik* (1817; 3rd ed., 1830); *Werke*, vol. vi., Eng. trans., Wallace (2nd ed., 1892).

142 *The Principles of Logic* (1883).

143 *Logic, or The Morphology of Thought* (2 vols., 1888).

144 *Logic*, Pref. pp. 6 seq.

145 *Id.* vol. ii. p. 4.

146 *Logik* (1873, 1889), Eng. trans. ii. 17.

147 *Op. cit.* ii. 289.

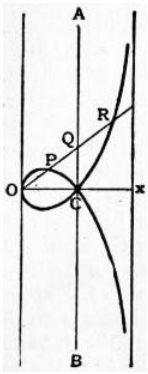
148 *Introd. to Logic.*, trans. Abbott, p. 10.

149 *Ueber Annahmen* (1902, &c.).

150 *Logik* (1880, and in later editions).

151 Yet see *Studies in Logic*, by John Dewey and others (1903).

LOGOCYCLIC CURVE, STROPHOID or **FOLIATE,** a cubic curve generated by increasing or diminishing the radius vector of a variable point Q on a straight line AB by the distance QC of the point from the foot of the perpendicular drawn from the origin to the fixed line. The polar equation is $r \cos\theta = a(1 \pm \sin\theta)$, the upper sign referring to the case when the vector is increased, the lower when it is diminished. Both branches are included in the Cartesian equation $(x^2 + y^2)(2a - x) = a^2x$, where a is the distance of the line from the origin. If we take for axes the fixed line and the perpendicular through the initial point, the equation takes the form $y\sqrt{(a - x)} = x\sqrt{(a + x)}$. The curve resembles the folium of Descartes, and has a node between x = 0, x = a, and two branches asymptotic to the line x = 2a.



LOGOGRAPHI (λόγος, γράφω, writers of prose histories or tales), the name given by modern scholars to the Greek historiographers before Herodotus.[1] Thucydides, however, applies the term to all his own predecessors, and it is therefore usual to make a distinction between the older and the younger logographers. Their representatives, with one exception, came from Ionia and its islands, which from their position were most favourably situated for the acquisition of knowledge concerning the distant countries of East and West. They wrote in the Ionic dialect, in what was called the unperiodic style, and preserved the poetic character of their epic model. Their criticism amounts to nothing more than a crude attempt to rationalize the current legends and traditions connected with the founding of cities, the genealogies of ruling families, and the manners and customs of individual peoples. Of scientific criticism there is no trace whatever. The first of these historians was probably Cadmus of Miletus (who lived, if at all, in the early part of the 6th century), the earliest writer of prose, author of a work on the founding of his native city and the colonization of Ionia (so Suïdas); Pherecydes of Leros, who died about 400, is generally considered the last. Mention may also be made of the following: Hecataeus of Miletus (550-476); Acusilaus of Argos,[2] who paraphrased in prose (correcting the tradition where it seemed necessary) the genealogical works of Hesiod in the Ionic dialect; he confined his attention to the prehistoric period, and made no attempt at a real history; Charon of Lampsacus (*c.* 450), author of histories of Persia, Libya, and Ethiopia, of annals (ὧροι) of his native town with lists of the prytaneis and archons, and of the chronicles of Lacedaemonian kings; Xanthus of Sardis in Lydia (*c.* 450), author of a history of Lydia, one of the chief authorities used by Nicolaus of Damascus (*fl.* during the time of Augustus); Hellanicus of Mytilene; Stesimbrotus of Thasos, opponent of Pericles and reputed author of a political pamphlet on Themistocles, Thucydides and Pericles; Hippys and Glaucus, both of Rhegium, the first the author of histories of Italy and Sicily, the second of a treatise on ancient poets and musicians, used by Harpocration and Plutarch; Damastes of Sigeum, pupil of Hellanicus, author of genealogies of the combatants before Troy (an ethnographic and statistical list), of short treatises on poets, sophists, and geographical subjects.

On the early Greek historians, see G. Busolt, *Griechische Geschichte* (1893), i. 147-153; C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895); A. Schäfer, *Abriss der Quellenkunde der griechischen und römischen Geschichte* (ed. H. Nissen, 1889); J. B. Bury, *Ancient Greek Historians* (1909), lecture i.; histories of Greek literature by Müller-Donaldson (ch. 18) and W. Mure (bk. iv. ch. 3), where the little that is known concerning the life and writings of the logographers is exhaustively discussed. The fragments will be found, with Latin notes, translation, prolegomena, and copious indexes, in C. W. Müller's *Fragmenta historicorum Graecorum* (1841-1870).

See also GREECE: *History, Ancient* (section, "Authorities").

1 The word is also used of the writers of speeches for the use of the contending parties in the law courts, who were forbidden to employ advocates.

2 There is some doubt as to whether this Acusilaus was of Peloponnesian or Boeotian Argos. Possibly there were two of the name. For an example of the method of Acusilaus see Bury, *op. cit.* p. 19.

LOGOS λόγος, a common term in ancient philosophy and theology. It expresses the idea of an immanent reason in the world, and, under various modifications, is met with in Indian, Egyptian and Persian systems of thought. But the idea was developed mainly in Hellenic and Hebrew philosophy, and we may distinguish the following stages:

1. *The Hellenic Logos.*—To the Greek mind, which saw in the world a κόσμος (ordered whole), it was natural to regard the world as the product of reason, and reason as the ruling principle in the world. So we find a Logos doctrine more or less prominent from the dawn of Hellenic thought to its eclipse. It rises in the realm of physical speculation, passes over into the territory of ethics and theology, and makes its way through at least three well-defined stages. These are marked off by the names of Heraclitus of Ephesus, the Stoics and Philo.

It acquires its first importance in the theories of Heraclitus (6th century B.C.), who, trying to account for the aesthetic order of the visible universe, broke away to some extent from the purely physical conceptions of his predecessors and discerned at work in the cosmic process a λόγος analogous to the reasoning power in man. On the one hand the Logos is identified with γνώμη and connected with δίκη, which latter seems to have the function of correcting deviations from the eternal law that rules in things. On the other hand it is not positively distinguished either from the ethereal fire, or from the εἱμαρμένη and the ἀνάγκη according to which all things occur. Heraclitus holds that nothing material can be thought of without this Logos, but he does not conceive the Logos itself to be immaterial. Whether it is regarded as in any sense possessed of intelligence and consciousness is a question variously answered. But there is most to say for the negative. This Logos is not one above the world or prior to it, but in the world and inseparable from it. Man's soul is a part of it. It is *relation*, therefore, as Schleiermacher expresses it, or reason, not speech or word. And it is objective, not subjective, reason. Like a law of nature, objective in the world, it gives order and regularity to the movement of things, and makes the system rational.[1]

The failure of Heraclitus to free himself entirely from the physical hypotheses of earlier times prevented his speculation from influencing his successors. With Anaxagoras a conception entered which gradually triumphed over that of Heraclitus, namely, the conception of a supreme, intellectual principle, not identified with the world but independent of it. This, however, was νοῦς, not Logos. In the Platonic and Aristotelian systems, too, the theory of ideas involved an absolute separation between the material world and the world of higher reality, and though the term Logos is found the conception is vague and undeveloped. With Plato the term selected for the expression of the principle to which the order visible in the universe is due is νοῦς or σοφία, not λόγος. It is in the pseudo-Platonic *Epinomis* that λόγος appears as a synonym for νοῦς. In Aristotle, again, the principle which sets all nature under the rule of thought, and directs it towards a rational end, is νοῦς, or the divine spirit itself; while λόγος is a term with many senses, used as more or less identical with a number of phrases, οὗ ἕνεκα, ἐνέργια, ἐντελέχεια, οὐσία, εἶδος, μορφή, &c.

In the reaction from Platonic dualism, however, the Logos doctrine reappears in great breadth. It is a capital element in the system of the Stoics. With their teleological views of the world they naturally predicated an active principle pervading it and determining it. This operative principle is called both Logos and God. It is conceived of as material, and is described in terms used equally of nature and of God. There is at the same time the special doctrine of the λόγος σπερματικός, the seminal Logos, or the law of generation in the world, the principle of the active reason working in dead matter. This parts into λόγοι σπερματικοί, which are akin, not to the Platonic ideas, but rather to the λόγοι ἔνυλοι of Aristotle. In man, too, there is a Logos which is his characteristic possession, and which is ἐνδιάθετος, as long as it is a thought resident within his breast, but προφορικός when it is expressed as a word. This distinction between Logos as ratio and Logos as *oratio*, so much used subsequently by Philo and the Christian fathers, had been so far anticipated by Aristotle's distinction between the ἔξω λόγος and the λόγος ἐν τῇ ψυχῇ. It forms the point of attachment by which the Logos doctrine connected itself with Christianity. The Logos of the Stoics (*q.v.*) is a reason in the world gifted with intelligence, and analogous to the reason in man.

2. *The Hebrew Logos.*—In the later Judaism the earlier anthropomorphic conception of God and with it the sense of the divine nearness had been succeeded by a belief which placed God at a remote distance, severed from man and the world by a deep chasm. The old familiar name Yahweh became a secret; its place was taken by such general expressions as the Holy, the Almighty, the Majesty on High, the King of Kings, and also by the simple word "Heaven." Instead of the once powerful confidence in the immediate presence of God there grew up a mass of speculation regarding on the one hand the distant future, on the other the distant past. Various attempts were made to bridge the gulf between God and man, including the angels, and a number of other hybrid forms of which it is hard to say whether they are personal beings or abstractions. The wisdom, the Shekinah or Glory, and the Spirit of God are intermediate beings of this kind, and even the Law came to be regarded as an independent spiritual entity. Among these conceptions that of the word of God had an important place, especially the creative word of Genesis i. Here as in the other cases we cannot always say whether the Word is regarded as a mere attribute or activity of God, or an independent being, though there is a clear tendency towards the latter. The ambiguity lies in the twofold purpose of these activities: (1) to establish communication with God; (2) to prevent direct connexion between God and the world. The word of the God of revelation is represented as the creative principle (*e.g.* Gen. i. 3; Psalm xxxiii. 6), as the executor of the divine judgments (Hosea vi. 5), as healing (Psalm cvii. 20), as possessed of almost personal qualities (Isaiah lv. 11; Psalm cxlvii. 15). Along with this comes the doctrine of the angel of Yahweh, the angel of the covenant, the angel of the presence, in whom God manifests Himself, and who is sometimes identified with Yahweh or Elohim (Gen. xvi. 11, 13; xxxii. 29-31; Exod. iii. 2; xiii. 21), sometimes distinguished from Him (Gen. xxii. 15, &c.; xxiv. 7; xxviii. 12, &c.), and sometimes presented in both aspects (Judges ii., vi.; Zech. i.). To this must be added the doctrine of Wisdom, given in the books of Job and Proverbs. At one time it is exhibited as an attribute of God (Prov. iii. 19). At another it is strongly personified, so as to become rather the creative thought of God than a quality (Prov. viii. 22). Again it is described as proceeding from God as the principle of creation and objective to Him. In these and kindred passages (Job xv. 7, &c.) it is on the way to become hypostatized.

> The Hebrew conception is partially associated with the Greek in the case of Aristobulus, the predecessor of Philo, and, according to the fathers, the founder of the Alexandrian school. He speaks of Wisdom in a way reminding us of the book of Proverbs. The pseudo-Solomonic *Book of Wisdom* (generally supposed to be the work of an Alexandrian flourishing somewhere between Aristobulus and Philo) deals both with the Wisdom and with the Logos. It fails to hypostatize either. But it represents the former as the framer of the world, as the power or spirit of God, active alike in the physical, the intellectual, and the ethical domain, and apparently objective to God. In the Targums, on the other hand, the three doctrines of the word, the angel, and the wisdom of God converge in a very definite conception. In the Jewish theology God is represented as purely transcendent, having no likeness of nature with man, and making no personal entrance into history. Instead of the immediate relation of God to the world the Targums introduce the ideas of the *Mēmrā* (word) and the *Shechīnā* (real presence). This Memra (= Ma'amar) or, as it is also designated, *Dibbūrā*, is a hypostasis that takes the place of God when direct intercourse with man is in view. In all those passages of the Old Testament where anthropomorphic terms are used of God, the Memra is substituted for God. The Memra proceeds from God, and retains the creaturely relation to God. It does not seem to have been identified with the Messiah.[2]

3. *Philo.*—In the Alexandrian philosophy, as represented by the Hellenized Jew Philo, the Logos doctrine assumes a leading place and shapes a new career for itself. Philo's doctrine is moulded by three forces—Platonism, Stoicism and Hebraism. He detaches the Logos idea from its connexion with Stoic materialism and attaches it to a thoroughgoing Platonism. It is Plato's idea of the Good regarded as creatively active. Hence, instead of being merely immanent in the Cosmos, it has an independent existence. Platonic too is the doctrine of the divine architect who seeks to realize in the visible universe the archetypes already formed in his mind. Philo was thus able to make the Logos theory a bridge between Judaism and Greek philosophy. It preserved the monotheistic idea yet afforded a description of the Divine activity in terms of Hellenic thought; the word of the Old Testament is one with the λόγος of the Stoics. And thus in Philo's conception the Logos is much more than "the principle of reason, informing the infinite variety of things, and so creating the World-Order"; it is also the divine dynamic, the energy and self-revelation of God. The Stoics indeed sought, more or less consciously, by their doctrine of the Logos as the Infinite Reason to escape from the belief in a

divine Creator, but Philo, Jew to the core, starts from the Jewish belief in a supreme, self-existing God, to whom the reason of the world must be subordinated though related. The conflict of the two conceptions (the Greek and the Hebrew) led him into some difficulty; sometimes he represents the Logos as an independent and even personal being, a "second God," sometimes as merely an aspect of the divine activity. And though passages of the first class must no doubt be explained figuratively—for Philo would not assert the existence of two Divine agents—it remains true that the two conceptions cannot be fused. The Alexandrian philosopher wavers between the two theories and has to accord to the Logos of Hellas a semi-independent position beside the supreme God of Judaea. He speaks of the Logos (1) as the agency by which God reveals Himself, in some measure to all men, in greater degree to chosen souls. The appearances recorded in the Old Testament are manifestations of the Logos, and the knowledge of God possessed by the great leaders and teachers of Israel is due to the same source; (2) as the agency whereby man, enmeshed by illusion, lays hold of the higher spiritual life and rising above his partial point of view participates in the universal reason. The Logos is thus the means of redemption; those who realize its activity being emancipated from the tyranny of circumstance into the freedom of the eternal.

4. *The Fourth Gospel.*—Among the influences that shaped the Fourth Gospel that of the Alexandrian philosophy must be assigned a distinct, though not an exaggerated importance. There are other books in the New Testament that bear the same impress, the epistles to the Ephesians and the Colossians, and to a much greater degree the epistle to the Hebrews. The development that had thus begun in the time of Paul reaches maturity in the Fourth Gospel, whose dependence on Philo appears (1) in the use of the allegorical method, (2) in many coincident passages, (3) in the dominant conception of the Logos. The writer narrates the life of Christ from the point of view furnished him by Philo's theory. True, the Logos doctrine is only mentioned in the prologue to the Gospel, but it is presupposed throughout the whole book. The author's task indeed was somewhat akin to that of Philo, "to transplant into the world of Hellenic culture a revelation originally given through Judaism." This is not to say that he holds the Logos doctrine in exactly the same form as Philo. On the contrary, the fact that he starts from an actual knowledge of the earthly life of Jesus, while 921
Philo, even when ascribing a real personality to the Logos, keeps within the bounds of abstract speculation, leads him seriously to modify the Philonic doctrine. Though the Alexandrian idea largely determines the evangelist's treatment of the history, the history similarly reacts on the idea. The prologue is an organic portion of the Gospel and not a preface written to conciliate a philosophic public. It assumes that the Logos idea is familiar in Christian theology, and vividly summarizes the main features of the Philonic conception—the eternal existence of the Logos, its relation to God (πρὸς τὸν θεόν, yet distinct), its creative, illuminative and redemptive activity. But the adaptation of the idea to John's account of a historical person involved at least three profound modifications:—(1) the Logos, instead of the abstraction or semi-personification of Philo, becomes fully personified. The word that became flesh subsisted from all eternity as a distinct personality within the divine nature. (2) Much greater stress is laid upon the redemptive than upon the creative function. The latter indeed is glanced at ("All things were made by him"), merely to provide a link with earlier speculation, but what the writer is concerned about is not the mode in which the world came into being but the spiritual life which resides in the Logos and is communicated by him to men. (3) The idea of λόγος as Reason becomes subordinated to the idea of λόγος as Word, the expression of God's will and power, the outgoing of the divine energy, life, love and light. Thus in its fundamental thought the prologue of the Fourth Gospel comes nearer to the Old Testament (and especially to Gen. i.) than to Philo. As speech goes out from a man and reveals his character and thought, so Christ is "sent out from the Father," and as the divine word is also, in accordance with the Hebrew idea, the medium of God's quickening power.

What John thus does is to take the Logos idea of Philo and use it for a practical purpose—to make more intelligible to himself and his readers the divine nature of Jesus Christ. That this endeavour to work into the historical tradition of the life and teaching of Jesus—a hypothesis which had a distinctly foreign origin—led him into serious difficulties is a consideration that must be discussed elsewhere.

5. *The Early Church.*—In many of the early Christian writers, as well as in the heterodox schools, the Logos doctrine is influenced by the Greek idea. The Syrian Gnostic Basilides held (according to Irenaeus i. 24) that the Logos or Word emanated from the νοῦς, or personified reason, as this latter emanated from the unbegotten Father. The completest type of Gnosticism, the Valentinian, regarded Wisdom as the last of the series of aeons that emanated from the original Being or Father, and the Logos as an emanation from the first two principles that issued from God, Reason (νοῦς) and Truth. Justin Martyr, the first of the sub-apostolic fathers, taught that God produced of His own nature a rational power(δύναμίν τινα λογικήν), His agent in creation, who now became man in Jesus (*Dial. c. Tryph.* chap. 48, 60). He affirmed also the action of the λόγος σπερματικός, (*Apol.* i. 46; ii. 13, &c.). With Tatian (*Cohort. ad. Gr.* chap. 5, &c.) the Logos is the beginning of the world, the reason that comes into being as the sharer of God's rational power. With Athenagoras (*Suppl.* chap. 9, 10) He is the prototype of the world and the energizing principle (ἰδέα καὶ ἐνέργεια) of things. Theophilus (Ad *Autolyc.* ii. 10, 24) taught that the Logos was in eternity with God as the λόγος ἐνδιάθετος, the counsellor of God, and that when the world was to be created God sent forth this counsellor (σύμβουλος) from Himself as the λόγος προφορικός, yet so that the begotten Logos did not cease to be a part of Himself. With Hippolytus (*Refut.* x. 32, &c.) the Logos, produced of God's own substance, is both the divine intelligence that appears in the world as the Son of God, and the idea of the universe immanent in God. The early Sabellians (comp. Eusebius, *Hist. Eccl.* vi. 33; Athanasius, *Contra Arian.* iv.) held that the Logos was a faculty of God, the divine reason, immanent in God eternally, but not in distinct personality prior to the historical manifestation in Christ. Origen, referring the act of creation to eternity instead of to time, affirmed the eternal personal existence of the Logos. In relation to God this Logos or Son was a copy of the original, and as such inferior to that. In relation to the world he was its prototype, the ἰδέα ἰδεῶν and its redeeming power (*Contra Cels.* v. 608; *Frag. de princip.* i. 4; *De princip.* i. 109, 324).

In the later developments of Hellenic speculation nothing essential was added to the doctrine of the Logos. Philo's distinction between God and His rational power or Logos in contact with the world was generally maintained by the eclectic Platonists and Neo-Platonists. By some of these this distinction was carried out to the extent of predicating (as was done by Numenius of Apamea) three Gods:—the supreme God; the second God, or Demiurge or Logos; and the third God, or the world. Plotinus explained the logoi as constructive forces, proceeding from the ideas and giving form to the dead matter of sensible things (*Enneads*, v. 1. 8 and Richter's *Neu-Plat. Studien*).

See the histories of philosophy and theology, and works quoted under Heraclitus, Stoics, Philo, John, The Gospel of, &c., and for a general summary of the growth of the Logos doctrine, E. Caird, *Evolution of Theology in the Greek Philosophers* (1904), vol. ii.; A. Harnack, *History of Dogma*; E. F. Scott, *The Fourth Gospel*, ch. v. (1906); J. M. Heinze, *Die Lehre vom Logos in der griech. Philosophie* (1872); J. Réville, *La Doctrine du Logos* (1881); Aal, *Gesch. d. Logos-Idee* (1899); and the *Histories of Dogma*, by A. Harnack, F. Loofs, R. Seeberg.

(S. D. F. S.; A. J. G.)

1 Cf. Schleiermacher's *Herakleitos der Dunkle*; art. Heraclitus and authorities there quoted.

2 Cf. the Targum of Onkelos on the Pentateuch under Gen. vii. 16, xvii. 2, xxi. 20; Exod. xix. 16, etc.; the Jerusalem Targum on Numb. vii. 89, &c. For further information regarding the Hebrew *Logos* see, beside Dr Kaufmann Kohler, s.v. "Memra," *Jewish Encyc.* viii. 464-465, Bousset, *Die Religion des Judenthums* (1903), p. 341, and Weber, *Jüdische Theologie* (1897), pp. 180-184. The hypostatizing of the Divine word in the doctrine of the Memra was probably later than the time of Philo, but it was the

outcome of a mode of thinking already common in Jewish theology. The same tendency is of course expressed in the “Logos” of the Fourth Gospel.

LOGOTHETE (Med. Lat. *logotheta*, Gr. λογοθέτης, from λόγος, word, account, calculation, and τιθέναι, to set, *i.e.* “one who accounts, calculates or ratiocinates”), originally the title of a variety of administrative officials in the Byzantine Empire, *e.g.* the λογοθέτης τοῦ δρόμου, who was practically the equivalent of the modern postmaster-general; and the λογοθέτης τοῦ στρατιωτικοῦ, the logothete of the military chest. Gibbon defines the great Logothete as “the supreme guardian of the laws and revenues,” who “is compared with the chancellor of the Latin monarchies.” From the Eastern Empire the title was borrowed by the west, though it only became firmly established in Sicily, where the *logotheta* occupied the position of chancellor elsewhere, his office being equal if not superior to that of the *magnus cancellarius*. Thus the title was borne by Pietro della Vigna, the all-powerful minister of the emperor Frederick II., king of Sicily.

See Du Cange, *Glossarium*, s.v. *Logotheta*.

LOGROÑO, an inland province of northern Spain, the smallest of the eight provinces formed in 1833 out of Old Castile; bounded N. by Burgos, Álava and Navarre, W. by Burgos, S. by Soria and E. by Navarre and Saragossa. Pop. (1900) 189,376; area, 1946 sq. m. Logroño belongs entirely to the basin of the river Ebro, which forms its northern boundary except for a short distance near San Vicente; it is drained chiefly by the rivers Tiron, Oja, Najerilla, Iregua, Leza, Cidacos and Alhama, all flowing in a north-easterly direction. The portion skirting the Ebro forms a spacious and for the most part fertile undulating plain, called La Rioja, but in the south Logroño is considerably broken up by offshoots from the sierras which separate that river from the Douro. In the west the Cerro de San Lorenzo, the culminating point of the Sierra de la Demanda, rises 7562 ft., and in the south the Pico de Urbion reaches 7388 ft. The products of the province are chiefly cereals, good oil and wine (especially in the Rioja), fruit, silk, flax and honey. Wine is the principal export, although after 1892 this industry suffered greatly from the protective duties imposed by France. Great efforts have been made to keep a hold upon French and English markets with light red and white Rioja wines. No less than 128,000 acres are covered with vines, and 21,000 with olive groves. Iron and argentiferous lead are mined in small quantities and other ores have been discovered. The manufacturing industries are insignificant. A railway along the right bank of the Ebro connects the province with Saragossa, and from Miranda there is railway communication with Madrid, Bilbao and France; but there is no railway in the southern districts, where trade is much retarded by the lack even of good roads. The town of Logroño (pop. 1900, 19,237) and the city of Calahorra (9475) are separately described. The only other towns with upwards of 5000 inhabitants are Haro (7914), Alfaro (5938) and Cervera del Río Alhama (5930).

LOGROÑO, the capital of the Spanish province of Logroño, on the right bank of the river Ebro and on the Saragossa-Miranda de Ebro railway. Pop. (1900) 19,237. Logroño is an ancient walled town, finely situated on a hill 1204 ft. high. Its bridge of twelve arches across the Ebro was built in 1138, but has frequently been restored after partial destruction by floods. The main street, arcaded on both sides, and the crooked but highly picturesque alleys of the older quarters are in striking contrast with the broad, tree-shaded avenues and squares laid out in modern times. The chief buildings are a bull-ring which accommodates 11,000 spectators, and a church, Santa Maria de Palacio, called “the imperial,” from the tradition that its founder was Constantine the Great (274-337). As the commercial centre of the fertile and well-cultivated plain of the Rioja, Logroño has an important trade in wine.

The district of Logroño was in ancient times inhabited by the *Berones* or *Verones* of Strabo and Pliny, and their *Varia* is to be identified with the modern suburb of the city of Logroño now known as Varea of Barea. Logroño was named by the Romans *Juliobriga* and afterwards *Lucronius*. It fell into the hands of the Moors in the 8th century, but was speedily retaken by the Christians, and under the name of Lucronius appears with frequency in medieval history. It was unsuccessfully besieged by the French in 1521, and occupied by them from 1808 to 1813. It was the birthplace of the dumb painter Juan Fernandez Navarrete (1526-1579).

LOGROSCINO (or Lo Groscino), NICOLA (1700?-1763?), Italian musical composer, was born at Naples and was a pupil of Durante. In 1738 he collaborated with Leo and others in the hasty production of *Demetrio*; in the autumn of the same year he produced a comic opera *L’inganno per inganno*, the first of a long series of comic operas, the success of which won him the name of “il Dio dell’ opera buffa.” He went to Palermo, probably in 1747, as a teacher of counterpoint; as an opera composer he is last heard of in 1760, and is supposed to have died about 1763. Logroscino has been credited with the invention of the concerted operatic finale, but as far as can be seen from the

score of *Il Governatore* and the few remaining fragments of other operas, his finales show no advance upon those of Leo. As a musical humorist, however, he deserves remembrance, and may justly be classed alongside of Rossini.

LOGWOOD (so called from the form in which it is imported), the heart-wood of a leguminous tree, *Haematoxylon campechianum*, native of Central America, and grown also in the West Indian Islands. The tree attains a height not exceeding 40 ft., and is said to be ready for felling when about ten years old. The wood, deprived of its bark and the sap-wood, is sent into the market in the form of large blocks and billets. It is very hard and dense, and externally has a dark brownish-red colour; but it is less deeply coloured within. The best qualities come from Campeachy, but it is obtained there only in small quantity.

Logwood is used in dyeing (*q.v.*), in microscopy, in the preparation of ink, and to a small extent in medicine on account of the tannic acid it contains, though it has no special medicinal value, being much inferior to kino and catechu. The wood was introduced into Europe as a dyeing substance soon after the discovery of America, but from 1581 to 1662 its use in England was prohibited by legislative enactment on account of the inferior dyes which at first were produced by its employment.

The colouring principle of logwood exists in the timber in the form of a glucoside, from which it is liberated as haematoxylin by fermentation. Haematoxylin, $C_{16}H_{14}O_6$, was isolated by M. E. Chevreul in 1810. It forms a crystalline hydrate, $C_{16}H_{14}O_6 + 3H_2O$, which is a colourless body very sparingly soluble in cold water, but dissolving freely in hot water and in alcohol. By exposure to the air, especially in alkaline solutions, haematoxylin is rapidly oxidized into haematein, $C_{16}H_{12}O_6$, with the development of a fine purple colour. This reaction of haematoxylin is exceedingly rapid and delicate, rendering that body a laboratory test for alkalis. By the action of hydrogen and sulphurous acid, haematein is easily reduced to haematoxylin. It is chemically related to brazilin, found in brazil-wood. Haematoxylin and brazilin, and also their oxidation products, haematin and brazilin, have been elucidated by W. H. Perkin and his pupils (see *Jour. Chem. Soc.*, 1908, 1909).

LOHARU, a native state of India, in the south-east corner of the Punjab, between Hissar district and Rajputana. Area, 222 sq. m.; pop. (1901) 15,229; estimated gross revenue, £4800. The chief, whose title is nawab, is a Mahommedan, of Afghan descent. The nawab Sir Amir-ud-din-Ahmad Khan, K.C.I.E., who is a member of the viceroy's legislative council, was until 1905 administrator and adviser of the state of Maler Kotla. The town of Loharu had a population in 1901 of 2175.

LÖHE, JOHANN KONRAD WILHELM (1808-1872), German divine and philanthropist, was born on the 21st of February 1808 in Fürth near Nuremberg, and was educated at the universities of Erlangen and Berlin. In 1831 he was appointed vicar at Kirchenlamitz, where his fervent evangelical preaching attracted large congregations and puzzled the ecclesiastical authorities. A similar experience ensued at Nuremberg, where he was assistant pastor of St Egidia. In 1837 he became pastor in Neuendettelsau, a small and unattractive place, where his life's work was done, and which he transformed into a busy and influential community. He was interested in the spiritual condition of Germans who had emigrated to the United States, and built two training homes for missionaries to them. In 1849 he founded the Lutheran Society of Home Missions and in 1853 an institution of deaconesses. Other institutions were added to these, including a lunatic asylum, a Magdalen refuge, and hospitals for men and women. In theology Löhe was a strict Lutheran, but his piety was of a most attractive kind. Originality of conception, vividness of presentation, fertility of imagination, wide knowledge of Scripture and a happy faculty of applying it, intense spiritual fervour, a striking physique and a powerful voice made him a great pulpit force. He wrote a good deal, amongst his books being *Drei Bücher von der Kirche* (1845), *Samenkörner des Gebetes* (over 30 editions) and several volumes of sermons. He died on the 2nd of January 1872.

See his *Life*, by J. Deinzer (3 vols., Gütersloh, 1873, 3rd ed., 1901).

LOHENGRIN, the hero of the German version of the legend of the knight of the swan. The story of Lohengrin as we know it is based on two principal motives common enough in folklore: the metamorphosis of human beings into swans, and the curious wife whose question brings disaster. Lohengrin's guide (the swan) was originally the little brother who, in one version of "the Seven Swans," was compelled through the destruction of his golden chain to remain in swan form and attached himself to the fortunes of one of his brothers. The swan played a part in classical mythology as the bird of Apollo, and in Scandinavian lore the swan maidens, who have the gift of prophecy and are sometimes confused with the Valkyries, reappear again and again. The wife's desire to know her husband's origin is a parallel of the myth of Cupid and Psyche, and bore in medieval times a similar mystical interpretation. The Lohengrin

legend is localized on the Lower Rhine, and its incidents take place at Antwerp, Nijmwegen, Cologne and Mainz. In its application it falls into sharp division in the hands of German and French poets. By the Germans it was turned to mystical use by being attached loosely to the Grail legend (see Grail and Perceval); in France it was adapted to glorify the family of Godfrey de Bouillon.

The German story makes its appearance in the last stanzas of Wolfram von Eschenbach's *Parzival*, where it is related how Parzival's son, Loherangrîn,[1] was sent from the castle of the Grail to the help of the young duchess of Brabant. Guided by the swan he reached Antwerp, and married the lady on condition that she should not ask his origin. On the breach of this condition years afterwards Loherangrîn departed, leaving sword, horn and ring behind him. Between 1283 and 1290, a Bavarian disciple of Wolfram's[2] adopted the story and developed it into an epic poem of nearly 8000 lines, incorporating episodes of Lohengrin's prowess in tournament, his wars with Henry I. against the heathen Hungarians and the Saracens,[3] and incidentally providing a detailed picture of the everyday life of people of high condition. The epic of Lohengrin is put by the anonymous writer into the mouth of Wolfram, who is made to relate it during the Contest of the Singers at the Wartburg in proof of his superiority in knowledge of sacred things over Klingsor the magician, and the poem is thus linked on to German tradition. Its connexion with Parzival implies a mystic application. The consecrated wafer shared by Lohengrin and the swan on their voyage is one of the more obvious means taken by the poet to give the tale the character of an allegory of the relations between Christ, the Church and the human soul. The story was followed closely in its main outlines by Richard Wagner in his opera *Lohengrin*.

The French legend of the knight of the swan is attached to the house of Bouillon, and although William of Tyre refers to it about 1170 as fable, it was incorporated without question by later annalists. It forms part of the cycle of the *chansons de geste* dealing with the Crusade, and relates how Helyas, knight of the swan, is guided by the swan to the help of the duchess of Bouillon and marries her daughter Ida or Beatrix in circumstances exactly parallel to the adventures of Lohengrin and Elsa of Brabant, and with the like result. Their daughter marries Eustache, count of Boulogne, and had three sons, the eldest of whom, Godefroid (Godfrey), is the future king of Jerusalem. But in French story Helyas is not the son of Parzival, but of the king and queen of Lillefort, and the story of his birth, of himself, his five brothers and one sister is, with variations, that of "the seven swans" persecuted by the wicked grandmother, which figures in the pages of Grimm and Hans Andersen. The house of Bouillon was not alone in claiming the knight of the swan as an ancestor, and the tradition probably originally belonged to the house of Cleves.

German Versions.—See *Lohengrin*, ed. Rückert (Quedlinburg and Leipzig, 1858); another version of the tale, *Lorengel*, is edited in the *Zeitschr. für deutsches Altertum* (vol. 15); modern German translation of *Lohengrin*, by H. A. Junghaus (Leipzig, 1878); Conrad von Würzburg's fragmentary *Schwanritter*, ed. F. Roth (Frankfurt, 1861). Cf. Elster, *Beiträge zur Kritik des Lohengrin* (Halle, 1884), and R. Heinrichs, *Die Lohengrindichtung und ihre Deutung* (Hamm i. West., 1905).

French Versions.—Baron de Reiffenberg, *Le Chevalier au cygne et Godfrey de Bouillon* (Brussels, 2 vols., 1846-1848), in *Mon. pour servir à l'hist. de la province de Namur*; C. Hippeau, *La Chanson du chevalier au cygne* (1874); H. A. Todd, *La Naissance du chevalier au cygne, an inedited French poem of the 12th cent.* (Mod. Lang. Assoc., Baltimore, 1889); cf. the Latin tale by Jean de Haute Seille (Johannes de Alta Silva) in his *Dolopathos* (ed. Oesterley, Strassburg, 1873).

English Versions.—In England the story first appears in a short poem preserved among the Cotton MSS. of the British Museum and entitled *Chevelere assigne*. This was edited by G. E. V. Utterson in 1820 for the Roxburghe Club, and again by H. H. Gibbs in 1868 for the Early English Text Society. The E.E.T.S. edition is accompanied by a set of photographs of a 14th-century ivory casket, on which the story is depicted in 36 compartments. An English prose romance, *Helyas Knight of the Swan*, translated by Robert Copland, and printed by W. Copland about 1550, is founded on a French romance *La Génealogie ... de Godeffroy de Boulin* (printed 1504) and is reprinted by W. J. Thoms in *Early Prose Romances*, vol. iii. It was also printed by Wynkyn de Worde in 1512. A modern edition was issued in 1901 from the Grolier Club, New York.

1 *i.e.* Garin le Loherin (*q.v.*), or Garin of Lorraine.

2 Elster (*Beiträge*) says that the poem is the work of two poets: the first part by a Thuringian wandering minstrel, the second—which differs in style and dialect—by a Bavarian official.

3 Based on material borrowed from the *Sächsische Weltchronik* (formerly called *Repgowische Chronik* from its dubious assignment to Eime von Repgow), the oldest prose chronicle of the world in German (*c.* 1248 or 1260).

LOIN (through O. Fr. *loigne* or *logne*, mod. *longe*, from Lat. *lumbus*), that part of the body in an animal which lies between the upper part of the hip-bone and the last of the false ribs on either side of the back-bone, hence in the plural the general term for the lower part of the human body at the junction with the legs, covered by the loin-cloth, the almost universal garment among primitive peoples. There are also figurative uses of the word, chiefly biblical, due to the loins being the supposed seat of male vigour and power of generation. Apart from these uses the word is a butcher's term for a joint of meat cut from this part of the body. The upper part of a loin of beef is known as the "surloin" (Fr. *surlonge*, *i.e.* upper loin). This has been commonly corrupted into "sirloin," and a legend invented, to account for the name, of a king, James I. or Charles II., knighting a prime joint of beef "Sir Loin" in pleasure at its excellence. A double surloin, undivided at the back-bone, is known as a "baron of beef," probably from an expansion of the legend of the "Sir Loin."

LOIRE, the longest river of France, rising in the Gerbier de Jonc in the department of Ardèche, at a height of 4500 ft. and flowing north and west to the Atlantic. After a course of 18 m. in Ardèche it enters Haute-Loire, in which it follows a picturesque channel along the foot of basaltic rocks, through narrow gorges and small plains. At Vorey,

where it is joined by the Arzon, it becomes navigable for rafts. Four miles below its entrance into the department of Loire, at La Noirie, river navigation is officially reckoned to begin, and breaking through the gorges of Saint Victor, the Loire enters the wide and swampy plain of Forez, after which it again penetrates the hills and flows out into the plain of Roanne. As in Haute-Loire, it is joined by a large number of streams, the most important being the Coise on the right and the Lignon du Nord or du Forez and the Aix on the left. Below Roanne the Loire is accompanied on its left bank by a canal to Digoin (35 m.) in Saône-et-Loire, thence by the so-called "lateral canal of the Loire" to Briare in Loiret (122 m.). Owing to the extreme irregularity of the river in different seasons these canals form the only certain navigable way. At Digoin the Loire receives the Arroux, and gives off the canal du Centre (which utilizes the valley of the Bourbince) to Chalon-sur-Saône. At this point its northerly course begins to be interrupted by the mountains of Morvan, and flowing north-west it enters the department of Nièvre. Just beyond Nevers it is joined by the Allier; this river rises 30 m. S.W. of the Loire in the department of Lozère, and following an almost parallel course has at the confluence a volume equal to two-thirds of that of the main stream. Above Nevers the Loire is joined by the Aron, along which the canal du Nivernais proceeds northward, and the Nièvre, and below the confluence of the Allier gives off the canal du Berry to Bourges and the navigable part of the Cher. About this point the valley becomes more ample and at Briare (in Loiret) the river leaves the highlands and flows between the plateaus of Gatinais and the Beauce on the right and the Sologne on the left. In Loiret it gives off the canal de Briare northward to the Seine and itself bends north-west to Orléans, whence the canal d'Orléans, following the little river Cens, communicates with the Briare canal. At Orléans the river changes its north-westerly for a south-westerly course. A striking peculiarity of the affluents of the Loire in Loiret and the three subsequent departments is that they frequently flow in a parallel channel to the main stream and in the same valley. Passing Blois in Loir-et-Cher, the Loire enters Indre-et-Loire and receives on the right the Cisse, and, after passing Tours, the three important left-hand tributaries of the Cher, Indre and the Vienne. At the confluence of the Vienne the Loire enters Maine-et-Loire, in its course through which department it is frequently divided by long sandy islands fringed with osiers and willows; while upon arriving at Les Ponts-de-Cé it is split into several distinct branches. The principal tributaries are: left, the Thouet at Saumur, the Layon and the Evre; right: the Authion, and, most important tributary of all, the Maine, formed by the junction of the rivers Mayenne, Sarthe and Loir. Through Loire-Inférieure the river is studded with islands until below Nantes, where the largest of them, called Belle-Ile, is found. It receives the Erdre on the right at Nantes and on the opposite shore the Sèvre-Nantaise, and farther on the canalized Achenau on the left and the navigable Etier de Méan on the right near Saint Nazaire. Below Nantes, between which point and La Martinière (below Pellerin) the channel is embanked, the river is known as the Loire Maritime and widens out between marshy shores, passing Paimbœuf on the left and finally Saint-Nazaire, where it is 1½ m. broad. The length of the channel of the Loire is about 625 m.; its drainage area is 46,700 sq. m. A lateral canal (built in 1881-1892 at a cost of about £1,000,000) known as the Maritime Canal of the Loire between Le Carnet and La Martinière enables large ships to ascend to Nantes. It is 9½ m. long, and 19½ (capable of being increased to 24) ft. deep. At each end is a lock 405 ft. long by 59 ft. wide. The canal de Nantes à Brest connects this city with Brest.

The Loire is navigable only in a very limited sense. During the drought of summer thin and feeble streams thread their way between the sandbanks of the channel; while at other times a stupendous flood submerges wide reaches of land. In the middle part of its course the Loire traverses the western portion of the undulating Paris basin, with its Tertiary marls, sands and clays, and the alluvium carried off from these renders its lower channel inconstant; the rest of the drainage area is occupied by crystalline rocks, over the hard surface of which the water, undiminished by absorption, flows rapidly into the streams. When the flood waters of two or more tributaries arrive at the same time serious inundations result. Attempts to control the river must have begun at a very early date, and by the close of the middle ages the bed between Orléans and Angers was enclosed by dykes 10 to 13 ft. high. In 1783 a double line of dykes or *turcies* 23 ft. high was completed from Bec d'Allier downwards. The channel was, however, so much narrowed that the embankments are almost certain to give way as soon as the water rises 16 ft. (the average rise is about 14, and in 1846 and 1856 it was more than 22). In modern times embankments, aided by dredging operations extending over a large number of years, have ensured a depth of 18 ft. in the channel between La Martinière and Nantes. Several towns have constructed special works to defend themselves against the floods; Tours, the most exposed of all, is surrounded by a circular dyke.

Various schemes for the systematic regulation of the Loire have been discussed. It has been proposed to construct in the upper valleys of the several affluents a number of gigantic dams or reservoirs from which the water, stored during flood, could be let off into the river as required. A dam of this kind (built in 1711) at the village of Pinay, about 18 m. above Roanne, and capable of retaining from 350 to 450 million cub. ft. of water, has greatly diminished the force of the floods at Roanne, and maintained the comparative equilibrium of the current during the dry season. Three other dams of modern construction are also in existence, one near Firminy, the other two near St Étienne.

LOIRE, a department of central France, made up in 1793 of the old district of Forez and portions of Beaujolais and Lyonnais, all formerly included in the province of Lyonnais. Pop. (1906) 643,943. Area 1853 sq. m. It is bounded N. by the department of Saône-et-Loire, E. by those of Rhône and Isère, S. by Ardèche and Haute-Loire, and W. by Puy-de-Dôme and Allier. From 1790 to 1793 it constituted, along with that of Rhône, a single department (Rhône-et-Loire). It takes its name from the river which bisects it from south to north. The Rhone skirts the S.E. of the department, about one-eighth of which belongs to its basin. After crossing the southern border the Loire runs through wild gorges, passing the picturesque crag crowned by the old fortress of St Paul-en-Cornillon. At St Rambert it issues into the broad plain of Fotez, flows north as far as its confluence with the Aix where the plain ends, and then again traverses gorges till it enters the less extensive plain of Roanne in the extreme north of the department. These two plains, the beds of ancient lakes, are enclosed east and west by chains of mountains running parallel with the river. In the west are the Forez mountains, which separate the Loire basin from that of the Allier; their highest point (Pierre sur Haute, 5381 ft.) is 12 m. W. of Montbrison. They sink gradually towards the north, and are successively called Bois Noirs (4239 ft.), from their woods, and Monts de la Madeleine (3822 to 1640 ft.). In the east the Rhone and Loire basins are separated, by Mont Pilat (4705 ft.) at the north extremity of the Cévennes, and by the hills of Lyonnais, Tarare, Beaujolais and Charolais, none of which rise higher than 3294 ft. Of the affluents of the Loire the most important are the Lignon du Nord, the beautiful valley of which has been called "La Suisse Forezienne," and the Aix on the left, and on the right the Ondaine (on which stand the industrial towns of Chambon-Feugerolles and Firminy), the Furens and the Rhin. The Gier forms a navigable channel to the Rhone at Givors, and has on its banks the industrial towns of St Chamond and Rive-de-Gier. From Mont Pilat descends the Déôme, in the valley of which are the workshops of Annonay (*q.v.*). The climate on the heights is cold and healthy, it is unwholesome in the marshy plain of Forez, mild in the valley of the Rhone. The annual rainfall varies from 39 to 48 in. on the Forez mountains, but only reaches 20 to 24 in. in the vicinity of

Montbrison.

The plains of Forez and Roanne are the two most important agricultural districts, but the total production of grain within the department is insufficient for the requirements of the population. The pasture lands of the plain of Forez, the western portion of which is irrigated by the canal of Forez, support a large number of live stock. Good pasturage is also found on the higher levels of the Forez mountains, on the north-eastern plateaus, where oxen of the famous Charolais breed are raised, and on the uplands generally. Wheat and rye are the leading cereal crops; oats come next in importance, barley and colza occupying a relatively small area. The vine is cultivated in the valley of the Rhone, on the lower slopes of the Forez mountains and on the hills west of the plain of Roanne. The forests of Mont Pilat and the Forez chain yield good-sized pines and wood for mining purposes. The so-called Lyons chestnuts are to a large extent obtained from Forez; the woods and pasture lands of Mont Pilat yield medicinal plants, such as mint. Poultry-rearing and bee-keeping are considerable industries. The department is rich in mineral springs, the waters of St Galmier, Sail-sous-Couzan, St Romain-le-Puy and St Alban being largely exported. The chief wealth of the department lies in the coal deposits of the basin of St Étienne (*q.v.*), the second in importance in France, quarrying is also active. Metal-working industries are centred in the S.E. of the department, where are the great manufacturing towns of St Étienne, Rive-de-Gier, St Chamond and Firminy. At St Étienne there is a national factory of arms, in which as many as 10,000 have been employed; apart from other factories of the same kind carried on by private individuals, the production of hardware, locks, edge-tools, common cutlery, chain cables for the mines, files, rails, &c., occupies thousands of hands. Cast steel is largely manufactured, and the workshops of the department supply the heaviest constructions required in naval architecture, as well as war material and machinery of every description. The glass industry is carried on at Rive-de-Gier and St Galmier. St Étienne and St Chamond are centres for the fabrication of silk ribbons, elastic ribbons and laces, and the dressing of raw silks. Between 50,000 and 60,000 people are employed in the last-named industries. The arrondissement of Roanne manufactures cotton stuffs, muslins and the like. That of Montbrison produces table linen. The department has numerous dye-works, flour-mills, paper works, tanyards, brick-works, silk-spinning works and hat factories. It is served by the Paris-Lyon railway, Roanne being the junction of important lines from Paris to Lyons and St Étienne. Within the department the Loire is hardly used for commercial navigation; the chief waterways are the canal from Roanne to Digoin (13 m. in the department), that from Givors to Rive-de-Gier (7 m.) and the Rhone (7 m.).

Loire comprises three arrondissements—St Étienne, Montbrison and Roanne—with 31 cantons and 335 communes. It falls within the region of the XIII. army corps and the *diocèse* and *académie* (educational circumscription) of Lyons, where also is its court of appeal. St Étienne is the capital, other leading towns being Roanne, Montbrison, Rive-de-Gier, St Chamond, Firminy and Le Chambon, all separately noticed. St Bonnet-le-Château, besides old houses, has a church of the 15th and 16th centuries, containing paintings of the 15th century; St Rambert and St Romain-le-Puy have priory churches of the 11th and 12th centuries; and at Charlieu there are remains of a Benedictine abbey founded in the 9th century, including a porch decorated with fine Romanesque carving.

LOIRE-INFÉRIEURE,

a maritime department of western France, made up in 1790 of a portion of Brittany on the right and of the district of Retz on the left of the Loire, and bounded W. by the ocean, N. by Morbihan and Ille-et-Vilaine, E. by Maine-et-Loire and S. by Vendée. Pop. (1906) 666,748. Area 2694 sq. m. The surface is very flat, and the highest point, in the north on the borders of Ille-et-Vilaine, reaches only 377 ft. The line of hillocks skirting the right bank of the Loire, and known as the *sillon de Bretagne*, scarcely exceeds 250 ft.; below Savenay they recede from the river, and meadows give place to peat bogs. North of St Nazaire and Grande Brière, measuring 9 m. by 6, and rising hardly 10 ft. above the sea-level, still supplies old trees which can be used for joiners' work. A few scattered villages occur on the more elevated spots, but communication is effected chiefly by the canals which intersect it. The district south of the Loire lies equally low; its most salient feature is the lake of Grandlieu, covering 27 sq. m., and surrounded by low and marshy ground, but so shallow (6½ ft. at most) that drainage would be comparatively easy. The Loire (*q.v.*) has a course of 70 m. within the department. On the left bank a canal stretches for 9 m. between Pellerin, where the dikes which protect the Loire valley from inundation terminate, and Paimbœuf, and vessels drawing 17 or 18 ft. can reach Nantes. The principal towns on the river within the department are Ancenis, Nantes and St Nazaire (one of the most important commercial ports of France) on the right, and Paimbœuf on the left. The chief affluents are, on the right the Erdre and on the left the Sèvre, both debouching at Nantes. The Erdre in its lower course broadens in places into lakes which give it the appearance of a large river. Four miles below Nort it coalesces with the canal from Nantes to Brest. The Sèvre is hemmed in by picturesque hills; at the point where it enters the department it flows past the beautiful town of Clisson with its imposing castle of the 13th century. Apart from the Loire, the only navigable channel of importance within the department is the Nantes and Brest canal, fed by the Isac, a tributary of the Vilaine, which separates Loire-Inférieure from Ille-et-Vilaine and Morbihan. The climate is humid, mild and equable. At Nantes the mean annual temperature is 54.7° Fahr., and there are one hundred and twenty-two rainy days, the annual rainfall being 25.6 in.

Horse and cattle raising prospers, being carried on chiefly in the west of the department and in the Loire valley. Good butter and cheese are produced. Poultry also is reared, and there is a good deal of bee-keeping. Wheat, oats, buckwheat and potatoes are produced in great abundance; leguminous plants are also largely cultivated, especially near Nantes. Wine, cider and forage crops are the chief remaining agricultural products. The woods are of oak in the interior and pine on the coast. The department has deposits of tin, lead and iron. N.W. of Ancenis coal is obtained from a bed which is a prolongation of that of Anjou. The salt marshes, about 6000 acres in all, occur for the most part between the mouth of the Vilaine and the Loire, and on the Bay of Bourgneuf, and salt-refining, of which Guérande is the centre, is an important industry. The granite of the sea-coast and of the Loire up to Nantes is quarried for large blocks. Steam-engines are built for the government at Indret, a few miles below Nantes; the forges of Basse-Indre are in good repute for the quality of their iron; and the production of the lead-smelting works at Couëron amounts to several millions of francs annually. There are also considerable foundries at Nantes, Chantenay, close to Nantes, and St Nazaire, and shipbuilding yards at Nantes and St Nazaire. Among other industries may be mentioned the preparation of pickles and preserved meats at Nantes, the curing of sardines at Le Croisic and in the neighbouring communes, the manufacture of sugar, brushes, tobacco, macaroni and similar foods, soap and chemicals at Nantes, and of paper, sugar and soap at Chantenay. Fishing is prosecuted along the entire coast, particularly at Le Croisic. Among the seaside resorts Le Croisic, Pornichet and Pornic, where there are megalithic monuments, may be mentioned. The department is traversed by the railways of the state, the Orléans company and the Western company. The department is divided into five arrondissements—Nantes, Ancenis, Châteaubriant, Paimbœuf and St Nazaire—45 cantons and 219 communes. It has its appeal court at Rennes, which is also the centre of the *académie* (educational division) to which it belongs.

The principal places are Nantes, the capital, St Nazaire and Châteaubriant, which receive separate treatment. On

the west coast the town of Batz, and the neighbouring villages, situated on the peninsula of Batz, are inhabited by a small community possessed of a distinct costume and dialect, and claiming descent from a Saxon or Scandinavian stock. Its members are employed for the most part in the salt marshes N.E. of the town. Guérande has well-preserved ramparts and gates of the 15th century, a church dating from the 12th to the 16th centuries, and other old buildings. At St Philbert-de-Grandlieu there is a church, rebuilt in the 16th and 17th centuries, but preserving remains of a previous edifice belonging at least to the beginning of the 11th century.

LOIRET, a department of central France, made up of the three districts of the ancient province of Orléanais—Orléanais proper, Gâtinais and Dunois—together with portions of those of Île-de-France and Berry. It is bounded N. by Seine-et-Oise, N.E. by Seine-et-Marne, E. by Yonne, S. by Nièvre and Cher, S.W. and W. by Loir-et-Cher and N.W. by Eure-et-Loir. Area, 2629 sq. m. Pop. (1906) 364,999. The name is borrowed from the Loiret, a stream which issues from the ground some miles to the south of Orléans, and after a course of about 7 m. falls into the Loire; its large volume gives rise to the belief that it is a subterranean branch of that river. The Loire traverses the south of the department by a broad valley which, though frequently devastated by disastrous floods, is famed for its rich tilled lands, its castles, its towns and its vine-clad slopes. To the north of the Loire are the Gâtinais (capital Montargis) and the Beauce; the former district is so named from its *gâtines* or wildernesses, of which saffron is, along with honey, the most noteworthy product; the Beauce (*q.v.*), a monotonous tract of corn-fields without either tree or river, has been called the granary of France. Between the Beauce and the Loire is the extensive forest of Orléans, which is slowly disappearing before the advances of agriculture. South of the Loire is the Sologne, long barren and unhealthy from the impermeability of its subsoil, but now much improved in both respects by means of pine plantation and draining and manuring operations. The highest point (on the borders of Cher) is 900 ft. above sea-level, and the lowest (on the borders of Seine-et-Marne) is 220 ft. The watershed on the plateau of Orléans between the basins of the Seine and Loire, which divide Loiret almost equally between them, is almost imperceptible. The lateral canal of the Loire from Roanne stops at Briare; from the latter town a canal (canal de Briare) connects with the Seine by the Loing valley, which is joined by the Orléans canal below Montargis. The only important tributary of the Loire within the department is the Loiret; the Loing, a tributary of the Seine, has a course of 40 m. from south to north, and is accompanied first by the Briare canal and afterwards by that of the Loing. The Essonne, another important affluent of the Seine, leaving Loiret below Malesherbes, takes its rise on the plateau of Orléans, as also does its tributary the Juine. The department has the climate of the Sequanian region, the mean temperature being a little above that of Paris; the rainfall varies from 18.5 to 27.5 in., according to the district, that of the exposed Beauce being lower than that of the well-wooded Sologne. Hailstorms cause much destruction in the Loire valley and the neighbouring regions.

The department is essentially agricultural in character. A large number of sheep, cattle, horses and pigs are reared; poultry, especially geese, and bees are plentiful. The yield of wheat and oats is in excess of the consumption; rye, barley, meslin, potatoes, beetroot, colza and forage plants are also cultivated. Wine in abundance, but of inferior quality, is grown on the hills of the Loire valley. Buckwheat supports bees by its flowers, and poultry by its seeds. Saffron is another source of profit. The woods consist of oak, elm, birch and pine; fruit trees thrive in the department, and Orléans is a great centre of nursery gardens. The industries are brick and tile making, and the manufacture of faience, for which Gien is one of the most important centres in France. The Briare manufacture of porcelain buttons and pearls employs many workmen. Flour-mills are very numerous. There are iron and copper foundries, which, with agricultural implement making, bell-founding and the manufacture of pins, nails and files, represent the chief metal-working industries. The production of hosiery, wool-spinning and various forms of wool manufacture are also engaged in. A large quantity of the wine grown is made into vinegar (vinaigre d'Orléans). The tanneries produce excellent leather; and paper-making, sugar-refining, wax-bleaching and the manufacture of caoutchouc complete the list of industries. The four arrondissements are those of Orléans, Gien, Montargis and Pithiviers, with 31 cantons and 349 communes. The department forms part of the *académie* (educational division) of Paris.

Besides Orléans, the capital, the more noteworthy places, Gien, Montargis, Beaugency, Pithiviers, Briare and St Benoît-sur-Loire, are separately noticed. Outside these towns notable examples of architecture are found in the churches of Cléry (15th century), of Ferrières (13th and 14th centuries), of Puiseaux (12th and 13th centuries) and Meung (12th century). At Germigny-des-Prés there is a church built originally at the beginning of the 9th century and rebuilt in the 19th century, on the old plan and to some extent with the old materials. Yèvre-le-Châtel has an interesting château of the 13th century, and Sully-sur-Loire the fine medieval château rebuilt at the beginning of the 17th century by Maximilien de Béthune, duke of Sully, the famous minister of Henry IV. There are remains of a Gallo-Roman town (perhaps the ancient *Vellaunodunum*) at Triguères and of a Roman amphitheatre near Montbouy.

LOIR-ET-CHER, a department of central France, formed in 1790 from a small portion of Touraine, the Perche, but chiefly from the Dunois, Vendômois and Blésois, portions of Orléanais. It is bounded N. by Eure-et-Loir, N.E. by Loiret, S.E. by Cher, S. by Indre, S.W. by Indre-et-Loire and N.W. by Sarthe. Pop. (1906) 276,019. Area, 2479 sq. m. The department takes its name from the Loir and the Cher by which it is traversed in the north and south respectively. The Loir rises on the eastern border of the Perche and joins the Maine after a course of 195 m.; the Cher rises on the Central Plateau near Aubusson, and reaches the Loire after a course of 219 m. The Loire flows through the department from north-east to south-west, and divides it into two nearly equal portions. To the south-east is the district of the Sologne, to the north-west the rich wheat-growing country of the Beauce (*q.v.*) which stretches to the Loir. Beyond that river lies the Perche. The surface of this region, which contains the highest altitude in the department (840 ft.), is varied by hills, valleys, hedged fields and orchards. The Sologne was formerly a region of forests, of which those in the neighbourhood of Chambord are the last remains. Its soil, once barren and marshy, has been considerably improved by draining and afforestation, though pools are still very numerous. The district is much frequented by sportsmen. The Cher and Loir traverse pleasant valleys, occasionally bounded by walls of tufa in which dwellings have been excavated, as at Les Roches in the Loir valley; the stone, hardened by exposure to the air, is also used for building purposes. The Loire and, with the help of the Berry canal, the Cher are navigable. The chief remaining rivers of the department are

the Beuvron, which flows into the Loire on the left, and the Sauldre, a right-hand affluent of the Cher. The climate is temperate and mild, though that of the Beauce tends to dryness and that of the Sologne to dampness. The mean annual temperature is between 52° and 53° F.

> The department is primarily agricultural, yielding abundance of wheat and oats. Besides these the chief products are rye, wheat and potatoes. Vines thrive on the valley slopes, the vineyards falling into four groups—those of the Cher, which yield fine red wines, the Sologne, the Blésois and the Vendômois. In the valleys fruit-trees and nursery gardens are numerous; the asparagus of Romorantin and Vendôme is well-known. The Sologne supplies pine and birch for fuel, and there are extensive forests around Blois and on both sides of the Loir. Pasture is of good quality in the valleys. Sheep are the chief stock; the Perche breed of horses is much sought after for its combination of lightness and strength. Bee-farming is of some importance in the Sologne. Formerly the speciality of Loir-et-Cher was the production of gun-flints. Stone-quarries are numerous. The chief industries are the cloth-manufacture of Romorantin, and leather-dressing and glove-making at Vendôme; and lime-burning, flour-milling, distilling, saw-milling, paper-making and the manufacture of "sabots" and boots and shoes, hosiery and linen goods, are carried on. The department is served chiefly by the Orléans railway.

The arrondissements are those of Blois, Romorantin and Vendôme, with 24 cantons and 297 communes. Loir-et-Cher forms part of the educational division (*académie*) of Paris. Its court of appeal and the headquarters of the V. army corps, to the regions of which it belongs, are at Orléans. Blois, the capital, Vendôme, Romorantin and Chambord are noticed separately. In addition to those of Blois and Chambord there are numerous fine châteaux in the department, of which that of Montrichard with its donjon of the 11th century, that of Chaumont dating from the 15th and 16th centuries, and that of Cheverny (17th century) in the late Renaissance style are the most important. Those at St Aignan, Lassay, Lavardin and Cellettes may also be mentioned. Churches wholly or in part of Romanesque architecture are found at Faverolles, Selles-sur-Cher, St Aignan and Suèvres. The village of Trôo is built close to ancient tumuli and has an interesting church of the 12th century, and among other remains those of a lazar-house of the Romanesque period. At Pontlevoy are the church, consisting of a fine choir in the Gothic style, and the buildings of a Benedictine abbey. At La Poissonnière (near Montoire) is a small Renaissance manor-house, in which Ronsard was born in 1524.

LOISY, ALFRED FIRMIN (1857-), French Catholic theologian, was born at Ambrières in French Lorraine of parents who, descended from a long line of resident peasantry, tilled there the soil themselves. The physically delicate boy was put into the ecclesiastical school of St Dizier, without any intention of a clerical career; but he decided for the priesthood, and in 1874 entered the Grand Seminaire of Chalons-sur-Marne. Mgr Meignan, then bishop of Chalons, afterwards cardinal and archbishop of Tours, ordained him priest in 1879. After being *curé* successively of two villages in that diocese, Loisy went in May 1881, to study and take a theological degree, to the Institut Catholique in Paris. Here he was influenced, as to biblical languages and textual criticism, by the learned and loyal-minded Abbé Paulin Martin, and as to a vivid consciousness of the true nature, gravity and urgency of the biblical problems and an Attic sense of form by the historical intuition and the mordant irony of Abbé Louis Duchesne. At the governmental institutions, Professors Oppert and Halévy helped further to train him. He took his theological degree in March 1890, by the oral defence of forty Latin scholastic theses and by a French dissertation, *Histoire du canon de l'ancien testament*, published as his first book in that year.

Professor now at the Institut Catholique, he published successively his lectures: *Histoire du canon du N.T.* (1891); *Histoire critique du texte et des versions de la Bible* (1892); and *Les Évangiles synoptiques* (1893, 1894). The two latter works appeared successively in the bi-monthly *L'Enseignement biblique*, a periodical written throughout and published by himself. But already, on the occasion of the death of Ernest Renan, October 1892, the attempts made to clear up the main principles and results of biblical science, first by Mgr d'Hulst, rector of the Institut Catholique, in his article "La Question biblique" (*Le Correspondant*, Jan. 25th, 1893), and then by Loisy himself, in his paper "La Question biblique et l'inspiration des Écritures" (*L'Enseignement biblique*, Nov.-Dec. 1893), promptly led to serious trouble. The latter article was immediately followed by Loisy's dismissal, without further explanation, from the Institut Catholique. And a few days later Pope Leo XIII. published his encyclical *Providentissimus Deus*, which indeed directly condemned not Abbé Loisy's but Mgr d'Hulst's position, yet rendered the continued publication of consistently critical work so difficult that Loisy himself suppressed his *Enseignement* at the end of 1893. Five further instalments of his *Synoptiques* were published after this, bringing the work down to the Confession of Peter inclusively.

Loisy next became chaplain to a Dominican convent and girls' school at Neuilly-sur-Seine (Oct. 1894-Oct. 1899), and here matured his apologetic method, resuming in 1898 the publication of longer articles, under the pseudonyms of Desprès and Firmin in the *Revue du clergé français*, and of Jacques Simon in the lay *Revue d'histoire et de littérature religieuses*. In the former review, a striking paper upon development of doctrine (Dec. 1st, 1898) headed a series of studies apparently taken from an already extant large apologetic work. In October 1899 he resigned his chaplaincy for reasons of health, and settled at Bellevue, somewhat farther away from Paris. His notable paper, "La Religion d'Israël" (*Revue du clergé français*, Oct. 15th, 1900), the first of a series intended to correct and replace Renan's presentation of that great subject, was promptly censured by Cardinal Richard, archbishop of Paris; and though scholarly and zealous ecclesiastics, such as the Jesuit Père Durand and Monseigneur Mignot, archbishop of Albi, defended the general method and several conclusions of the article, the aged cardinal never rested henceforward till he had secured a papal condemnation also. At the end of 1900 Loisy secured a government lectureship at the École des Hautes Études Pratiques, and delivered there in succession courses on the Babylonian myths and the first chapters of Genesis; the Gospel parables; the narrative of the ministry in the synoptic Gospels; and the Passion narratives in the same. The first course was published in the *Revue d'histoire et de littérature religieuses*; and here also appeared instalments of his commentary on St John's Gospel, his critically important *Notes sur la Genèse*, and a *Chronique biblique* unmatched in its mastery of its numberless subjects and its fearless yet delicate penetration.

It was, however, two less erudite little books that brought him a European literary reputation and the culmination of his ecclesiastical troubles. *L'Évangile et l'église* appeared in November 1902 (Eng. trans., 1903). Its introduction and six chapters present with rare lucidity the earliest conceptions of the Kingdom of Heaven, the Son of God, the Church, Christian dogma and Catholic worship; and together form a severely critico-historical yet strongly Catholic answer to Harnack's still largely pietistic *Wesen des Christentums*. It develops throughout the principles that "what is essential in Jesus' Gospel is what occupies the first and largest place in His authentic teaching, the ideas for which He fought and died, and not only that idea which we may consider to be still a living force to day"; that "it is supremely arbitrary to decree that Christianity must be essentially what the Gospel did not borrow from Judaism, as though what the

Gospel owes to Judaism were necessarily of secondary worth"; that "whether we trust or distrust tradition, we know Christ only by means of, athwart and within the Christian tradition"; that "the *essence of Christianity* resides in the fulness and totality of its life"; and that "the adaptation of the Gospel to the changing conditions of humanity is to-day a more pressing need than ever." The second edition was enlarged by a preliminary chapter on the sources of the Gospels, and by a third section for the Son of God chapter. The little book promptly aroused widespread interest, some cordial sympathy and much vehement opposition; whilst its large companion the *Études évangéliques*, containing the course on the parables and four sections of his coming commentary on the Fourth Gospel, passed almost unnoticed. On the 21st of January 1903 Cardinal Richard publicly condemned the book, as not furnished with an *imprimatur*, and as calculated gravely to trouble the faith of the faithful in the fundamental Catholic dogmas. On the 2nd of February Loisy wrote to the archbishop: "I condemn, as a matter of course, all the errors which men have been able to deduce from my book, by placing themselves in interpreting it at a point of view entirely different from that which I had to occupy in composing it." The pope refused to interfere directly, and the nuncio, Mgr Lorenzelli, failed in securing more than ten public adhesions to the cardinal's condemnation from among the eighty bishops of France.

Pope Leo had indeed, in a letter to the Franciscan minister-general (November 1898), and in an encyclical to the French clergy (September 1899), vigorously emphasized the traditionalist principles of his encyclical *Providentissimus* of 1893; he had even, much to his prompt regret, signed the unfortunate decree of the Roman Inquisition, January 1897, prohibiting all doubt as to the authenticity of the "Three Heavenly witnesses" passage, 1 John v. 7, a text which, in the wake of a line of scholars from Erasmus downwards, Abbé Paulin Martin had, in 1887, exhaustively shown to be no older than the end of the 4th century A.D. Yet in October 1902 he established a "Commission for the Progress of Biblical Studies," preponderantly composed of seriously critical scholars; and even one month before his death he still refused to sign a condemnation of Loisy's *Études évangéliques*.

Cardinal Sarto became Pope Pius X. on the 4th of August 1903. On the 1st of October Loisy published three new books, *Autour d'un petit livre*, *Le Quatrième Évangile* and *Le Discours sur la Montagne*. *Autour* consists of seven letters, on the origin and aim of *L'Évangile et l'Église*; on the biblical question; the criticism of the Gospels; the Divinity of Christ; the Church's foundation and authority; the origin and authority of dogma, and on the institution of the sacraments. The second and third, addressed respectively to a cardinal (Perraud) and a bishop (Le Camus), are polemical or ironical in tone; the others are all written to friends in a warm, expansive mood; the fourth letter especially, appropriated to Mgr Mignot, attains a grand elevation of thought and depth of mystical conviction. *Le Quatrième Évangile*, one thousand large pages long, is possibly over-confident in its detailed application of the allegorical method; yet it constitutes a rarely perfect sympathetic reproduction of a great mystical believer's imperishable intuitions. *Le Discours sur la Montagne* is a fragment of a coming enlarged commentary on the synoptic Gospels. On the 23rd of December the pope ordered the publication of a decree of the Congregation of the Index, incorporating a decree of the Inquisition, condemning Loisy's *Religion d'Israël*, *L'Évangile et l'Église*, *Études évangéliques*, *Autour d'un petit livre* and *Le Quatrième Évangile*. The pope's secretary of state had on the 19th December, in a letter to Cardinal Richard, recounted the causes of the condemnation in the identical terms used by the latter himself when condemning the *Religion d'Israël* three years before. On the 12th of January 1904 Loisy wrote to Cardinal Merry del Val that he received the condemnation with respect, and condemned whatever might be reprehensible in his books, whilst reserving the rights of his conscience and his opinions as an historian, opinions doubtless imperfect, as no one was more ready to admit than himself, but which were the only form under which he was able to represent to himself the history of the Bible and of religion. Since the Holy See was not satisfied, Loisy sent three further declarations to Rome; the last, despatched on the 17th of March, was addressed to the pope himself, and remained unanswered. And at the end of March Loisy gave up his lectureship, as he declared, "on his own initiative, in view of the pacification of minds in the Catholic Church." In the July following he moved into a little house, built for him by his pupil and friend, the Assyriologist François Thureau Dangin, within the latter's park at Garnay, by Dreux. Here he continued his important reviews, notably in the *Revue d'histoire et de littérature religieuses*, and published *Morceaux d'exégèse* (1906), six further sections of his synoptic commentary. In April 1907 he returned to his native Lorraine, to Ceffonds by Montier-en-Der, and to his relatives there.

Five recent Roman decisions are doubtless aimed primarily at Loisy's teaching. The Biblical Commission, soon enlarged so as to swamp the original critical members, and which had become the simple mouthpiece of its presiding cardinals, issued two decrees. The first, on the 27th of June 1906, affirmed, with some significant but unworkable reservations, the Mosaic authorship of the Pentateuch; and the second (29th of May 1907) strenuously maintained the Apostolic Zebedean authorship of the fourth Gospel, and the strictly historical character of the events and speeches recorded therein. The Inquisition, by its decree *Lamentabili sane* (2nd of July 1907), condemned sixty-five propositions concerning the Church's *magisterium*; biblical inspiration and interpretation; the synoptic and fourth Gospels; revelation and dogma; Christ's divinity, human knowledge and resurrection; and the historical origin and growth of the Sacraments, the Church and the Creed. And some forty of these propositions represent, more or less accurately, certain sentences or ideas of Loisy, when torn from their context and their reasons. The encyclical *Pascendi Dominici Gregis* (Sept. 6th, 1907), probably the longest and most argumentative papal utterance extant, also aims primarily at Loisy, although here the vehemently scholastic redactor's determination to piece together a strictly coherent, complete a priori system of "Modernism" and his self-imposed restriction to medieval categories of thought as the vehicles for describing essentially modern discoveries and requirements of mind, make the identification of precise authors and passages very difficult. And on the 21st of November 1907 a papal *motu proprio* declared all the decisions of the Biblical Commission, past and future, to be as binding upon the conscience as decrees of the Roman Congregations.

Yet even all this did not deter Loisy from publishing three further books. *Les Évangiles synoptiques*, two large 8vo volumes of 1009 and 798 pages, appeared "chez l'auteur, à Ceffonds, Montier-en-Der, Haute-Marne," in January 1908. An incisive introduction discusses the ecclesiastical tradition, modern criticism; the second, the first and the third Gospels; the evangelical tradition; the career and the teaching of Jesus; and the literary form, the tradition of the text and the previous commentaries. The commentary gives also a careful translation of the texts. Loisy recognizes two eye-witness documents, as utilized by all three synoptists, while Matthew and Luke have also incorporated Mark. His chief peculiarity consists in clearly tracing a strong Pauline influence, especially in Mark, which there remodels certain sayings and actions as these were first registered by the eye-witness documents. These doctrinal interpretations introduce the economy of blinding the Jews into the parabolic teaching; the declaration as to the redemptive character of the Passion into the sayings; the sacramental, institutional words into the account of the Last Supper, originally, a solemnly simple Messianic meal; and the formal night-trial before Caiaphas into the original Passion-story with its informal, morning decision by Caiaphas, and its one solemn condemnation of Jesus, by Pilate. Mark's narratives of the sepulture by Joseph of Arimathea and of the empty tomb are taken as posterior to St Paul; the narratives of the infancy in Matthew and Luke as later still. Yet the great bulk of the sayings remain substantially authentic; if the historicity of certain words and acts is here refused with unusual assurance, that of other sayings and deeds is established with stronger proofs; and the redemptive conception of the Passion and the sacramental interpretation of the Last Supper are found to spring up promptly and legitimately from our Lord's work and words, to saturate the Pauline and Johannine writings, and even to constitute an element of all three synoptic Gospels.

Simples Réflexions sur le décret Lamentabili et sur l'encyclique Pascendi, 12mo, 277 pages, was published from Ceffonds a few days after the commentary. Each proposition of the decree is carefully tracked to its probable source, and is often found to modify the latter's meaning. And the study of the encyclical concludes: "Time is the great teacher ... we would do wrong to despair either of our civilization or of the Church."

The Church authorities were this time not slow to act. On the 14th of February Mgr Amette, the new archbishop of Paris, prohibited his diocesans to read or defend the two books, which "attack and deny several fundamental dogmas of Christianity," under pain of excommunication. The abbé again declared "it is impossible for me honestly and sincerely to make the act of absolute retractation and submission exacted by the sovereign pontiff." And the Holy Office, on the 7th of March, pronounced the major excommunication against him. At the end of March Loisy published *Quelques Lettres* (December 1903-February 1908), which conclude: "At bottom I have remained in my last writings on the same line as in the earlier ones. I have aimed at establishing principally the historical position of the various questions, and secondarily the necessity for reforming more or less the traditional concepts."

Three chief causes appear jointly to have produced M. Loisy's very absolute condemnation. Any frank recognition of the abbé's even general principles involves the abandonment of the identification of theology with scholasticism or even with specifically ancient thought in general. The abbé's central position, that our Lord himself held the proximateness of His second coming, involves the loss by churchmen of the prestige of directly divine power, since Church and Sacraments, though still the true fruits and vehicles of his life, death and spirit, cannot thus be immediately founded by the earthly Jesus himself. And the Church policy, as old as the times of Constantine, to crush utterly the man who brings more problems and pressure than the bulk of traditional Christians can, at the time, either digest or resist with a fair discrimination, seemed to the authorities the one means to save the very difficult situation.

BIBLIOGRAPHY.—Autobiographical passages in M. Loisy's *Autour d'un petit livre* (Paris, 1903), pp. xv. xvi. 1, 2, 157, 218. A full account of his literary activity and ecclesiastical troubles will be found in Abbé Albert Houtin's *La Question biblique au XIX^e siècle* (Paris, 2nd ed., 1902) and *La Question biblique au XX^e siècle* (Paris, 1906), but the latter especially is largely unfair to the conservatives and sadly lacking in religious feeling. The following articles and booklets concerning M. Loisy and the questions raised by him are specially remarkable. **France:** Père Durand, S.J., *Études religieuses* (Paris, Nov. 1901) frankly describes the condition of ecclesiastical biblical studies; Monseigneur Mignot, archbishop of Albi, *Lettres sur les études ecclésiastiques 1900-1901* (collected ed., Paris, 1908) and "Critique et tradition" in *Le Correspondant* (Paris, 10th January 1904), the utterances of a finely trained judgment; Mgr Le Camus, bishop of La Rochelle, *Fausse Exégèse, mauvaise théologie* (Paris, 1902), a timid, mostly rhetorical, scholar's protest; Père Lagrange, a Dominican who has done much for the spread of Old Testament criticism, *La Méthode historique, surtout à propos de l'Ancien Testament* (Paris, 1903) and *Éclaircissement* to same (ibid. 1903); P. Lagrange, Mgr P. Batiffol, P. Portalié, S.J., "Autour des fondements de la Foi" in the *Bulletin de litt. eccl. Toulouse* (Paris, December 1903, January 1904), very suggestive papers; Professor Maurice Blondel's "Histoire et dogma," in *La Quinzaine* (Paris January 16, February 16, 1904), F. de Hugel's "Du Christ éternel et des christologies successives" (*ibid.* June 1, 1904), the Abbé J. Wehrle's "Le Christ et la conscience catholique" (*ibid.* August 16, 1904) and F. de Hügel's "Correspondance" (*ibid.* Sept. 16, 1904) discuss the relations between faith and the affirmation of phenomenal happenings; Paul Sabatier, "Les Derniers Ouvrages de l'Abbé Loisy," in the *Revue chrétienne* (Dôle, 1904) and Paul Desjardins' *Catholicisme et critique* (Paris, 1905), a Broad Church Protestant's and a moralist agnostic's delicate appreciations; a revue of *Les Évangiles synoptiques* by the Abbé Mangenot, in *Revue du Clergé français* (Feb. 15, 1908) containing some interesting discriminations; a revue by L. in the *Revue biblique* (1908), pp. 608-620, a mixture of unfair insinuation, powerful criticism and discriminating admissions; and a paper by G. P. 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(F. v. H.)

LOJA (formerly written *Loxa*), a town of southern Spain, in the province of Granada, on the Granada-Algeciras railway. Pop. (1900) 19,143. The narrow and irregular streets of Loja wind up the sides of a steep hill surmounted by a Moorish citadel; many of the older buildings, including a fine Moorish bridge, were destroyed by an earthquake in December 1884, although two churches of the early 16th century remained intact. An iron bridge spans the river Genil, which flows past the town on the north, forcing a passage through the mountains which encircle the fertile and beautiful Vega of Granada. This passage would have afforded easy access to the territory still held by the Moors in the last half of the 15th century, had not Loja been strongly fortified; and the place was thus of great military importance, ranking with the neighbouring town of Alhama as one of the keys of Granada. Its manufactures consist chiefly of coarse woollens, silk, paper and leather. Salt is obtained in the neighbourhood.

Loja, which, has sometimes been identified with the ancient *Ilipula*, or with the *Lacibi* (*Lacibis*) of Pliny and Ptolemy, first clearly emerges in the Arab chronicles of the year 890. It was taken by Ferdinand III. in 1226, but was soon afterwards abandoned, and was not finally recaptured until the 28th of May, 1486, when it surrendered to Ferdinand and Isabella after a siege.

LOKEREN, an important industrial town of Belgium between Ghent and Antwerp (in East Flanders on the Durme). Pop. (1904) 21,869. It lies at the southern point of the district called Pays de Waes, which in the early part of the 19th century was only sandy moorland, but is now the most highly cultivated and thickly populated tract in Belgium. The church of St Laurence is of some interest.

LOKOJA, a town of Nigeria, at the junction of the Niger and Benue rivers, founded in 1860 by the British consul, W. B. Baikie, and subsequently the military centre of the Royal Niger Company. It is in the province of Kabba, 250 m. from the mouth of the Niger, and is of considerable commercial importance (see NIGERIA and KABBA).

LOLLARDS, the name given to the English followers of John Wycliffe; they were the adherents of a religious movement which was widespread in the end of the 14th and beginning of the 15th centuries, and to some extent maintained itself on to the Reformation. The name is of uncertain origin; some derive it from *lolium*, tares, quoting Chaucer (*C.T.*, Shipman's Prologue):—

> "This Loller heer wil prechen us somwhat ...
> He wolde sowen som difficultee
> Or springen cokkel in our clene corn";

but the most generally received explanation derives the words from *lollen* or *lullen*, to sing softly. The word is much older than its English use; there were Lollards in the Netherlands at the beginning of the 14th century, who were akin to the Fratricelli, Beghards and other sectaries of the recusant Franciscan type. The earliest official use of the name in England occurs in 1387 in a mandate of the bishop of Worcester against five "poor preachers," *nomine seu ritu Lollardorum confoederatos*. It is probable that the name was given to the followers of Wycliffe because they resembled those offshoots from the great Franciscan movement which had disowned the pope's authority and set before themselves the ideal of *Evangelical poverty*.

The 14th century, so full of varied religious life, made it manifest that the two different ideas of a life of separation from the world which in earlier times had lived on side by side within the medieval church were irreconcilable. The church chose to abide by the idea of Hildebrand and to reject that of Francis of Assisi; and the revolt of Ockham and the Franciscans, of the Beghards and other spiritual fraternities, of Wycliffe and the Lollards, were all protests against that decision. Gradually there came to be facing each other a great political Christendom, whose rulers were statesmen, with aims and policy of a worldly type, and a religious Christendom, full of the ideas of separation from the world by self-sacrifice and of participation in the benefits of Christ's work by an ascetic imitation. The war between the two ideals was fought out in almost every country in Europe in the 14th century. In England Wycliffe's whole life was spent in the struggle, and he bequeathed his work to the Lollards. The main practical thought with Wycliffe was that the church, if true to her divine mission, must aid men to live that life of evangelical poverty by which they could be separate from the world and imitate Christ, and if the church ceased to be true to her mission she ceased to be a church. Wycliffe was a metaphysician and a theologian, and had to invent a metaphysical theory—the theory of *Dominium*—to enable him to transfer, in a way satisfactory to himself, the powers and privileges of the church to his company of poor Christians; but his followers were content to allege that a church which held large landed possessions, collected tithes greedily and took money from starving peasants for baptizing, burying and praying, could not be the church of Christ and his apostles.

Lollardy was most flourishing and most dangerous to the ecclesiastical organization of England during the ten years after Wycliffe's death. It had spread so rapidly and grown so popular that a hostile chronicler could say that almost every second man was a Lollard. Wycliffe left three intimate disciples:—Nicolas Hereford, a doctor of theology of Oxford, who had helped his master to translate the Bible into English; John Ashton, also a fellow of an Oxford college; and John Purvey, Wycliffe's colleague at Lutterworth, and a co-translator of the Bible, with these were associated more or less intimately, in the first age of Lollardy, John Parker, the strange ascetic William Smith, the restless fanatic Swynderly, Richard Waytstract and Crompe. Wycliffe had organized in Lutterworth an association for sending the gospel through all England, a company of poor preachers somewhat after the Wesleyan method of modern times. "To be poor without mendicancy, to unite the flexible unity, the swift obedience of an order, with free and constant mingling among the poor, such was the ideal of Wycliffe's 'poor priests'" (cf. Shirley, *Fasc. Ziz.* p. xl.), and, although proscribed, these "poor preachers" with portions of their master's translation of the Bible in their hand to guide them, preached all over England. In 1382, two years before the death of Wycliffe, the archbishop of Canterbury got the Lollard opinions condemned by convocation, and, having been promised royal support, he began the long conflict of the church with the followers of Wycliffe. He was able to coerce the authorities of the university of Oxford, and to drive out of it the leading Wycliffite teachers, but he was unable to stifle Oxford sympathies or to prevent the banished

teachers preaching throughout the country. Many of the nobles, like Lords Montacute and Salisbury, supported the poor preachers, took them as private chaplains, and protected them against clerical interference. Country gentlemen like Sir Thomas Latimer of Braybrooke and Sir Richard Stury protected them, while merchants and burgesses supported them with money. When Richard II. issued an ordinance (July 1382) ordering every bishop to arrest all Lollards, the Commons compelled him to withdraw it. Thus protected, the "poor preachers" won masses of the people to their opinions, and Leicester, London and the west of England became their headquarters.

The organization must have been strong in numbers, but only those who were seized for heresy are known by name, and it is only from the indictments of their accusers that their opinions can be gathered. The preachers were picturesque figures in long russet dress down to the heels, who, staff in hand, preached in the mother tongue to the people in churches and graveyards, in squares, streets and houses, in gardens and pleasure grounds, and then talked privately with those who had been impressed. The Lollard literature was very widely circulated—books by Wycliffe and Hereford and tracts and broadsides—in spite of many edicts proscribing it. In 1395 the Lollards grew so strong that they petitioned parliament through Sir Thomas Latimer and Sir R. Stury to reform the church on Lollardist methods. It is said that the Lollard Conclusions printed by Canon Shirley (p. 360) contain the substance of this petition. If so, parliament was told that temporal possessions ruin the church and drive out the Christian graces of faith, hope and charity; that the priesthood of the church in communion with Rome was not the priesthood Christ gave to his apostles; that the monk's vow of celibacy had for its consequence unnatural lust, and should not be imposed; that transubstantiation was a feigned miracle, and led people to idolatry; that prayers made over wine, bread, water, oil, salt, wax, incense, altars of stone, church walls, vestments, mitres, crosses, staves, were magical and should not be allowed; that kings should possess the *jus episcopale*, and bring good government into the church; that no special prayers should be made for the dead; that auricular confession made to the clergy, and declared to be necessary for salvation, was the root of clerical arrogance and the cause of indulgences and other abuses in pardoning sin; that all wars were against the principles of the New Testament, and were but murdering and plundering the poor to win glory for kings; that the vows of chastity laid upon nuns led to child murder; that many of the trades practised in the commonwealth, such as those of goldsmiths and armourers, were unnecessary and led to luxury and waste. These Conclusions really contain the sum of Wycliffite teaching; and, if we add that the principal duty of priests is to preach, and that the worship of images, the going on pilgrimages and the use of gold and silver chalices in divine service are sinful (*The Peasants' Rising and the Lollards*, p. 47), they include almost all the heresies charged in the indictments against individual Lollards down to the middle of the 15th century. The king, who had hitherto seemed anxious to repress the action of the clergy against the Lollards, spoke strongly against the petition and its promoters, and Lollardy never again had the power in England which it wielded up to this year.

If the formal statements of Lollard creed are to be got from these Conclusions, the popular view of their controversy with the church may be gathered from the ballads preserved in the *Political Poems and Songs relating to English History*, published in 1859 by Thomas Wright for the Master of the Rolls series, and in the Piers Ploughman poems. *Piers Ploughman's Creed* (see Langland) was probably written about 1394, when Lollardy was at its greatest strength; the ploughman of the *Creed* is a man gifted with sense enough to see through the tricks of the friars, and with such religious knowledge as can be got from the creed, and from Wycliffe's version of the Gospels. The poet gives us a "portrait of the fat friar with his double chin shaking about as big as a goose's egg, and the ploughman with his hood full of holes, his mittens made of patches, and his poor wife going barefoot on the ice so that her blood followed" (*Early English Text Society*, vol. xxx., pref., p. 16); and one can easily see why farmers and peasants turned from the friars to the poor preachers. The *Ploughman's Complaint* tells the same tale. It paints popes, cardinals, prelates, rectors, monks and friars, who call themselves followers of Peter and keepers of the gates of heaven and hell, and pale poverty-stricken people, cotless and landless, who have to pay the fat clergy for spiritual assistance, and asks if these are Peter's priests. "I trowe Peter took no money, for no sinners that he sold.... Peter was never so great a fole, to leave his key with such a losell."

In 1399 the Lancastrian Henry IV. overthrew the Plantagenet Richard II., and one of the most active partisans of the new monarch was Arundel, archbishop of Canterbury and the most determined opponent of Lollardy. Richard II. had aided the clergy to suppress Lollardy without much success. The new dynasty supported the church in a similar way and not more successfully. The strength of the anti-clerical party lay in the House of Commons, in which the representatives of the shires took the leading part. Twice the Commons petitioned the crown to seize the temporalities of the church and apply them to such national purposes as relief of taxation, maintenance of the poor and the support of new lords and knights. Their anti-clerical policy was not continuous, however. The court party and the clergy proposed statutes for the suppression of heresy, and twice at least secured the concurrence of the Commons. One of these was the well-known statute *De heretico comburendo* passed in 1401.

In the earlier stages of Lollardy, when the court and the clergy managed to bring Lollards before ecclesiastical tribunals backed by the civil power, the accused generally recanted and showed no disposition to endure martyrdom for their opinions. They became bolder in the beginning of the 15th century, William Sawtrey (Chartris), caught and condemned, refused to recant and was burnt at St Paul's Cross (March 1401), and other martyrdoms followed. The victims usually belonged to the lower classes. In 1410 John Badby, an artisan, was sent to the stake. His execution was memorable from the part taken in it by the prince of Wales, who himself tried to reason the Lollard out of his convictions. But nothing said would make Badby confess that "Christ sitting at supper did give to His disciples His living body to eat." The Lollards, far from daunted, abated no effort to make good their ground, and united a struggle for social and political liberty to the hatred felt by the peasants towards the Romish clergy. Jak Upland (John Countryman) took the place of Piers Ploughman, and upbraided the clergy, and especially the friars, for their wealth and luxury. Wycliffe had published the rule of St Francis, and had pointed out in a commentary upon the rule how far friars had departed from the maxims of their founder, and had persecuted the *Spirituales* (the Fratricelli, Beghards, Lollards of the Netherlands) for keeping them to the letter (cf. Matthews, *English Works of Wyclif hitherto unprinted*, Early Eng. Text Soc., vol. lxxiv., 1880). Jak Upland put all this into rude nervous English verse:

> "Freer, what charitie is this
> To fain that whoso liveth after your order
> Liveth most perfectlie,
> And next followeth the state of the Apostles
> In povertie and pennance:
> And yet the wisest and greatest clerkes of you
> Wend or send or procure to the court of Rome,
> ... and to be assoiled of the vow of povertie."

The archbishop, having the power of the throne behind him, attacked that stronghold of Lollardy the university of Oxford. In 1406 a document appeared purporting to be the testimony of the university in favour of Wycliffe; its genuineness was disputed at the time, and when quoted by Huss at the council of Constance it was repudiated by the

English delegates. The archbishop treated Oxford as if it had issued the document, and procured the issue of severe regulations in order to purge the university of heresy. In 1408 Arundel in convocation proposed and carried the famous *Constitutiones Thomae Arundel* intended to put down Wycliffite preachers and teaching. They provided amongst other things that no one was to be allowed to preach without a bishop's licence, that preachers preaching to the laity were not to rebuke the sins of the clergy, and that Lollard books and the translation of the Bible were to be searched for and destroyed.

When Henry V. became king a more determined effort was made to crush Lollardy. Hitherto its strength had lain among the country gentlemen who were the representatives of the shires. The court and clergy had been afraid to attack this powerful class. The new king determined to overawe them, and to this end selected one who had been a personal friend and whose life had been blameless. This was Sir John Oldcastle, in right of his wife, Lord Cobham, "the good Lord Cobham" as the common people called him. Henry first tried personal persuasion, and when that failed directed trial for heresy. Oldcastle was convicted, but was imprisoned for forty days in the Tower in hope that he might recant. He escaped, and summoned his co-religionists to his aid. A Lollard plot was formed to seize the king's person. In the end Oldcastle was burnt for an obstinate heretic (Dec. 1417). These persecutions were not greatly protested against; the wars of Henry V. with France had awakened the martial spirit of the nation, and little sympathy was felt for men who had declared that all war was but the murder and plundering of poor people for the sake of kings. Mocking ballads were composed upon the martyr Oldcastle, and this dislike to warfare was one of the chief accusations made against him (comp. Wright's *Political Poems*, ii. 244). But Arundel could not prevent the writing and distribution of Lollard books and pamphlets. Two appeared about the time of the martyrdom of Oldcastle—*The Ploughman's Prayer* and the *Lanthorne of Light*. *The Ploughman's Prayer* declared that true worship consists in three things—in loving God, and dreading God and trusting in God above all other things; and it showed how Lollards, pressed by persecution, became further separated from the religious life of the church. "Men maketh now great stonen houses full of glasen windows, and clepeth thilke thine houses and churches. And they setten in these houses mawmets of stocks and stones, to fore them they knelen privilich and apert and maken their prayers, and all this they say is they worship.... For Lorde our belief is that thine house is man's soul." Notwithstanding the repression, Lollardy fastened in new parts of England, and Lollards abounded in Somerset, Norfolk, Suffolk, Essex, Lincoln and Buckinghamshire.

The council of Constance (1414-1418) put an end to the papal schism, and also showed its determination to put down heresy by burning John Huss. When news of this reached England the clergy were incited to still more vigorous proceedings against Lollard preachers and books. From this time Lollardy appears banished from the fields and streets, and takes refuge in houses and places of concealment. There was no more wayside preaching, but instead there were *conventicula occulta* in houses, in peasants' huts, in sawpits and in field ditches, where the Bible was read and exhortations were given, and so Lollardy continued. In 1428 Archbishop Chichele confessed that the Lollards seemed as numerous as ever, and that their literary and preaching work went on as vigorously as before. It was found also that many of the poorer rectors and parish priests, and a great many chaplains and curates, were in secret association with the Lollards, so much so that in many places processions were never made and worship on saints' days was abandoned. For the Lollards were hardened by persecution, and became fanatical in the statement of their doctrines. Thomas Bagley was accused of declaring that if in the sacrament a priest made bread into God, he made a God that can be eaten by rats and mice; that the pharisees of the day, the monks, and the nuns, and the friars and all other privileged persons recognized by the church were limbs of Satan; and that auricular confession to the priest was the will not of God but of the devil. And others held that any priest who took salary was excommunicate; and that boys could bless the bread as well as priests.

From England Lollardy passed into Scotland. Oxford infected St Andrews, and we find traces of more than one vigorous search made for Lollards among the teaching staff of the Scottish university, while the Lollards of Kyle in Ayrshire were claimed by Knox as the forerunners of the Scotch Reformation.

> The opinions of the later Lollards can best be gathered from the learned and unfortunate Pecock, who wrote his elaborate *Repressor* against the "Bible-men," as he calls them. He summed up their doctrines under eleven heads: they condemn the having and using of images in the churches, the going on pilgrimages to the memorial or "mynde places" of the saints, the holding of landed possessions by the clergy, the various ranks of the hierarchy, the framing of ecclesiastical laws and ordinances by papal and episcopal authority, the institution of religious orders, the costliness of ecclesiastical decorations, the ceremonies of the mass and the sacraments, the taking of oaths and the maintaining that war and capital punishment are lawful. When these points are compared with the Lollard Conclusions of 1395, it is plain that Lollardy had not greatly altered its opinions after fifty-five years of persecution. All the articles of Pecock's list, save that on capital punishment, are to be found in the Conclusions; and, although many writers have held that Wycliffe's own views differed greatly from what have been called the "exaggerations of the later and more violent Lollards," all these views may be traced to Wycliffe himself. Pecock's idea was that all the statements which he was prepared to impugn came from three false opinions or "trowings," viz. that no governance or ordinance is to be esteemed a law of God which is not founded on Scripture, that every humble-minded Christian man or woman is able without "fail and defaut" to find out the true sense of Scripture, and that having done so he ought to listen to no arguments to the contrary; he elsewhere adds a fourth (i. 102), that if a man be not only meek but also keep God's law he shall have a true understanding of Scripture, even though "no man ellis teche him saue God." These statements, especially the last, show us the connexion between the Lollards and those mystics of the 14th century, such as Tauler and Ruysbroeck, who accepted the teachings of Nicholas of Basel, and formed themselves into the association of the Friends of God.

The persecutions were continued down to the reign of Henry VIII., and when the writings of Luther began to appear in England the clergy were not so much afraid of Lutheranism as of the increased life they gave to men who for generations had been reading Wycliffe's *Wickette*. "It is," wrote Bishop Tunstall to Erasmus in 1523, "no question of pernicious novelty, it is only that new arms are being added to the great band of Wycliffite heretics." Lollardy, which continued down to the Reformation, did much to shape the movement in England. The subordination of clerical to laic jurisdiction, the reduction in ecclesiastical possessions, the insisting on a translation of the Bible which could be read by the "common" man were all inheritances bequeathed by the Lollards.

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and the Reformation in England (1908).

(T. M. L.)

LOLLIUS, MARCUS, Roman general, the first governor of Galatia (25 B.C.), consul in 21. In 16, when governor of Gaul, he was defeated by the Sigambri (Sygambri), Usipetes and Tencteri, German tribes who had crossed the Rhine. This defeat is coupled by Tacitus with the disaster of Varus, but it was disgraceful rather than dangerous. Lollius was subsequently (2 B.C.) attached in the capacity of tutor and adviser to Gaius Caesar (Augustus's grandson) on his mission to the East. He was accused of extortion and treachery to the state, and denounced by Gaius to the emperor. To avoid punishment he is said to have taken poison. According to Velleïus Paterculus and Pliny, he was a hypocrite and cared for nothing but amassing wealth. It was formerly thought that this was the Lollius whom Horace described as a model of integrity and superior to avarice in *Od.* iv. 9, but it seems hardly likely that this Ode, as well as the two Lollian epistles of Horace (i. 2 and 18), was addressed to him. All three must have been addressed to the same individual, a young man, probably the son of this Lollius.

See Suetonius, *Augustus*, 23, *Tiberius*, 12; Vell. Pat. ii. 97. 102; Tacitus, *Annals*, i. 10, iii. 48; Pliny, *Nat. Hist.* ix. 35 (58); Dio Cassius, liv. 6; see also J. C. Tarver, *Tiberius the Tyrant* (1902), pp. 200 foll.

LOLOS, the name given by the Chinese to a large tribe of aborigines who inhabit the greater part of southern Szechuen. Their home is in the mountainous country called Taliang shan, which lies between the Yangtsze river on the east and the Kien ch'ang valley on the west, in south Szechuen, but they are found in scattered communities as far south as the Burmese frontier, and west to the Mekong. There seems no reason to doubt that they were, like the Miaotze, one of the aboriginal tribes of China, driven southwards by the advancing flood of Chinese. The name is said to be a Chinese corruption of Lulu, the name of a former chieftain of a tribe who called themselves Nersu. Their language, like the Chinese, is monosyllabic and probably ideographic, and the characters bear a certain resemblance to Chinese. No literature, however, worthy of the name is known to exist, and few can read and write. Politically they are divided into tribes, each under the government of a hereditary chieftain. The community consists of three classes, the "blackbones" or nobles, the "whitebones" or plebeians, and the *watze* or slaves. The last are mostly Chinese captured in forays, or the descendants of such captives. Within Lolo-land proper, which covers some 11,000 sq. m., the Chinese government exercises no jurisdiction. The Lolos make frequent raids on their unarmed Chinese neighbours. They cultivate wheat, barley and millet, but little rice. They have some knowledge of metals, making their own tools and weapons. Women are said to be held in respect, and may become chiefs of the tribes. They do not intermarry with Chinese.

See A. F. Legendre, "Les Lolos. Étude ethnologique et anthropologique," in *T'oung Pao II.*, vol. x. (1909); E. C. Baber, *Royal Geog. Society Sup. Papers*, vol. i. (London, 1882); F. S. A. Bourne, *Blue Book, China, No. 1* (1888); A. Hosie, *Three Years in Western China* (London, 1897).

LOMBARD LEAGUE, the name given in general to any league of the cities of Lombardy, but applied especially to the league founded in 1167, which brought about the defeat of the emperor Frederick I. at Legnano, and the consequent destruction of his plans for obtaining complete authority over Italy.

Lacking often the protection of a strong ruler, the Lombard cities had been accustomed to act together for mutual defence, and in 1093 Milan, Lodi, Piacenza and Cremona formed an alliance against the emperor Henry IV., in favour of his rebellious son Conrad. The early years of the reign of Frederick I. were largely spent in attacks on the privileges of the cities of Lombardy. This led to a coalition, formed in March 1167, between the cities of Cremona, Mantua, Bergamo and Brescia to confine Frederick to the rights which the emperors had enjoyed for the past hundred years. This league or *concordia* was soon joined by other cities, among which were Milan, Parma, Padua, Verona, Piacenza and Bologna, and the allies began to build a fortress near the confluence of the Tanaro and the Bormida, which, in honour of Pope Alexander III., was called Alessandria. During the absence of Frederick from Italy from 1168 to 1174, the relations between the pope and the league became closer, and Alexander became the leader of the alliance. Meetings of the league were held in 1172 and 1173 to strengthen the bond, and to concert measures against the emperor, the penalties of the church being invoked to prevent defection. The decisive struggle began when Frederick attacked Alessandria in 1174. The fortress was bravely defended, and the siege was raised on the approach of succour from the allied cities. Negotiations for peace failed, and the emperor, having marched against Milan, suffered a severe defeat at Legnano on the 29th of May 1176. Subsequently Pope Alexander was detached from his allies, and made peace with Frederick, after which a truce for six years was arranged between the emperor and the league. Further negotiations ripened into the peace of Constance signed on the 25th of June 1183, which granted almost all the demands of the cities, and left only a shadowy authority to the emperor (see ITALY).

In 1226, when the emperor Frederick II. avowed his intention of restoring the imperial authority in Italy, the league was renewed, and at once fifteen cities, including Milan and Verona, were placed under the ban. Frederick, however, was not in a position to fight, and the mediation of Pope Honorius III. was successful in restoring peace. In 1231 the hostile intentions of the emperor once more stirred the cities into activity. They held a meeting at Bologna and raised an army, but as in 1226, the matter ended in mutual fulminations and defiances. A more serious conflict arose in 1234. The great question at issue, the nature and extent of the imperial authority over the Lombard cities, was still unsettled

when Frederick's rebellious son, the German king Henry VII., allied himself with them. Having crushed his son and rejected the proffered mediation of Pope Gregory IX., the emperor declared war on the Lombards in 1236; he inflicted a serious defeat upon their forces at Cortenuova in November 1237 and met with other successes, but in 1238 he was beaten back from before Brescia. In 1239 Pope Gregory joined the cities and the struggle widened out into the larger one of the Empire and the Papacy. This was still proceeding when Frederick died in December 1250 and it was only ended by the overthrow of the Hohenstaufen and the complete destruction of the imperial authority in Italy.

For a full account of the Lombard League see C. Vignati, *Storia diplomata della Lega Lombarda* (Milan, 1866); H. Prutz, *Kaiser Friedrich I.*, Band ii. (Danzig, 1871-1874); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Band v. (Leipzig, 1888); and J. Ficker, *Zur Geschichte des Lombardenbundes* (Vienna, 1868).

LOMBARDO, the name of a family of Venetian sculptors and architects; their surname was apparently Solaro, and the name of Lombardo was given to the earliest known, Martino, who emigrated from Lombardy to Venice in the middle of the 15th century and became celebrated as an architect. He had two sons, Moro and Pietro, of whom the latter (*c.* 1435-1515) was one of the greatest sculptors and architects of his time, while his sons Antonio (d. 1516) and Tullio (d. 1559) were hardly less celebrated. Pietro's work as an architect is seen in numerous churches, the Vendramini-Calargi palace (1481), the doge's palace (1498), the façade (1485) of the *scuola* of St Mark and the cathedral of Cividale del Friuli (1502); but he is now more famous as a sculptor, often in collaboration with his sons; he executed the tomb of the doge Mocenigo (1478) in the church of San Giovanni e Paolo at Venice, and a bas-relief for the tomb of Dante at Ravenna, and in 1483 began the beautiful decorations in the church of Sta Maria de' Miracoli at Venice, which is associated with his workshop (see also VENICE for numerous references to the work of the Lombardi). Antonio's masterpiece is the marble relief of St Anthony making a new-born child speak in defence of its mother's honour, in the Santo at Padua (1505). Tullio's best-known works are the four kneeling angels (1484) in the church of San Martino, Venice, a coronation of the Virgin in San Giovanni Crisostomo and two bas-reliefs in the Santo, Padua, besides two others formerly in the Spitzer collection, representing Vulcan's Forge and Minerva disputing with Neptune.

LOMBARDS, or LANGOBARDI, a Suevic people who appear to have inhabited the lower basin of the Elbe and whose name is believed to survive in the modern Bardengau to the south of Hamburg. They are first mentioned in connexion with the year A.D. 5, at which time they were defeated by the Romans under Tiberius, afterwards emperor. In A.D. 9, however, after the destruction of Varus's army, the Romans gave up their attempt to extend their frontier to the Elbe. At first, with most of the Suevic tribes, they were subject to the hegemony of Maroboduus, king of the Marcomanni, but they revolted from him in his war with Arminius, chief of the Cherusci, in the year 17. We again hear of their interference in the dynastic strife of the Cherusci some time after the year 47. From this time they are not mentioned until the year 165, when a force of Langobardi, in alliance with the Marcomanni, was defeated by the Romans, apparently on the Danubian frontier. It has been inferred from this incident that the Langobardi had already moved southwards, but the force mentioned may very well have been sent from the old home of the tribe, as the various Suevic peoples seem generally to have preserved some form of political union. From this time onwards we hear no more of them until the end of the 5th century.

In their own traditions we are told that the Langobardi were originally called Winnili and dwelt in an island named Scadinavia (with this story compare that of the Gothic migration, see GOTHS). Thence they set out under the leadership of Ibor and Aio, the sons of a prophetess called Gambara, and came into conflict with the Vandals. The leaders of the latter prayed to Wodan for victory, while Gambara and her sons invoked Frea. Wodan promised to give victory to those whom he should see in front of him at sunrise. Frea directed the Winnili to bring their women with their hair let down round their faces like beards and turned Wodan's couch round so that he faced them. When Wodan awoke at sunrise he saw the host of the Winnili and said, "*Qui sunt isti Longibarbi?*"—"Who are these long-beards?"—and Frea replied, "As thou hast given them the name, give them also the victory." They conquered in the battle and were thenceforth known as Langobardi. After this they are said to have wandered through regions which cannot now be identified, apparently between the Elbe and the Oder, under legendary kings, the first of whom was Agilmund, the son of Aio.

Shortly before the end of the 5th century the Langobardi appear to have taken possession of the territories formerly occupied by the Rugii whom Odoacer had overthrown in 487, a region which probably included the present province of Lower Austria. At this time they were subject to Rodulf, king of the Heruli, who, however, took up arms against them; according to one story, owing to the treacherous murder of Rodulf's brother, according to another through an irresistible desire for fighting on the part of his men. The result was the total defeat of the Heruli by the Langobardi under their king Tato and the death of Rodulf at some date between 493 and 508. By this time the Langobardi are said to have adopted Christianity in its Arian form. Tato was subsequently killed by his nephew Waccho. The latter reigned for thirty years, though frequent attempts were made by Ildichis, a son or grandson of Tato, to recover the throne. Waccho is said to have conquered the Suabi, possibly the Bavarians, and he was also involved in strife with the Gepidae, with whom Ildichis had taken refuge. He was succeeded by his youthful son Walthari, who reigned only seven years under the guardianship of a certain Audoin. On Walthari's death (about 546?) Audoin succeeded. He also was involved in hostilities with the Gepidae, whose support of Ildichis he repaid by protecting Ustrogotthus, a rival of their king Thorisind. In these quarrels both nations aimed at obtaining the support of the emperor Justinian, who, in pursuance of his policy of playing off one against the other, invited the Langobardi into Noricum and Pannonia, where they now settled.

A large force of Lombards under Audoin fought on the imperial side at the battle of the Apennines against the Ostrogothic king Totila in 553, but the assistance of Justinian, though often promised, had no effect on the relations of the two nations, which were settled for the moment after a series of truces by the victory of the Langobardi, probably in 554. The resulting peace was sealed by the murder of Ildichis and Ustrogotthus, and the Langobardi seem to have

continued inactive until the death of Audoin, perhaps in 565, and the accession of his son Alboin, who had won a great reputation in the wars with the Gepidae. It was about this time that the Avars, under their first Chagun Baian, entered Europe, and with them, Alboin is said to have made an alliance against the Gepidae under their new king Cunimund. The Avars, however, did not take part in the final battle, in which the Langobardi were completely victorious. Alboin, who had slain Cunimund in the battle, now took Rosamund, daughter of the dead king, to be his wife.

In 568 Alboin and the Langobardi, in accordance with a compact made with Baian, which is recorded by Menander, abandoned their old homes to the Avars and passed southwards into Italy, were they were destined to found a new and mighty kingdom.

(F. G. M. B.)

The Lombard Kingdom in Italy.—In 568 Alboin, king of the Langobards, with the women and children of the tribe and all their possessions, with Saxon allies, with the subject tribe of the Gepidae and a mixed host of other barbarians, descended into Italy by the great plain at the head of the Adriatic. The war which had ended in the downfall of the Goths had exhausted Italy; it was followed by famine and pestilence; and the government at Constantinople made but faint efforts to retain the province which Belisarius and Narses had recovered for it. Except in a few fortified places, such as Ticinum or Pavia, the Italians did not venture to encounter the new invaders; and, though Alboin was not without generosity, the Lombards, wherever resisted, justified the opinion of their ferocity by the savage cruelty of the invasion. In 572, according to the Lombard chronicler, Alboin fell a victim to the revenge of his wife Rosamund, the daughter of the king of the Gepidae, whose skull Alboin had turned into a drinking cup, out of which he forced Rosamund to drink. By this time the Langobards had established themselves in the north of Italy. Chiefs were placed, or placed themselves, first in the border cities, like Friuli and Trent, which commanded the north-eastern passes, and then in other principal places; and this arrangement became characteristic of the Lombard settlement. The principal seat of the settlement was the rich plain watered by the Po and its affluents, which was in future to receive its name from them; but their power extended across the Apennines into Liguria and Tuscany, and then southwards to the outlying dukedoms of Spoleto and Benevento. The invaders failed to secure any maritime ports or any territory that was conveniently commanded from the sea. Ticinum (Pavia), the one place which had obstinately resisted Alboin, became the seat of their kings.

After the short and cruel reign of Cleph, the successor of Alboin, the Lombards (as we may begin for convenience sake to call them) tried for ten years the experiment of a national confederacy of their dukes (as, after the Latin writers, their chiefs are styled), without any king. It was the rule of some thirty-five or thirty-six petty tyrants, under whose oppression and private wars even the invaders suffered. With anarchy among themselves and so precarious a hold on the country, hated by the Italian population and by the Catholic clergy, threatened also by an alliance of the Greek empire with their persistent rivals the Franks beyond the Alps, they resolved to sacrifice their independence and elect a king. In 584 they chose Authari, the grandson of Alboin, and endowed the royal domain with a half of their possessions. From this time till the fall of the Lombard power before the arms of their rivals the Franks under Charles the Great, the kingly rule continued. Authari, “the Long-haired,” with his Roman title of Flavius, marks the change from the war king of an invading host to the permanent representative of the unity and law of the nation, and the increased power of the crown, by the possession of a great domain, to enforce its will. The independence of the dukes was surrendered to the king. The dukedoms in the neighbourhood of the seat of power were gradually absorbed, and their holders transformed into royal officers. Those of the northern marches, Trent and Friuli, with the important dukedom of Turin, retained longer the kind of independence which marchlands usually give where invasion is to be feared. The great dukedom of Benevento in the south, with its neighbour Spoleto, threatened at one time to be a separate principality, and even to the last resisted, with varying success, the full claims of the royal authority at Pavia.

The kingdom of the Lombards lasted more than two hundred years, from Alboin (568) to the fall of Desiderius (774)—much longer than the preceding Teutonic kingdom of Theodoric and the Goths. But it differed from the other Teutonic conquests in Gaul, in Britain, in Spain. It was never complete in point of territory: there were always two, and almost to the last three, capitals—the Lombard one, Pavia; the Latin one, Rome; the Greek one, Ravenna; and the Lombards never could get access to the sea. And it never was complete over the subject race: it profoundly affected the Italians of the north; in its turn it was entirely transformed by contact with them; but the Lombards never amalgamated with the Italians till their power as a ruling race was crushed by the victory given to the Roman element by the restored empire of the Franks. The Langobards, German in their faults and in their strength, but coarser, at least at first, than the Germans whom the Italians had known, the Goths of Theodoric and Totila, found themselves continually in the presence of a subject population very different from anything which the other Teutonic conquerors met with among the provincials—like them, exhausted, dispirited, unwarlike, but with the remains and memory of a great civilization round them, intelligent, subtle, sensitive, feeling themselves infinitely superior in experience and knowledge to the rough barbarians whom they could not fight, and capable of hatred such as only cultivated races can nourish. The Lombards who, after they had occupied the lands and cities of Upper Italy, still went on sending forth furious bands to plunder and destroy where they did not care to stay, never were able to overcome the mingled fear and scorn and loathing of the Italians. They adapted themselves very quickly indeed to many Italian fashions. Within thirty years of the invasions, Authari took the imperial title of Flavius, even while his bands were leading Italian captives in leash like dogs under the walls of Rome, and under the eyes of Pope Gregory; and it was retained by his successors. They soon became Catholics; and then in all the usages of religion, in church building, in founding monasteries, in their veneration for relics, they vied with Italians. Authari’s queen, Theodelinda, solemnly placed the Lombard nation under the patronage of St John the Baptist, and at Monza she built in his honour the first Lombard church, and the royal palace near it. King Liutprand (712-744) bought the relics of St Augustine for a large sum to be placed in his church at Pavia. Their Teutonic speech disappeared; except in names and a few technical words all traces of it are lost. But to the last they had the unpardonable crime of being a ruling barbarian race or caste in Italy. To the end they are “nefandissimi,” execrable, loathsome, filthy. So wrote Gregory the Great when they first appeared. So wrote Pope Stephen IV., at the end of their rule, when stirring up the kings of the Franks to destroy them.

Authari’s short reign (584-591) was one of renewed effort for conquest. It brought the Langobards face to face, not merely with the emperors at Constantinople, but with the first of the great statesmen popes, Gregory the Great (590-604). But Lombard conquest was bungling and wasteful; when they had spoiled a city they proceeded to tear down its walls and raze it to the ground. Authari’s chief connexion with the fortunes of his people was an important, though an accidental one. The Lombard chronicler tells a romantic tale of the way in which Authari sought his bride from Garibald, duke of the Bavarians, how he went incognito in the embassy to judge of her attractions, and how she recognized her disguised suitor. The bride was the Christian Theodelinda, and she became to the Langobards what Bertha was to the Anglo-Saxons and Clotilda to the Franks. She became the mediator between the Lombards and the Catholic Church. Authari, who had brought her to Italy, died shortly after his marriage. But Theodelinda had so won on the Lombard chiefs that they bid her as queen choose the one among them whom she would have for her husband and for king. She chose Agilulf, duke of Turin (592-615). He was not a true Langobard, but a Thuringian. It was the beginning of peace between the Lombards and the Catholic clergy. Agilulf could not abandon his traditional Arianism,

and he was a very uneasy neighbour, not only to the Greek exarch, but to Rome itself. But he was favourably disposed both to peace and to the Catholic Church. Gregory interfered to prevent a national conspiracy against the Langobards, like that of St Brice's day in England against the Danes, or that later uprising against the French, the Sicilian Vespers. He was right both in point of humanity and of policy. The Arian and Catholic bishops went on for a time side by side; but the Lombard kings and clergy rapidly yielded to the religious influences around them, even while the national antipathies continued unabated and vehement. Gregory, who despaired of any serious effort on the part of the Greek emperors to expel the Lombards, endeavoured to promote peace between the Italians and Agilulf; and, in spite of the feeble hostility of the exarchs of Ravenna, the pope and the king of the Lombards became the two real powers in the north and centre of Italy. Agilulf was followed, after two unimportant reigns, by his son-in-law, the husband of Theodelinda's daughter, King Rothari (636-652), the Lombard legislator, still an Arian though he favoured the Catholics. He was the first of their kings who collected their customs under the name of laws—and he did this, not in their own Teutonic dialect, but in Latin. The use of Latin implies that the laws were to be not merely the personal law of the Lombards, but the law of the land, binding on Lombards and Romans alike. But such rude legislation could not provide for all questions arising even in the decayed state of Roman civilization. It is probable that among themselves the Italians kept to their old usages and legal precedents where they were not overridden by the conquerors' law, and by degrees a good many of the Roman civil arrangements made their way into the Lombard code, while all ecclesiastical ones, and they were a large class, were untouched by it.

> There must have been much change of property; but appearances are conflicting as to the terms on which land generally was held by the old possessors or the new comers, and as to the relative legal position of the two. Savigny held that, making allowance for the anomalies and usurpations of conquest, the Roman population held the bulk of the land as they had held it before, and were governed by an uninterrupted and acknowledged exercise of Roman law in their old municipal organization. Later inquirers, including Leo, Troya and Hegel, have found that the supposition does not tally with a whole series of facts, which point to a Lombard territorial law ignoring completely any parallel Roman and personal law, to a great restriction of full civil rights among the Romans, analogous to the condition of the rayah under the Turks, and to a reduction of the Roman occupiers to a class of half-free "aldii," holding immovable tenancies under lords of superior race and privilege, and subject to the sacrifice either of the third part of their holdings or the third part of the produce. The Roman losses, both of property and rights, were likely to be great at first; how far they continued permanent during the two centuries of the Lombard kingdom, or how far the legal distinctions between Rome and Lombard gradually passed into desuetude, is a further question. The legislation of the Lombard kings, in form a territorial and not a personal law, shows no signs of a disposition either to depress or to favour the Romans, but only the purpose to maintain, in a rough fashion, strict order and discipline impartially among all their subjects.

From Rothari (d. 652) to Liutprand (712-744) the Lombard kings, succeeding one another in the irregular fashion of the time, sometimes by descent, sometimes by election, sometimes by conspiracy and violence, strove fitfully to enlarge their boundaries, and contended with the aristocracy of dukes inherent in the original organization of the nation, an element which, though much weakened, always embarrassed the power of the crown, and checked the unity of the nation. Their old enemies the Franks on the west, and the Slavs or Huns, ever ready to break in on the north-east, and sometimes called in by mutinous and traitorous dukes of Friuli and Trent, were constant and serious dangers. By the popes, who represented Italian interests, they were always looked upon with dislike and jealousy, even when they had become zealous Catholics, the founders of churches and monasteries; with the Greek empire there was chronic war. From time to time they made raids into the unsubdued parts of Italy, and added a city or two to their dominions. But there was no sustained effort for the complete subjugation of Italy till Liutprand, the most powerful of the line. He tried it, and failed. He broke up the independence of the great southern duchies, Benevento and Spoleto. For a time, in the heat of the dispute about images, he won the pope to his side against the Greeks. For a time, but only for a time, he deprived the Greeks of Ravenna. Aistulf, his successor, carried on the same policy. He even threatened Rome itself, and claimed a capitation tax. But the popes, thoroughly irritated and alarmed, and hopeless of aid from the East, turned to the family which was rising into power among the Franks of the West, the mayors of the palace of Austrasia. Pope Gregory III. applied in vain to Charles Martel. But with his successors Pippin and Charles the popes were more successful. In return for the transfer by the pope of the Frank crown from the decayed line of Clovis to his own, Pippin crossed the Alps, defeated Aistulf and gave to the pope the lands which Aistulf had torn from the empire, Ravenna and the Pentapolis (754-756). But the angry quarrels still went on between the popes and the Lombards. The Lombards were still to the Italians a "foul and horrid" race. At length, invited by Pope Adrian I., Pippin's son Charlemagne once more descended into Italy. As the Lombard kingdom began, so it ended, with a siege of Pavia. Desiderius, the last king, became a prisoner (774), and the Lombard power perished. Charlemagne, with the title of king of the Franks and Lombards, became master of Italy, and in 800 the pope, who had crowned Pippin king of the Franks, claimed to bestow the Roman empire, and crowned his greater son emperor of the Romans (800).

Effects of the Carolingian Conquest.—To Italy the overthrow of the Lombard kings was the loss of its last chance of independence and unity. To the Lombards the conquest was the destruction of their legal and social supremacy. Henceforth they were equally with the Italians the subjects of the Frank kings. The Carolingian kings expressly recognized the Roman law, and allowed all who would be counted Romans to "profess" it. But Latin influences were not strong enough to extinguish the Lombard name and destroy altogether the recollections and habits of the Lombard rule; Lombard law was still recognized, and survived in the schools of Pavia. Lombardy remained the name of the finest province of Italy, and for a time was the name for Italy itself. But what was specially Lombard could not stand in the long run against the Italian atmosphere which surrounded it. Generation after generation passed more and more into real Italians. Antipathies, indeed, survived, and men even in the 10th century called each other Roman or Langobard as terms of reproach. But the altered name of Lombard also denoted henceforth some of the proudest of Italians; and, though the Lombard speech had utterly perished their most common names still kept up the remembrance that their fathers had come from beyond the Alps.

But the establishment of the Frank kingdom, and still more the re-establishment of the Christian empire as the source of law and jurisdiction in Christendom, had momentous influence on the history of the Italianized Lombards. The Empire was the counterweight to the local tyrannies into which the local authorities established by the Empire itself, the feudal powers, judicial and military, necessary for the purposes of government, invariably tended to degenerate. When they became intolerable, from the Empire were sought the exemptions, privileges, immunities from that local authority, which, anomalous and anarchical as they were in theory, yet in fact were the foundations of all the liberties of the middle ages in the Swiss cantons, in the free towns of Germany and the Low Countries, in the Lombard cities of Italy. Italy was and ever has been a land of cities; and, ever since the downfall of Rome and the decay of the municipal system, the bishops of the cities had really been at the head of the peaceful and industrial part of their population, and were a natural refuge for the oppressed, and sometimes for the mutinous and the evil doers, from the military and civil powers of the duke or count or judge, too often a rule of cruelty or fraud. Under the Carolingian empire, a vast system grew up in the North Italian cities of episcopal "immunities," by which a city with its surrounding district was removed, more or less completely, from the jurisdiction of the ordinary authority, military or civil, and placed under that of the bishop. These "immunities" led to the temporal sovereignty of the bishops; under it

the spirit of liberty grew more readily than under the military chief. Municipal organization, never quite forgotten, naturally revived under new forms, and with its “consuls” at the head of the citizens, with its “arts” and “crafts” and “gilds,” grew up secure under the shadow of the church. In due time the city populations, free from the feudal yoke, and safe within the walls which in many instances the bishops had built for them, became impatient also of the bishop’s government. The cities which the bishops had made thus independent of the dukes and counts next sought to be free from the bishops; in due time they too gained their charters of privilege and liberty. Left to take care of themselves, islands in a sea of turbulence, they grew in the sense of self-reliance and independence; they grew also to be aggressive, quarrelsome and ambitious. Thus, by the 11th century, the Lombard cities had become “communes,” commonalties, republics, managing their own affairs, and ready for attack or defence. Milan had recovered its greatness, ecclesiastically as well as politically; it scarcely bowed to Rome, and it aspired to the position of a sovereign city, mistress over its neighbours. At length, in the 12th century, the inevitable conflict came between the republicanism of the Lombard cities and the German feudalism which still claimed their allegiance in the name of the Empire. Leagues and counter-leagues were formed; and a confederacy of cities, with Milan at its head, challenged the strength of Germany under one of its sternest emperors, Frederick Barbarossa. At first Frederick was victorious; Milan, except its churches, was utterly destroyed; everything that marked municipal independence was abolished in the “rebel” cities; and they had to receive an imperial magistrate instead of their own (1158-1162). But the Lombard league was again formed. Milan was rebuilt, with the help even of its jealous rivals, and at Legnano (1176) Frederick was utterly defeated. The Lombard cities had regained their independence; and at the peace of Constance (1183) Frederick found himself compelled to confirm it.

From the peace of Constance the history of the Lombards is merely part of the history of Italy. Their cities went through the ordinary fortunes of most Italian cities. They quarrelled and fought with one another. They took opposite sides in the great strife of the time between pope and emperor, and were Guelf and Ghibelline by old tradition, or as one or other faction prevailed in them. They swayed backwards and forwards between the power of the people and the power of the few; but democracy and oligarchy passed sooner or later into the hands of a master who veiled his lordship under various titles, and generally at last into the hands of a family. Then, in the larger political struggles and changes of Europe, they were incorporated into a kingdom, or principality or duchy, carved out to suit the interest of a foreigner, or to make a heritage for the nephew of a pope. But in two ways especially the energetic race which grew out of the fusion of Langobards and Italians between the 9th and the 12th centuries has left the memory of itself. In England, at least, the enterprising traders and bankers who found their way to the West, from the 13th to the 16th centuries, though they certainly did not all come from Lombardy, bore the name of Lombards. In the next place, the Lombards or the Italian builders whom they employed or followed, the “masters of Como,” of whom so much is said in the early Lombard laws, introduced a manner of building, stately, solemn and elastic, to which their name has been attached, and which gives a character of its own to some of the most interesting churches in Italy.

(R. W. C.)

LOMBARDY, a territorial division of Italy, bounded N. by the Alps, S. by Emilia, E. by Venetia and W. by Piedmont. It is divided into eight provinces, Bergamo, Brescia, Como, Cremona, Mantua, Milan, Pavia and Sondrio, and has an area of 9386 sq. m. Milan, the chief city, is the greatest railway centre of Italy; it is in direct communication not only with the other principal towns of Lombardy and the rest of Italy but also with the larger towns of France, Germany and Switzerland, being the nearest great town to the tunnels of the St Gothard and the Simplon. The other railway centres of the territory are Mortara, Pavia and Mantua, while every considerable town is situated on or within easy reach of the railway, this being rendered comparatively easy owing to the relative flatness of the greater part of the country. The line from Milan to Porto Ceresio is worked in the main by electric motor driven trains, while on that from Lecco to Colico and Chiavenna over-head wires are adopted. The more remote districts and the immediate environs of the larger town are served by steam tramways and electric railways. The most important rivers are the Po, which follows, for the most part, the southern boundary of Lombardy, and the Ticino, one of the largest tributaries of the Po, which forms for a considerable distance the western boundary. The majority of the Italian lakes, those of Garda, Idro, Iseo, Como, Lugano, Varese and Maggiore, lie wholly or in part within it. The climate of Lombardy is thoroughly continental; in summer the heat is greater than in the south of Italy, while the winter is very cold, and bitter winds, snow and mist are frequent. In the summer rain is rare beyond the lower Alps, but a system of irrigation, unsurpassed in Europe, and dating from the middle ages, prevails, so that a failure of the crops is hardly possible. There are three zones of cultivation: in the mountains, pasturage; the lower slopes are devoted to the culture of the vine, fruit-trees (including chestnuts) and the silkworm; while in the regions of the plain, large crops of maize, rice, wheat, flax, hemp and wine are produced, and thousands of mulberry-trees are grown for the benefit of the silkworms, the culture of which in the province of Milan has entirely superseded the sheep-breeding for which it was famous during the middle ages. Milan is indeed the principal silk market in the world. In 1905 there were 490 mills reeling silk in Lombardy, with 35,407 workers, and 276 throwing-mills with 586,000 spindles. The chief centre of silk weaving is Como, but the silk is commercially dealt with at Milan, and there is much exportation. A considerable amount of cotton is manufactured, but most of the raw cotton (600,000 bales) is imported, the cultivation being insignificant in Italy. There are 400 mills in Lombardy, 277 of which are in the province of Milan. The largest linen and woollen mills in Italy are situated at Fara d’Adda. Milan also manufactures motor-cars, though Turin is the principal centre in Italy for this industry. There are copper, zinc and iron mines, and numerous quarries of marble, alabaster and granite. In addition to the above industries the chief manufactures are hats, rope and paper-making, iron-casting, gun-making, printing and lithography. Lombardy is indeed the most industrial district of Italy. In parts the peasants suffer much from *pellagra*.

The most important towns with their communal population in the respective provinces, according to the census of 1901, are Bergamo (46,861), Treviglio (14,897), total of province 467,549, number of communes 306; Brescia (69,210), Chiari (10,749), total of province 541,765, number of communes 280; Como (38,174), Varese (17,666), Cantù (10,725), Lecco (10,352), total of province 594,304, number of communes 510; Cremona (36,848), Casalmaggiore (16,407), Soresina (10,358), total of province 329,471, number of communes 133; Mantua (30,127), Viadana (16,082), Quistello (11,228), Suzzara (11,502), St Benedetto Po (10,908), total of province 315,448, number of communes 68; Milan (490,084), Monza (42,124), Lodi (26,827), Busto Arsizio (20,005), Legnano (18,285), Seregno (12,050), Gallarate (11,952), Codogno (11,925), total of province 1,450,214, number of communes 297; Pavia (33,922), Vigevano (23,560), Voghera (20,442), total of province 504,382, number of communes 221; Sondrio (7077), total of province 130,966, number of communes 78. The total population of Lombardy was 4,334,099. In most of the provinces of Lombardy there are far more villages than in other parts of Italy except Piedmont; this is attributable partly to their mountainous

character, partly perhaps to security from attack by sea (contrast the state of things in Apulia).

Previous to the fall of the Roman republic Lombardy formed a part of Gallia Transpadana, and it was Lombardy, Venetia and Piedmont, the portion of the Italian peninsula N. of the Po, that did not receive citizenship in 89 B.C. but only Latin rights. The gift of full citizenship in 49 B.C. made it a part of Italy proper, and Lombardy and Piedmont formed the 11th region of Augustus (Transpadana) while Venetia and Istria formed the 10th. It was the second of the regions of Italy in size, but the last in number of towns; it appears, however, to have been prosperous and peaceful, and cultivation flourished in its fertile portions. By the end of the 4th century A.D. the name Liguria had been extended over it, and Milan was regarded as the capital of both. Stranger still, in the 6th century the old Liguria was separated from it, and under the name of *Alpes Cottiae* formed the 5th Lombard province of Italy.

For details of subsequent history see LOMBARDS and ITALY; and for architecture see ARCHITECTURE. G. T. Rivoira in *Origini dell' Architettura* Lombarda (2 vols. Rome, 1901-1907), successfully demonstrates the classical origin of much that had hitherto been treated by some authorities as "Byzantine." In the development of Renaissance architecture and art Lombardy played a great part, inasmuch as both Bramante and Leonardo da Vinci resided in Milan at the end of the 15th century.

LOMBOK (called by the natives *Sasak*), one of the Lesser Sunda Islands, in the Dutch East Indies, E. of Java, between 8° 12′ and 9° 1′ S. and 115° 46′ and 116° 40′ E., with an area of 3136 sq. m. It is separated from Bali by the Strait of Lombok and from Sumbawa by the Strait of Alas. Rising out of the sea with bold and often precipitous coasts, Lombok is traversed by two mountain chains. The northern chain is of volcanic formation, and contains the peak of Lombok (11,810 ft.), one of the highest volcanoes in the Malay Archipelago. It is surrounded by a plateau (with lower summits, and a magnificent lake, Segara Anak) 8200 ft. high. The southern chain rises a little over 3000 ft. Between the two chains is a broad valley or terrace with a range of low volcanic hills. Forest-clad mountains and stretches of thorny jungle alternating with rich alluvial plains, cultivated like gardens under an ancient and elaborate system of irrigation, make the scenery of Lombok exceedingly attractive. The small rivers serve only for irrigation and the growing of rice, which is of superior quality. In the plains are also grown coffee, indigo, maize and sugar, katyang (native beans), cotton and tobacco. All these products are exported. To the naturalist Lombok is of particular interest as the frontier island of the Australian region, with its cockatoos and megapods or mound-builders, its peculiar bee-eaters and ground thrushes. The Sasaks must be considered the aborigines, as no trace of an earlier race is found. They are Mahommedans and distinct in many other respects from the Hindu Balinese, who vanquished but could not convert them. The island was formerly divided into the four states of Karang-Asam Lombok on the W. side, Mataram in the N.W., Pagarawan in the S.W. and Pagutan in the E. Balinese supremacy dated from the conquest by Agong Dahuran in the beginning of the 19th century; the union under a single raja tributary to Bali dated from 1839. In July 1894 a Dutch expedition landed at Ampanam, and advanced towards Mataram, the capital of the Balinese sultan, who had defied Dutch authority and refused to send the usual delegation to Batavia. The objects of that expedition were to punish Mataram and to redress the grievances of the Sasaks whom the Balinese held in cruel subjection. The first Dutch expedition met with reverses, and ultimately the invaders were forced back upon Ampanam. The Dutch at once despatched a much stronger expedition, which landed at Ampanam in September. Mataram was bombarded by the fleet, and the troops stormed the sultan's stronghold, and Tjakra Negara, another chieftain's citadel, both after a desperate resistance. The old sultan of Mataram was captured, and he and other Balinese chiefs were exiled to different parts of the Malay Archipelago, whilst the sultan's heir fell at the hands of his warriors. Thus ended the Balinese domination of Lombok, and the island was placed under direct Dutch-Indian control, an assistant resident being appointed at Ampanam. Lombok is now administered from Bali by the Dutch resident on that island. The people, however, are in undisturbed exercise of their own laws, religions, customs and institutions. Disturbances between the Sasaks and the Lombok Balinese frequently occur. Lombok has been divided since 1898 into the West, Middle and East Lombok. Its chief towns are Mataram, Praya and Sisi. On the west coast the harbour of Ampanam is the most frequented, though, on account of heavy breakers, it is often difficult of approach. The Sasaks are estimated at 320,000, the Balinese at 50,000, Europeans number about 40, Chinese 300, and Arabs 170.

See A. R. Wallace, *Malay Archipelago* (London, 1869, and later editions). The famous "Wallace's Line" runs immediately west of Lombok, which therefore has an important part in the work. Captain W. Cool, *With the Dutch in the East* (Amsterdam and London, 1897), in Dutch and English, is a narrative of the events sketched above, and contains many particulars about the folklore and dual religions of Lombok, which, with Bali, forms the last stronghold of Hinduism east of Java.

LOMBROSO, CESARE (1836-1909), Italian criminologist, was born on the 18th of November 1836 at Verona, of a Jewish family. He studied at Padua, Vienna and Paris, and was in 1862 appointed professor of psychiatry at Pavia, then director of the lunatic asylum at Pesaro, and later professor of forensic medicine and of psychiatry at Turin, where he eventually filled the chair of criminal anthropology. His works, several of which have been translated into English, include *L'Uomo delinquente* (1889); *L'Uomo di genio* (1888); *Genio e follia* (1877) and *La Donna delinquente* (1893). In 1872 he had made the notable discovery that the disorder known as *pellagra* was due (but see PELLAGRA) to a poison contained in diseased maize, eaten by the peasants, and he returned to this subject in *La Pellagra in Italia* (1885) and other works. Lombroso, like Giovanni Bovio (b. 1841), Enrico Ferri (b. 1856) and Colajanni, well-known Italian criminologists, and his sons-in-law G. Ferrero and Carrara, was strongly influenced by Auguste Comte, and owed to him an exaggerated tendency to refer all mental facts to biological causes. In spite of this, however, and a serious want of accuracy and discrimination in handling evidence, his work made an epoch in criminology; for he surpassed all his predecessors by the wide scope and systematic character of his researches, and by the practical conclusions he drew from them. Their net theoretical results is that the criminal population exhibits a higher percentage of physical, nervous and mental anomalies than non-criminals; and that these anomalies are due partly to degeneration, partly to atavism. The criminal is a special type of the human race, standing midway between the lunatic

and the savage. This doctrine of a "criminal type" has been gravely criticized, but is admitted by all to contain a substratum of truth. The practical reform to which it points is a classification of offenders, so that the born criminal may receive a different kind of punishment from the offender who is tempted into crime by circumstances (see also CRIMINOLOGY). Lombroso's biological principles are much less successful in his work on Genius, which he explains as a morbid, degenerative condition, presenting analogies to insanity, and not altogether alien to crime. In 1899 he published in French a book which gives a résumé of much of his earlier work, entitled *Le Crime, causes et remèdes*. Later works are: *Delitti vecchi e delitti nuovi* (Turin, 1902); *Nuovi studi sul genio* (2 vols., Palermo, 1902); and in 1908 a work on spiritualism (Eng. trans., *After Death—What?* 1909), to which subject he had turned his attention during the later years of his life. He died suddenly from a heart complaint at Turin on the 19th of October 1909.

See Kurella, *Cesare Lombroso und die Naturgeschichte des Verbrechers* (Hamburg, 1892); and a biography, with an analysis of his works, and a short account of their general conclusions by his daughters, Paola Carrara and Gina Ferrero, written in 1906 on the occasion of the sixth congress of criminal anthropology at Turin.

LOMÉNIE DE BRIENNE, ÉTIENNE CHARLES DE

(1727-1794), French politician and ecclesiastic, was born at Paris on the 9th of October 1727. He belonged to a Limousin family, dating from the 15th century, and after a brilliant career as a student entered the Church, as being the best way to attain to a distinguished position. In 1751 he became a doctor of theology, though there were doubts as to the orthodoxy of his thesis. In 1752 he was appointed grand vicar to the archbishop of Rouen. After visiting Rome, he was made bishop of Condom (1760), and in 1763 was translated to the archbishopric of Toulouse. He had many famous friends, among them A. R. J. Turgot, the Abbé A. Morellet and Voltaire, and in 1770 became an academician. He was on three occasions the head of the *bureau de jurisdiction* at the general assembly of the clergy; he also took an interest in political and social questions of the day, and addressed to Turgot a number of *mémoires* on these subjects, one of them, treating of pauperism, being especially remarkable. In 1787 he was nominated as president of the Assembly of Notables, in which capacity he attacked the fiscal policy of Calonne, whom he succeeded as head of the *conseil des finances* on the 1st of May 1787. Once in power, he succeeded in making the parlement register edicts dealing with internal free trade, the establishment of provincial assemblies and the redemption of the *corvée*; on their refusal to register edicts on the stamp duty and the proposed new general land-tax, he persuaded the king to hold a *lit de justice*, to enforce their registration. To crush the opposition to these measures, he persuaded the king to exile the parlement to Troyes (August 15th, 1787). On the agreement of the parlement to sanction a prolongation for two years to the tax of the two *vingtièmes* (a direct tax on all kinds of income), in lieu of the above two taxes, he recalled the councillors to Paris. But a further attempt to force the parlement to register an edict for raising a loan of 120 million *livres* met with determined opposition. The struggle of the parlement against the incapacity of Brienne ended on the 8th of May in its consenting to an edict for its own abolition; but with the proviso that the states-general should be summoned to remedy the disorders of the state. Brienne, who had in the meantime been made archbishop of Sens, now found himself face to face with almost universal opposition; he was forced to suspend the *Cour plénière* which had been set up to take the place of the parlement, and himself to promise that the states-general should be summoned. But even these concessions were not able to keep him in power, and on the 29th of August he had to retire, leaving the treasury empty. On the 15th of December following, he was made a cardinal, and went to Italy, where he spent two years. After the outbreak of the Revolution he returned to France, and took the oath of the Civil Constitution of the Clergy in 1790 (see FRENCH REVOLUTION). He was repudiated by the pope, and in 1791 had to give up the biretta at the command of Pius VI. Both his past and present conduct made him an object of suspicion to the revolutionaries; he was arrested at Sens on the 9th of November 1793, and died in prison, either of an apoplectic stroke or by poison, on the 16th of February 1794.

The chief works published by Brienne are: *Oraison funèbre du Dauphin* (Paris, 1766); *Compte-rendu au roi* (Paris, 1788); *Le Conciliateur*, in collaboration with Turgot (Rome, Paris, 1754). See also J. Perrin, *Le Cardinal Loménie de Brienne ... épisodes de la Révolution* (Sens, 1896).

LOMOND, LOCH,

the largest and most beautiful of Scottish lakes, situated in the counties of Stirling and Dumbarton. It is about 23 m. long; its width varies from 5 m. towards the south end to ⅓ m. at the narrows to the north of the Isle of the Vow; its area is 27 sq. m., and the greatest depth 630 ft. It is only 23 ft. above the sea, of which doubtless it was at one time an arm. It contains 30 islands, the largest of which is Inchmurrin, a deer park belonging to the duke of Montrose. Among other islands are Inch Cailliach (the "Island of Women," from the fact that a nunnery once stood there), Inchfad ("Long Island"), Inchcruin ("Round Island"), Inchtavannach ("Monks' Isle"), Inchconnachan ("Colquhoun's Isle"), Inchlonaig ("Isle of the Yews," where Robert Bruce caused yews to be planted to provide arms for his bowmen), Creinch, Torrinch and Clairinch (which gave the Buchanans their war-cry). From the west the loch receives the Inveruglas, the Douglas, the Luss, the Finlas and the Fruin. From Balloch in the south it sends off the Leven to the Clyde; from the east it receives the Endrick, the Blair, the Cashell and the Arklet; and from the north the Falloch. Ben Lomond (3192 ft.), the ascent of which is made with comparative ease from Rowardennan, dominates the landscape; but there are other majestic hills, particularly on the west and north-west banks. The fish are sea-trout, lake-trout, pike and perch. Part of the shore is skirted by the West Highland railway, opened in 1894, which has stations on the loch at Tarbet and Ardlui, and Balloch is the terminus of the lines from Dumbarton and from Stirling via Buchlyvie. Steamers make the tour of the loch, starting from Balloch and calling at Balmaha, Luss, Rowardennan, Tarbet, Inversnaid and Ardlui. LUSS has a considerable population, and there is some stone quarried near it. INVERSNAID is the point of arrival and departure for the Trossachs coaches, and here, too, there is a graceful waterfall, fed by the Arklet from the loch of that name, 2½ m. to the east, commemorated in Wordsworth's poem of the "Highland Girl." Inversnaid was in the heart of the Macgregor country, and the name of Rob Roy is still given to his cave on the loch side a mile to the north and to his prison 3 m. to the south. Inversnaid was the site of a fort built in 1713 to reduce the clan to subjection. Craig Royston, a tract lying between Inversnaid and Ben Lomond, was also associated with Rob Roy.

LOMONÓSOV, MIKHAIL VASILIEVICH (1711-1765), Russian poet and man of science, was born in the year 1711, in the village of Denisovka (the name of which was afterwards changed in honour of the poet), situated on an island not far from Kholmogorî, in the government of Archangel. His father, a fisherman, took the boy when he was ten years of age to assist him in his calling; but the lad's eagerness for knowledge was unbounded. The few books accessible to him he almost learned by heart; and, seeing that there was no chance of increasing his stock of knowledge in his native place, he resolved to betake himself to Moscow. An opportunity occurred when he was seventeen, and by the intervention of friends he obtained admission into the Zaikonospasski school. There his progress was very rapid, especially in Latin, and in 1734 he was sent from Moscow to St Petersburg. There again his proficiency, especially in physical science, was marked, and he was one of the young Russians chosen to complete their education in foreign countries. He accordingly commenced the study of metallurgy at Marburg; he also began to write poetry, imitating German authors, among whom he is said to have especially admired Günther. His *Ode on the Taking of Khotin from the Turks* was composed in 1739, and attracted a great deal of attention at St Petersburg. During his residence in Germany Lomonósov married a native of the country, and found it difficult to maintain his increasing family on the scanty allowance granted to him by the St Petersburg Academy, which, moreover, was irregularly sent. His circumstances became embarrassed, and he resolved to leave the country secretly and to return home. On his arrival in Russia he rapidly rose to distinction, and was made professor of chemistry in the university of St Petersburg; he ultimately became rector, and in 1764 secretary of state. He died in 1765.

The most valuable of the works of Lomonósov are those relating to physical science, and he wrote upon many branches of it. He everywhere shows himself a man of the most varied learning. He compiled a Russian grammar, which long enjoyed popularity, and did much to improve the rhythm of Russian verse.

LOMZA, or Lomzha, a government of Russian Poland, bounded N. by Prussia and the Polish government of Suwalki, E. by the Russian government of Grodno, S. by the Polish governments of Siedlce and Warsaw and W. by that of Plock. It covers 4666 sq. m. It is mostly flat or undulating, with a few tracts in the north and south-west where the deeply cut valleys give a hilly aspect to the country. Extensive marshes overspread it, especially on the banks of the Narev, which flows from east to south-west, joining the Bug in the south-western corner of the government. The Bug flows along the southern border, joining the Vistula 20 m. below its confluence with the Narev. There are forests in the east of the government. The inhabitants numbered 501,385 in 1872 and 585,033 in 1897, of whom 279,279 were women, and 69,834 lived in towns. The estimated population in 1906 was 653,100. By religion 77½% are Roman Catholics, 15½% Jews and 5½% members of the Orthodox Church. Agriculture is the predominant industry, the chief crops being rye, oats, wheat, barley, buckwheat, peas, potatoes, flax and hemp. Bees are extensively kept, and large numbers of poultry, especially geese, are reared. Stock raising is carried on to some extent. The wood trade is important; other industries are the production of pottery, beer, flour, leather, bricks, wooden wares, spirits, tobacco and sugar. There is only one railway (between Grodno and Warsaw); the Bug is navigable, but wood only is floated down the Narev. The government is divided into seven districts, of which the chief towns, with their populations in 1897, are Lomza (*q.v.*), Ostrolenka (8679), Mazowiec (3900), Ostrów (11,264), Maków (7232), Kolno (4941) and Szczuczyn (5725).

LOMZA, a town of Russia, capital of the government of the same name, on the Narew, 103 m. by rail N.E. from Warsaw. Pop. (1872), 13,860, (1900) 22,428. Lomza is an old town, one of its churches having been erected before 1000. In the 16th century it carried on a brisk trade with Lithuania and Prussia. It was well fortified and had two citadels, but nevertheless often suffered from the invasions of the Germans and Tatars, and in the 17th century it was twice plundered by the Cossacks of the Ukraine. In 1795 it fell under the dominion of Prussia, and after the peace of Tilsit (1807) it came under Russian rule.

LONAULI, a town of India, in the Poona district of Bombay, at the top of the Bhor Ghat pass in the Western Ghats, by which the Great Indian Peninsula railway climbs from Bombay to Poona. Pop. (1901), 6686. It contains the locomotive works of the railway. Lonauli is a place of resort from Bombay during the hot season.

LONDON, a city and port of entry of Middlesex county, Ontario, Canada, situated 121 m. N.W. of Toronto, on the river Thames and the Grand Trunk, Canadian Pacific and Michigan Central railways. Pop. (1901), 37,981; but several suburbs, not included in these figures, are in reality part of the city. The local nomenclature is largely a reproduction of that of the great city whose name it has borrowed. Situated in a fertile agricultural district, it is a large distributing centre. Among the industries are breweries, petroleum refineries, and factories for the manufacture of agricultural implements and of railway carriages. The educational institutions include the Hellmuth Ladies' College and the Western University (founded in 1878 under the patronage of the Church of England). London was founded in 1825-1826.

LONDON, the capital of England and of the British Empire, and the greatest city in the world, lying on each side of the river Thames 50 m. above its mouth.[1] The "City," so called both formally and popularly, is a small area (673 acres) on the north bank of the river, forming the heart of the metropolis, and constituting within its boundaries one only, and one of the smallest, of twenty-nine municipal divisions which make up the administrative County of London. The twenty-eight remaining divisions are the Metropolitan Boroughs. The county thus defined has an extreme length (E. to W.) of 16 m., an extreme breadth (N. to S.) of 11½ m., and an area of 74,839 acres or about 117 sq. m. The boroughs are as follows:—

1. *North of the Thames.*—Touching the northern boundary of the county, from W. to E.—Hammersmith, Kensington, Paddington, Hampstead, St Pancras, Islington, Stoke Newington, Poplar.

Bounded by the Thames—Fulham, Chelsea, the City of Westminster (here the City of London intervenes), Stepney, Poplar.

Between Westminster, the City and Stepney, and the northern boroughs—St Marylebone (commonly Marylebone), Holborn, Finsbury, Shoreditch, Bethnal Green.

2. *South of the Thames.*—Wandsworth, Battersea, Lambeth, Southwark, Camberwell, Bermondsey, Deptford, Lewisham, Greenwich, Woolwich (with a small part of the north bank).

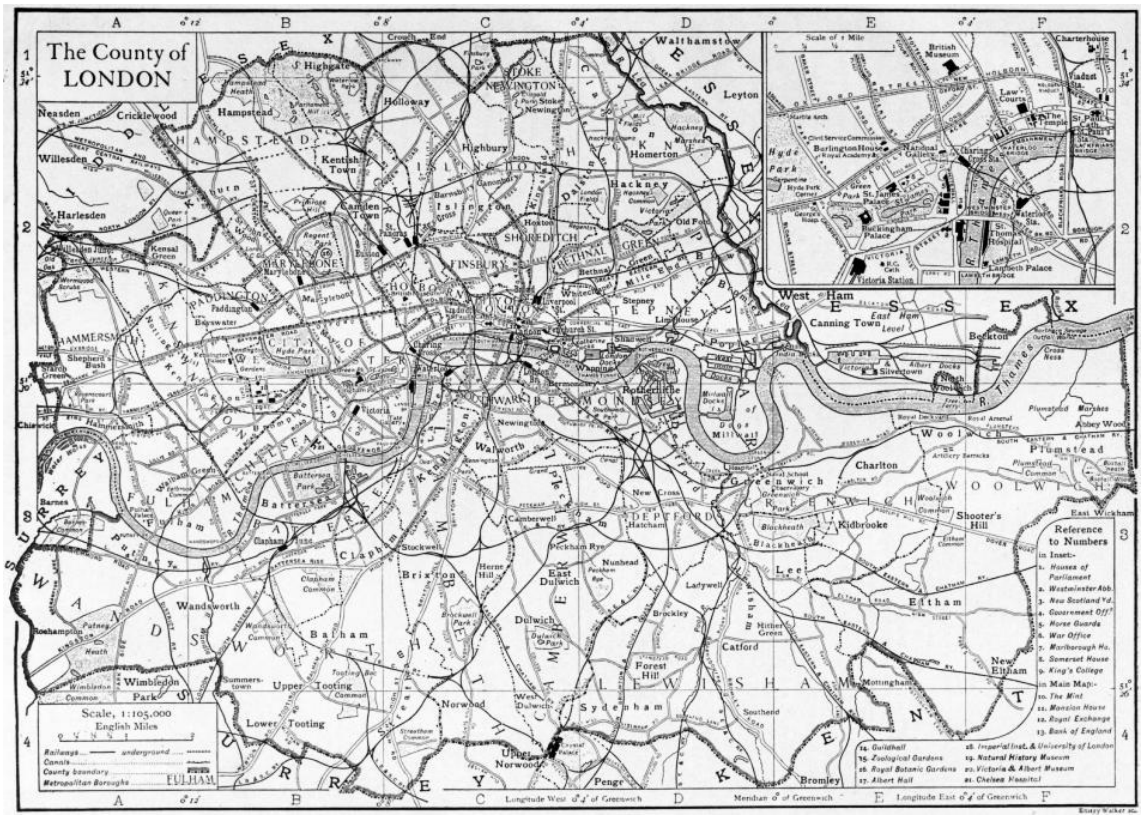
These names are all in common use, though their formal application is in some cases extended over several districts of which the ancient names remain familiar. Each borough is noticed in a separate article.

I. Extent and Site

The County of London is bounded N. and W. by Middlesex, E. by Essex and Kent, S. by Kent and Surrey. The Metropolitan police area, or "Greater London," however, embraces the whole of Middlesex, with parts of the other three counties and of Hertfordshire. Its extent is 443,419 acres or nearly 693 sq. m., and its population is about seven millions. Only here and there upon its fringe the identity of this great area with the metropolis is lost to the eye, where open country remains unbroken by streets or close-set buildings.

Site.—North of the Thames, and west of its tributary the Lea, which partly bounds the administrative county on the east, London is built upon a series of slight undulations, only rarely sufficient to make the streets noticeably steep. On the northern boundary of the county a height of 443 ft. is found on the open Hampstead Heath. The lesser streams which flow from this high ground to the Thames are no longer open. Some, however, as well as other natural features effaced by the growth of the city, retain an historical interest through the survival of their names in streets and districts, or through their relation to the original site of London (in the present City). South of the Thames a broken amphitheatre of low hills, approaching the river near Greenwich and Woolwich on the east and Putney and Richmond on the west, encloses a tract flatter than that to the north, and rises more abruptly in the southern districts of Streatham, Norwood and Forest Hill.

In attempting to picture the site of London in its original condition, that is, before any building took place, it is necessary to consider (1) the condition of the Thames unconfined between made banks, (2) the slopes overlooking it, (3) the tributary streams which watered these slopes. The low ground between the slight hills flanking the Thames valley, and therefore mainly south of the present river, was originally occupied by a shallow lagoon of estuarine character, tidal, and interspersed with marshy tracts and certain islets of relatively firm land. Through this the main stream of the Thames pursued an ill-defined course. The tributary streams entered through marshy channels. The natural process of sedimentation assisted the gradual artificial drainage of the marshes by means of embankments confining the river. The breadth of this low tract, from Chelsea downward, was from 2 to 3 m. The line of the foot of the southern hills, from Putney, where it nearly approaches the present river, lies through Stockwell and Camberwell to Greenwich, where it again approaches the river. On the north there is a flat tract between Chelsea and Westminster, covering Pimlico, but from Westminster down to the Tower there is a marked slope directly up from the river bank. Lower still, marshes formerly extended far up the valley of the Lea. The higher slopes of the hills were densely forested (cf. the modern district-name St John's Wood), while the lower slopes, north of the river, were more open (cf. Moorgate). The original city grew up on the site of the City of London of the present day, on a slight eminence intersected by the Wal- or Wall-brook, and flanked on the west by the river Fleet.



(Click to enlarge.)

These and other tributary streams have been covered in and built over (in some cases serving as sewers), but it is possible to trace their valleys at various points by the fall and rise of streets crossing them, and their names survive, as will be seen, in various modern applications. The Wallbrook rose in a marsh in the modern district of Finsbury, and joined the Thames close to the Cannon Street railway bridge. A street named after it runs south from the Mansion House parallel with its course. The Fleet was larger, rising in, and collecting various small streams from, the high ground of Hampstead. It passed Kentish Town, Camden Town and King's Cross, and followed a line approximating to King's Cross Road. The slope of Farringdon Road, where crossed by Holborn Viaduct, and of New Bridge Street, Blackfriars, marks its course exactly, and that of Fleet Street and Ludgate Hill its steep banks. The name also appears in Fleet Road, Hampstead. From King's Cross downward the banks were so steep and high that the stream was called 939
Hollow or Hole-bourne, this name surviving in Holborn; and it was fed by numerous springs (Bagnigge Well, Clerkenwell and others) in this vicinity. It entered a creek which was navigable for a considerable distance, and formed a subsidiary harbour for the City, but by the 14th century this was becoming choked with refuse, and though an attempt was made to clear it, and wharves were built in 1670, it was wholly arched over in 1737-1765 below Holborn Bridge. Continuing westward, the most important stream was Tyburn (*q.v.*), which rose at Hampstead, and joined the Thames through branches on either side of Thorney Island, on which grew up the great ecclesiastical foundation of St Peter, Westminster, better known as Westminster Abbey. There is no modern survival of the name of Tyburn, which finds, indeed, its chief historical interest as attaching to the famous place of execution which lay near the modern Marble Arch. The residential district in this vicinity was known at a later date as Tyburnia. The next stream westward was the Westbourne, the name of which is perpetuated in Westbourne Grove and elsewhere in Paddington. It rose on the heights of Hampstead, traversed Paddington, may be traced in the course of the Serpentine lake in Hyde Park, ran parallel to and east of Sloane Street, and joined the Thames close to Chelsea Bridge. The main tributaries of the Thames from the north, to east and west of those described, are not covered, nor is any tributary of importance from the south entirely concealed.

Geology.—London lies within the geological area known as the London basin. Within the confines of Greater London the chalk which forms the basement of this area appears at the surface in isolated patches about Greenwich, while its main line approaches within 10 m. of the City to the south and within 15 to the north-west. In the south and north-west the typical London clay is the principal formation. In the south-east, however, the Blackheath and Woolwich pebble-beds appear, with their belts of Thanet sands bordering the chalk. Valley gravel borders the Thames, with some interruptions, from Kingston to Greenwich, and extends to a wide belt, with ramifications, from Wandsworth south to Croydon, and in a narrower line from Greenwich towards Bromley. Brick earth overlies it from Kensington to Brentford and west thereof, and appears in Chelsea and Fulham, Hornsey and Stoke Newington, and in patches south of the Thames between Battersea and Richmond. The main deposits of alluvium occur below Lambeth and Westminster, and in the valley of the Wandle, which joins the Thames from the south near Putney. In the north and west the clay is interspersed with patches of plateau gravel in the direction of Finchley (where boulder clay also appears), Enfield and Barnet; and of Bagshot sands on Hampstead Heath and Harrow Hill. Gravel is found on the high ground about Richmond Park and Wimbledon. (See further MIDDLESEX.)

Climate.—The climate is equable (though excessive heat is sometimes felt for short periods during the summer) and moist, but healthy. Snow is most common in the early months of the year. The fogs of London have a peculiar and perhaps an exaggerated notoriety. They are apt to occur at all seasons, are common from September to February, and most common in November. The atmosphere of London is almost invariably misty in a greater or less degree, but the denser fogs are generally local and of no long duration. They sometimes cause a serious dislocation of railway and other traffic. Their principal cause is the smoke from the general domestic use of coal. The evil is of very long standing, for in 1306 the citizens petitioned Edward I. to prohibit the use of sea-coal, and he made it a capital offence. The average temperature of the hottest month, July, is 64°.4 F.; of the coldest, January, 37°.9; and the mean annual 50°.4. The mean annual rainfall ranges in different parts of the metropolis from about 20½ to 27½ in.

London as a whole owes nothing in appearance to the natural configuration of its site. Moreover, the splendid building is nearly always a unit; seldom, unless accidentally, a component part of a broad effect. London has not grown up along formal lines; nor is any large part of it laid out according to the conceptions of a single generation. Yet not a few of the great thoroughfares and buildings are individually worthy of London's preeminence as a city. The most notable of these fall within a circumscribed area, and it is therefore necessary to preface their consideration with a statement of the broader characteristic divisions of the metropolis.

Characteristic Divisions.—In London north of the Thames, the salient distinction lies between West and East. From the western boundary of the City proper, an area covering the greater part of the city of Westminster, and extending into Chelsea, Kensington, Paddington and Marylebone, is exclusively associated with the higher-class life of London. Within the bounds of Westminster are the royal palaces, the government offices and many other of the finest public buildings, and the wider area specified includes the majority of the residences of the wealthier classes, the most beautiful parks and the most fashionable places of recreation. "Mayfair," north of Piccadilly, and "Belgravia," south of Knightsbridge, are common though unofficial names for the richest residential districts. The "City" bears in the great commercial buildings fringing its narrow streets all the marks of a centre of the world's exchanges. East of it there is an abrupt transition to the district commonly known as the "East End," as distinguished from the wealthy "West End," a district of mean streets, roughly coincident with the boroughs of Stepney and Poplar, Shoreditch and Bethnal Green, and primarily (though by no means exclusively) associated with the problems attaching to the life of the poor. On the Thames below London Bridge, London appears in the aspect of one of the world's great ports, with extensive docks and crowded shipping. North London is as a whole residential: Hackney, Islington and St Pancras consist mainly of dwellings of artisans and the middle classes; while in Hampstead, St Marylebone and Paddington are many terraces and squares of handsome houses. Throughout the better residential quarters of London the number of large blocks of flats has greatly increased in modern times. But even in the midst of the richest quarters, in Westminster and elsewhere, small but well-defined areas of the poorest dwellings occur.

London south of the Thames has none of the grander characteristics of the wealthy districts to the north. Poor quarters lie adjacent to the river over the whole distance from Battersea to Greenwich, merging southward into residential districts of better class. London has no single well-defined manufacturing quarter.

Suburbs.—Although the boundary of the county of London does not, to outward appearance, enclose a city distinct from its suburbs, London outside that boundary may be conveniently considered as suburban. Large numbers of business men and others who must of necessity live in proximity to the metropolis have their homes aloof from its centre. It is estimated that upwards of a million daily enter and leave the City alone as the commercial heart of London, and a great proportion of these travel in and out by the suburban railways. In this aspect the principal extension of London has been into the counties of Kent and Surrey, to the pleasant hilly districts about Sydenham, Norwood and Croydon, Chislehurst and Orpington, Caterham, Redhill and Reigate, Epsom, Dorking and Leatherhead; and up the valley of the Thames through Richmond to Kingston and Surbiton, Esher and Weybridge, and the many townships on both the Surrey and the Middlesex shores of the river. On the west and north the residential suburbs immediately outside the county include Acton and Ealing, Willesden, Highgate, Finchley and Hornsey; from the last two a densely populated district extends north through Wood Green and Southgate to Barnet and Enfield; while the "residential influence" of the metropolis far exceeds these limits, and may be observed at Harrow and Pinner, Bushey and Boxmoor, St Albans, Harpenden, Stevenage and many other places. To the north-east the beauty of Epping Forest attracts numerous residents to Woodford, Chingford and Loughton. The valley of the Lea is also thickly populated, but chiefly by an industrial population working in the numerous factories along this river. The Lea separates the county of London from Essex, but the townships of West Ham and Stratford, Barking and Ilford, Leyton and Walthamstow continue the metropolis in this direction almost without a break. Their population is also largely occupied in local manufacturing establishments; while numerous towns on either bank of the lower Thames share in the industries of the port of London.

Streets.—The principal continuous thoroughfares within the metropolis, though each bears a succession of names, are coincident with the main roads converging upon the capital from all parts of England. On the north of the Thames two great thoroughfares from the west meet in the heart of the City. The northern enters the county in Hammersmith as Uxbridge Road, crosses Kensington and borders the north side of Kensington Gardens and Hyde Park as Bayswater Road. It then bears successively the names of Oxford Street, New Oxford Street and High Holborn; enters the City, becomes known as Holborn Viaduct from the fact that it is there carried over other streets which lie at a lower level, and then as Newgate Street and Cheapside. The southern highway enters Hammersmith, crosses the centre of Kensington as Kensington Road and High Street, borders Kensington Gardens and Hyde Park as Kensington Gore and Knightsbridge, with terraces of fine residences, and merges into Piccadilly. This beautiful street, with its northward branches, Park Lane, from which splendid houses overlook Hyde Park, and Bond Street, lined with handsome shops, may be said to focus the fashionable life of London. The direct line of the thoroughfare is interrupted after Piccadilly Circus (the term "circus" is frequently applied to the open space—not necessarily round—at the junction of several roads), but is practically resumed in the Strand, with its hotels, shops and numerous theatres, and continued through the City in Fleet Street, the centre of the newspaper world, and Ludgate Hill, at the head of which is St Paul's Cathedral. Thence it runs by commercial Cannon Street to the junction with Cheapside and several other busy streets. At this junction stand the Royal Exchange, the Mansion House (the official residence of the Lord Mayor of London) and the Bank of England, from which this important point in the communications of London is commonly known as "Bank." From the east two main roads similarly converge upon the City, which they enter by Aldgate (the suffix in this and other names indicating the former existence of one of the City gates). The southern of these highways, approaching through the eastern suburbs as Barking Road, becomes East India Docks Road in Poplar and Commercial Road East in Stepney. The continuous thoroughfare of 12 m. between Hammersmith and the East India Docks illustrates successively every phase of London life. The northern road enters from Stratford and is called Bow Road, Mile End Road, Whitechapel Road and High Street, Whitechapel. From the north of England two roads preserve communication-lines from the earliest times. The Old North Road, entering London from the Lea valley through Hackney and Shoreditch as Stamford Hill, Stoke Newington Road and Kingsland Road, reaches the City by Bishopsgate. The straight highway from the north-west which as Edgware Road joins Oxford Street at the Marble Arch (the north-eastern entrance to Hyde Park) is coincident with the Roman Watling Street. The Holyhead and Great North Roads, uniting at Barnet, enter London by branches through Hampstead and through Highgate, between the Old North and Edgware roads. South of the Thames the thoroughfares crossing the river between Lambeth and Bermondsey converge upon two circuses, St George's and the Elephant and Castle. At the second of these points the majority of the chief roads from the southern suburbs and the south of England are collected. Among them, the Old Kent Road continues the southern section of Watling Street, from Dover and the south-east, through Woolwich and across Blackheath. The road through Streatham, Brixton and Kennington, taking name from these districts successively, is the principal southern highway. The Portsmouth Road from the south-west is well marked as far as Lambeth, under the names of

Wandsworth, High Street, St John's Hill, Lavender Hill and Wandsworth Road.

Thames Embankments.—The Thames follows a devious course through London, and the fine embankments on its north side, nowhere continuing uninterruptedly for more than 2 m., do not form important thoroughfares, with the exception of the Victoria Embankment. Mostly they serve rather as beautiful promenades. One of them begins over against Battersea Bridge. Its finest portion is the Chelsea Embankment, fronting Battersea Park across the river, shaded by a pleasant avenue and lined with handsome houses. It continues, with some interruptions, nearly as far as the Houses of Parliament. Below these the grandest of the embankments extends to the City at Blackfriars. It was formed in 1864-1870, and is named the Victoria Embankment, though its popular title is "The Embankment" simply. Open gardens fringe it in part on the landward side, and it is lined with fine public and private buildings. The bold sweep of the Thames, here some 300 yds. wide, the towers of Westminster on the one hand and the dome of St Paul's on the other, make up a fine prospect. Below London Bridge the river is embanked for a short distance in front of the Tower of London, and above Westminster Bridge the Albert Embankment extends for nearly 1 m. along the south bank.

Bridges.—Fourteen road-bridges cross the Thames within the county of London. Of these London Bridge, connecting the City with Southwark and Bermondsey, stands first in historical interest and in importance as a modern highway. The old bridge, famous for many generations, bearing its rows of houses and its chapel in the centre, was completed early in the 13th century. It was 308 yds. long and had twenty narrow arches, through which the tides formed dangerous rapids. It stood just below the existing bridge, which was built of granite by John Rennie and his son Sir John Rennie, and completed in 1831. A widening to accommodate the growth of traffic, after being frequently discussed for many years, was completed in 1904, by means of corbels projecting on either side, without arresting traffic during the work. There was no bridge over the Thames below London Bridge until 1894, when the Tower Bridge was opened. This is a suspension bridge with a central portion, between two lofty and massive stone towers, consisting of bascules which can be raised by hydraulic machinery to admit the passage of vessels. The bridge is both a remarkable engineering work, and architecturally one of the finest modern structures in London. The bridges in order above London Bridge are as follows, railway-bridges being bracketed—Southwark, (Cannon Street), (Blackfriars), Blackfriars, Waterloo, (Hungerford—with a footway), Westminster, Lambeth, Vauxhall, (Grosvenor), Victoria, Albert, Battersea, (Battersea), Wandsworth, (Putney), Putney and Hammersmith. Waterloo Bridge, the oldest now standing within London, is the work of John Rennie, and was opened in 1817. It is a massive stone structure of nine arches, carrying a level roadway, and is considered one of the finest bridges of its kind in the world. The present Westminster Bridge, of iron on granite piers, was opened in 1862, but another preceded it, dating from 1750; the view from which was appreciated by Wordsworth in his sonnet beginning "Earth has not anything to show more fair." The complete reconstruction of Vauxhall Bridge was undertaken in 1902, and the new bridge was opened in 1906. Some of the bridges were built by companies, and tolls were levied at their crossing until modern times; thus Southwark Bridge was made toll-free in 1866, and Waterloo Bridge only in 1878, on being acquired by the City Corporation and the Metropolitan Board of Works respectively. The road-bridges mentioned (except the City bridges) are maintained by the London County Council, who expended for this purpose a sum of £9149 in 1907-1908. The following table shows the capital expenditure on the more important bridges and their cost of maintenance in 1907-1908:—

	Net Capital Expenditure.	Cost of Maintenance 1907-1908.
Albert Bridge	£120,774	£1296
Battersea Bridge	312,193	512
Hammersmith Bridge	204,250	421
Lambeth Bridge	47,555	496
Putney Bridge	430,052	653
Vauxhall Bridge (temporary)	270,749	73
Vauxhall Bridge (new)	457,108	1109
Wandsworth Bridge	65,661	410
Waterloo Bridge	552,867	1102
Westminster Bridge	393,189	1491

The properties entrusted to the Corporation for the upkeep of London Bridge are managed by the Bridge House Estates Committee, the revenues from which are also used in the maintenance of the other three City bridges, £26,989 being thus expended in 1907, the Tower bridge absorbing £17,735 of this amount.

Thames Tunnels.—Some of the metropolitan railway lines cross the river in tunnels beneath its bed. There are also several tunnels under the river below London Bridge, namely: Tower Subway, constructed in 1870 for foot-passengers, but no longer used, Greenwich Tunnel (1902) for foot-passengers, Blackwall Tunnel (1897), constructed by the County Council between Greenwich and Poplar, and Woolwich Tunnel, begun in 1910. A tunnel between Rotherhithe and Ratcliff was authorized in 1897 and opened in 1908. The Thames Tunnel (1825-1843), 2 m. below London Bridge, became a railway tunnel in 1865. The County Council maintains a free ferry at Woolwich for passengers and vehicular traffic. The capital expenditure on this undertaking was £185,337 and the expense of maintenance in 1907-1908 £20,881. The Greenwich Tunnel (capital expenditure £179,293) in the same year had expended on it for maintenance £3725, and the Blackwall Tunnel (capital expenditure £1,268,951) £11,420. The capital expenditure on the Rotherhithe Tunnel was £1,414,561.

Parks.—The administration and acreage of parks and open spaces, and their provisions for the public recreation, fall for consideration later, but some of them are notable features in the topography of London. The royal parks, namely St James's, Green and Hyde Park, and Kensington Gardens, stretch in an irregular belt for nearly 3 m. between Whitehall (Westminster) and Kensington. St James's Park was transformed from marshy land into a deer park, bowling green and tennis court by Henry VIII., extended and laid out as a pleasure garden by Charles II., and rearranged according to the designs of John Nash in 1827-1829. Its lake, the broad Mall leading up to Buckingham Palace, and the proximity of the government buildings in Whitehall, combine to beautify it. Here was established, by licence from James I., the so-called Milk Fair, which remained, its ownership always in the same family, until 1905, when, on alterations being made to the Mall, a new stall was erected for the owners during their lifetime, though the cow or cows kept here were no longer allowed. St James's Park is continued between the Mall and Piccadilly by the Green Park. Hyde Park, to the west, belonged originally to the manor of Hyde, which was attached to Westminster Abbey, but was taken by Henry VIII. on the dissolution of the monasteries. Two of its gateways are noteworthy, namely that at Hyde Park Corner at the south-east and the Marble Arch at the north-east. The first was built in 1828 from designs of Decimus Burton, and comprises three arches with a frieze above the central arch copied from the Elgin marbles in the British Museum. The Marble Arch was intended as a monument to Nelson, and first stood in front of Buckingham Palace, being moved to its present site in 1851. It no longer forms an entrance to the park, as in 1908 a corner of the park was cut off and a roadway was formed to give additional accommodation for the heavy traffic between Oxford Street, Edgware Road and Park Lane. The Marble Arch was thus left isolated. Hyde Park contains the Serpentine, a lake 1500 yds. in length, from the bridge over which one of the finest prospects in London is seen, extending to the distant towers of Westminster. Since the

17th century this park has been one of the most favoured resorts of fashionable society, and at the height of the "season," from May to the end of July, its drives present a brilliant scene. In the 17th and 18th centuries it was a favourite duelling-ground, and in the present day it is not infrequently the scene of political and other popular demonstrations (as is also Trafalgar Square), while the neighbourhood of Marble Arch is the constant resort of orators on social and religious topics. Kensington Gardens, originally attached to Kensington Palace, were subsequently much extended; they are magnificently timbered, and contain plantations of rare shrubs and flowering trees. Regent's Park, mainly in the borough of Marylebone, owes its preservation to the intention of George III. to build a palace here. The other most notable open spaces wholly or partly within the county are Hampstead Heath in the north-west, a wild, high-lying tract preserved to a great extent in its natural state, and in the south-west Wimbledon Common, Putney Heath and the royal demesne of Richmond Park, which from its higher parts commands a wonderful view up the rich valley of the Thames. The outlying parts of the county to east, south and north are not lacking in open spaces, but there is an extensive inner area where at most only small gardens and squares break the continuity of buildings, and where in some cases old churchyards serve as public grounds.

Architecture.—While stone is the material used in the construction of the majority of great buildings of London, some modern examples (notably the Westminster Roman Catholic cathedral) are of red brick with stone dressings; and brick is in commonest use for general domestic building. The smoke-laden atmosphere has been found not infrequently to exercise a deleterious effect upon the stonework of important buildings; and through the same cause the appearance of London as a whole is by some condemned as sombre. Bright colour, in truth, is wanting, though attempts are made in a few important modern erections to supply it, a notable instance being the Savoy Hotel buildings (1904) in the Strand. Portland stone is frequently employed in the larger buildings, as in St Paul's Cathedral, and under the various influences of weather and atmosphere acquires strongly contrasting tones of light grey and black. Owing to the by-laws of the County Council, the method of raising commercial or residential buildings to an extreme height is not practised in London; the block known as Queen Anne's Mansions, Westminster, is an exception, though it cannot be called high in comparison with American high buildings.

Architectural remains of earlier date than the Norman period are very few, and of historical rather than topographical importance. In architecture of the Norman and Gothic periods London must be considered rich, though its richness is poverty when its losses, particularly during the great fire of 1666, are recalled. These losses were confined within the City, but, to go no farther, included the Norman and Gothic cathedral of St Paul, perhaps a nobler monument of its period than any which has survived it, much as it had suffered from injudicious restoration. Ancient architecture in London is principally ecclesiastical. Westminster Abbey is pre-eminent; in part, it may be, owing to the reverence felt towards it in preference to the classical St Paul's by those whose ideal of a cathedral church is essentially Gothic, but mainly from the fact that it is the burial-place of many of the English monarchs and their greatest subjects, as well as the scene of their coronations (see WESTMINSTER). In the survey of London (1598) by John Stow, 125 churches, including St Paul's and Westminster Abbey, are named; of these 89 were destroyed by the great fire. Thirteen large conventual churches were mentioned by Fitzstephen in the time of Henry II., and of these there are some remains.

Ecclesiastical architecture.

The church of St Bartholomew the Great, Smithfield, is the finest remnant of its period in London. It was founded in 1123 by Rahere, who, probably a Breton by birth, was a courtier in the reign of William II. He is said to have been the king's minstrel, and to have spent the earlier part of his life in frivolity. Subsequently he entered holy orders, and in *c.* 1120, being stricken with fever while on a pilgrimage to Rome, vowed that he would found a hospital in London. St Bartholomew, appearing to him in a vision, bade him add a church to his foundation. He became an Augustinian canon, and founded his hospital, which is now, as St Bartholomew's Hospital, one of the principal medical institutions in the metropolis. He became its first master. Later he erected the priory, for canons of his order, of which the nave and transepts of the church remain. The work is in the main very fine Norman, with triforium, ambulatory and apsidal eastern end. An eastern lady chapel dates from *c.* 1410, but the upper part is modern, for the chapel was long desecrated. There are remains of the cloisters north of the church,—and praiseworthy efforts have been made since 1903 towards their restoration. The western limit of the former nave of the church is marked by a fine Early English doorway, now forming an entrance to the churchyard. Rahere's tomb remains in the church; the canopy is Perpendicular work, but the effigy is believed to be original. He died in 1144.

The Temple Church (see INNS OF COURT), serving for the Inner and Middle Temples, belonged to the Knights Templars. It is the finest of the four ancient round churches in England, dating from 1185, but an Early English choir opens from the round church. St Saviour's in Southwark (*q.v.*), the cathedral church of the modern bishopric of Southwark, was the church of the priory of St Mary Overy, and is a large cruciform building mainly Early English in style. There may be mentioned also an early pier in the church of St Katherine Cree or Christ Church, Leadenhall Street, belonging to the priory church of the Holy Trinity; old monuments in the vaults beneath St James's Church, Clerkenwell, formerly attached to a Benedictine nunnery; and the Perpendicular gateway and the crypt of the church of the priory of St John of Jerusalem (see FINSBURY). Among other ancient churches within the City, that of All Hallows Barking, near the Tower of London, is principally Perpendicular and contains some fine brasses. It belonged to the convent at Barking, Essex, and was the burial-place of many who were executed at the scaffold on Tower Hill. St Andrew Undershaft, so named because a Maypole used to be set up before the former church on May-day, is late Perpendicular (*c.* 1530); and contains a monument to John Stow the chronicler (d. 1605). The church of Austin Friars, originally belonging to a friary founded in 1253, became a Dutch church under a grant of Edward VI., and still remains so; its style is principally Decorated, but through various vicissitudes little of the original work is left. St Giles, Cripplegate, was founded *c.* 1090, but the existing church is late Perpendicular. It is the burial-place of Fox the martyrologist and Milton the poet, and contains some fine wood-carving by Grinling Gibbons. St Helen's, Bishopsgate, belonged to a priory of nuns founded *c.* 1212, but the greater part of the building is later. It has two naves parallel, originally for the use of the nuns and the parishioners respectively. The church of St Mary-le-Bow, in Cheapside, is built upon a Norman crypt, and that of St Olave's, Hart Street, which was Pepys's church and contains a modern memorial to him, is of the 15th century. Other ancient churches outside the City are few; but there may be noted St Margaret's, under the shadow of Westminster Abbey; and the beautiful Ely Chapel in Holborn (*q.v.*), the only remnant of a palace of the bishops of Ely, now used by the Roman Catholics. The Chapel Royal, Savoy, near the Strand, was rebuilt by Henry VII. on the site of Savoy Palace, which was erected by Peter, earl of Savoy and Richmond, in 1245, and destroyed in the insurrection of Wat Tyler in 1381. In 1505 Henry VII. endowed here a hospital of St John the Baptist for the poor. The chapel was used as the parish church of St Mary-le-Strand (1564-1717) and constituted a Chapel Royal in 1773; but there are no remains of the rest of the foundation.

The architect to whom, after the great fire of 1666, the opportunity fell of leaving the marks of his influence upon London was Sir Christopher Wren. Had all his schemes been followed out, that influence would have extended beyond architecture alone. He, among others, prepared designs for laying out the City anew. But no such model city was destined to be built; the necessity for haste and the jealous guardianship of rights to old foundations resulted in the old lines being generally followed. It is characteristic of London that St Paul's Cathedral (*q.v.*) should be closely hemmed in by houses, and its majestic west front approached obliquely by a winding thoroughfare. The cathedral is Wren's crowning work. It is the scene from time to time of splendid ceremonies, and contains the tombs of many great men; but in this respect it

Sir Christopher Wren.

cannot compete with the peculiar associations of Westminster Abbey. Of Wren's other churches it is to be noted that the necessity of economy usually led him to pay special attention to a single feature. He generally chose the steeple, and there are many fine examples of his work in this department. The steeple of St Mary-le-Bow, commonly called Bow Church, is one of the most noteworthy. This church has various points of interest besides its Norman crypt, from which it took the name of Bow, being the first church in London built on arches. The ecclesiastical Court of Arches sat here formerly. "Bow bells" are famous, and any person born within hearing of them is said to be a "Cockney," a term now applied particularly to the dialect of the lower classes in London. Wren occasionally followed the Gothic model, as in St Antholin. The classic style, however, was generally adopted in the period succeeding his own. Some fine churches belong to this period, such as St Martin's-in-the-Fields (1726), the Corinthian portico of which rises on the upper part of Trafalgar Square; but other examples are regrettable. While the architecture of the City churches, with the exceptions mentioned, is not as a rule remarkable, many are notable for the rich and beautiful wood-carving they contain. A Gothic style has been most commonly adopted in building modern churches; but of these the most notable, the Roman Catholic Westminster Cathedral (see WESTMINSTER), is Byzantine, and built principally of brick, with a lofty campanile. The only other ecclesiastical building to be specially mentioned is Lambeth Palace, opposite to the Houses of Parliament across the Thames. It has been a seat of the archbishops of Canterbury since 1197, and though the present residential portion dates only from the early 19th century, the chapel, hall and other parts are of the 13th century and later (see LAMBETH).

Later churches.

Among secular buildings, there is none more venerable than the Tower of London (*q.v.*), the moated fortress which overlooks the Thames at the eastern boundary of the City. It presents fine examples of Norman architecture; its historical associations are of the highest interest, and its armoury and the regalia of England, which are kept here, attract great numbers of visitors.

Tower of London.

The Houses of Parliament, with Westminster Abbey and St Margaret's Church, complete the finest group of buildings which London possesses; a group essentially Gothic, for the Houses of Parliament, completed in 1867 from the designs of Barry, are in a late Perpendicular style. They cover a great area, the east front giving immediately upon the Thames. The principal external features are the huge Victoria Tower at the south, and the clock tower, with its well-known chimes and the hour-bell "Big Ben," on the north. Some of the apartments are magnificently adorned within, and the building incorporates the ancient Westminster Hall, belonging to the former royal palace on the site (see WESTMINSTER). The government offices are principally in Whitehall, the fine thoroughfare which connects Parliament Square, in the angle between the Houses and the Abbey, with Trafalgar Square. Somerset House (1776-1786), a massive range of buildings by Sir William Chambers, surrounding a quadrangle, and having its front upon the Strand and back upon the Victoria Embankment, occupies the site of a palace founded by the protector Somerset, c. 1548. It contains the Exchequer and Audit, Inland Revenue, Probate, Registrar-General's and other offices, and one wing houses King's College. Other offices are the New Record Office, the repository of State papers and other records, and the Patent Office in Chancery Lane. The Heralds' College or College of Arms, the official authority in matters of armorial bearings and pedigrees, occupies a building in Queen Victoria Street, City, erected subsequently to the great fire (1683). The Royal Courts of Justice or Law Courts stand adjacent to the Inns of Court, facing the Strand at the point where a memorial marks the site of Old Temple Bar (1672), at the entrance to the City, removed in 1878 and later re-erected at Theobald's Park, near Cheshunt, Hertfordshire. The Law Courts (1882) were erected from the designs of G. E. Street, in a Gothic style.

Government buildings.

The buildings connected with local government in London are with one exception modern, and handsome town-halls have been erected for some of the boroughs. The exception is the Guildhall (*q.v.*) of the City Corporation, with its splendid hall, the scene of meetings and entertainments of the corporation, its council chamber, library and crypt (partly opened to the public in 1910). In 1906 the London County Council obtained parliamentary sanction for the erection of a county hall on the south bank of the Thames, immediately east of Westminster Bridge, and in 1908 a design submitted by Mr Ralph Knott was accepted in competition. The style prescribed was English Renaissance. Several of the great livery companies or gilds of the City possess fine halls, containing portraits and other collections of high interest and value. Among the more notable of these halls are those of the Mercers, Drapers, Fishmongers, Clothworkers, Armourers and Stationers.

The former royal palaces of Westminster and of Whitehall, of which the fine Jacobean banqueting hall remains, are described under WESTMINSTER. The present London residence of the sovereign is Buckingham Palace, on the west side of St James's Park, with beautiful gardens behind it. Buckingham House was built in 1705 for the duke of Buckinghamshire, and purchased by George III. in 1762. The existing palace was finished by John Nash in 1835, but did not meet with approval, and was considerably altered before Queen Victoria occupied it in 1837. As regards its exterior appearance it is one of the least satisfactory of London's great buildings, though the throne room and other state apartments are magnificent within. The picture gallery contains valuable works of Dutch masters and others. The front of the palace forms the background to the public memorial to Queen Victoria, at the head of the Mall. Provision was made in the design, by Sir Aston Webb, for the extension of the Mall to open upon Trafalgar Square, through gateways in a semicircular range of buildings to be occupied by government offices, and for a wide circular space in front of the Palace, with a statue of the Queen by Thomas Brock in its centre. St James's Palace, at the north side of St James's Park, was acquired and rebuilt by Henry VIII., having been formerly a hospital founded in the 12th century for leprous maidens. It was the royal residence after the destruction of Whitehall by fire in the time of William III. until a fire in 1809 destroyed the greater part. Only the gateway and certain apartments remain of the Tudor building. Marlborough House, adjacent to the palace, was built by the first duke of Marlborough in 1710 from the designs of Wren, came into possession of the Crown in 1817, and has been occupied since 1863 by the prince of Wales. In Kensington (*q.v.*), on the west side of Kensington Gardens, is the palace acquired by William III. as a country seat, and though no longer used by the sovereign, is in part occupied by members of the royal family, and possesses a deeper historical interest than the other royal palaces, as the birthplace of Queen Victoria and her residence in youth.

Royal palaces.

There are few survivals of ancient domestic architecture in London, but the gabled and timbered front of Staple Inn, Holborn (*q.v.*) is a picturesque fragment. In Bishopsgate Street, City, stood Crosby Hall, which belonged to Crosby Place, the mansion of Sir John Crosby (d. 1475). Richard III. occupied the mansion as duke of Gloucester and Lord Protector (cf. Shakespeare's *Richard III.*, Act i. Sc. 3, &c.) The hall was removed in 1908, in spite of strong efforts to preserve it, which resulted in its re-erection on a site in Chelsea. The hall of the Middle Temple is an admirable example of a refectory of later date (1572).

A fine though circumscribed group of buildings is that in the heart of the City which includes the Bank of England, the Royal Exchange and the Mansion House. The Bank is a characteristic building, quadrilateral, massive and low, but covering a large area, without external windows, and almost wholly unadorned; though the north-west corner is copied from the Temple of the Sibyl at Tivoli. The building is mainly the work of Sir John Soane (*c.* 1788). The first building for the Royal Exchange was erected and presented to the City by Sir Thomas Gresham (1565-1570) whose crest, a grasshopper, appears in the wind-vane above the present building. Gresham's Exchange was destroyed in the great fire of 1666; and the subsequent building was similarly destroyed in 1838. The present building has an imposing Corinthian portico, and encloses a court surrounded by an ambulatory adorned with historical paintings by Leighton, Seymour Lucas, Stanhope Forbes and others. The Mansion House was erected *c.* 1740.

The only other public buildings, beyond those at Westminster, which fall into a great group are the modern museums, the Imperial Institute, London University and other institutions, and Albert Hall, which lie between Kensington Gore and Brompton and Cromwell Roads, and these, together with the National Gallery (in Trafalgar Square) and other art galleries, and the principal scientific, educational and recreative institutions, are considered in Section V.

Monuments and Memorials.—The Monument (1677), Fish Street Hill, City, erected from the designs of Wren in commemoration of the great fire of 1666, is a Doric column surmounted by a gilt representation of a flaming urn. The Nelson Column, the central feature of Trafalgar Square, is from the designs of William Railton (1843), crowned with a statue of Nelson by Baily, and has at its base four colossal lions in bronze, modelled by Sir Edwin Landseer. A statue of the duke of Cambridge, by Captain Adrian Jones, was unveiled in 1907 in front of the War Office, Whitehall. The duke of York's Column, Carlton House Terrace (1833), an Ionic pillar, is surmounted by a bronze statue by Sir Richard Westmacott. The Westminster Column, outside the entrance to Dean's Yard, was erected to the memory of the old pupils of Westminster School who died in the Russian and Indian wars of 1854-1859. The Guards Memorial, Waterloo Place, commemorates the foot guards who died in the Crimea. The Albert Memorial, Kensington Gardens, was erected (1872) by "Queen Victoria and her People to the memory of Albert, Prince Consort," from the designs of Sir Gilbert Scott, with a statue of the Prince (1876) by John Henry Foley beneath a huge ornate Gothic canopy. At the eastern end of the Strand a memorial with statue by Hamo Thorneycroft of William Ewart Gladstone was unveiled in 1905. In Parliament Square and elsewhere are numerous statues, some of high merit, but it cannot be said that statuary occupies an important place in the adornment of streets and open places in London. Cleopatra's Needle, an ancient Egyptian monument, was presented to the government by Mehemet Ali in 1819, brought from Alexandria in 1878, and erected on the Victoria embankment on a pedestal of grey granite.

Nomenclature.—Having regard to the destruction of visible evidences of antiquity in London, both through accidental agencies such as the great fire, and through inevitable modernizing influences, it is well that historical associations in nomenclature are preserved in a great measure unimpaired. The City naturally offers the richest field for study in this direction. The derivations of names may here be grouped into two classes, those having a commercial connexion, and those associated with ancient buildings, particularly the City wall and ecclesiastical foundations. Among examples of the first group, Cheapside is prominent. This modern thoroughfare of shops was in early times the Chepe (O. Eng. *ceap*, bargain), an open place occupied by a market, having, until the 14th century, a space set apart for popular entertainments. There was a Queen Eleanor cross here, and conduits supplied the city with water. Modern Cheapside merges eastward into the street called the Poultry, from the poulterers' stalls "but lately departed from thence," according to Stow, at the close of the 16th century. Cornhill, again, recalls the cornmarket "time out of mind there holden" (Stow), and Gracechurch Street was corrupted from the name of the church of St Benet Grasschurch (destroyed by the great fire, rebuilt, and removed in 1868), which was said to be derived from a herb-market held under its walls. The Jews had their quarter near the commercial centre, their presence being indicated by the street named Old Jewry, though it is probable that they did not reoccupy this locality after their expulsion in 1290. Lombard Street similarly points to the residence of Lombard merchants, the name existing when Edward II. confirmed a grant to Florentine merchants in 1318, while the Lombards maintained their position until Tudor times. Paternoster Row, still occupied by booksellers, takes name from the sellers of prayer-books and writers of texts who collected under the shadow of St Paul's Cathedral. As regards names derived from ancient buildings, instances are the streets called London Wall and Barbican, and those named after the numerous gates. Of those associated with ecclesiastical foundations several occur in the course of this article (Section II., *Ecclesiastical Architecture*, &c.). Such are Austin Friars, Crutched Friars, Blackfriars and Whitefriars. To this last district a curious alternative name, Alsatia, was given, probably in the 17th century, with reference to its notoriety as a hiding-place of debtors. A derivation is suggested from the disputed territory of Alsace, pointing the contrast between this lawless district and the adjacent Temple, the home of the law itself. The name Bridewell came from a well near the Fleet (New Bridge Street), dedicated to St Bride, and was attached to a house built by Henry VIII. (1522), but is most familiar in its application to the house of correction instituted by Edward VI., which remained a prison till 1863. The Minories, a street leading south from Aldgate, takes name from an abbey of nuns of St Clare (*Sorores Minores*) founded in 1293. Apart from the City an interesting ecclesiastical survival is the name Broad Sanctuary, Westminster, recalling the place of sanctuary which long survived the monastery under the protection of which it originally existed. Covent Garden, again, took its name from a convent garden belonging to Westminster. Among the survivals of names of non-ecclesiastical buildings Castle Baynard may be noted; it stood in the City on the banks of the Thames, and was held by Ralph Baynard, a Norman, in the time of william the Conqueror; a later building being erected in 1428 by Humphrey duke of Gloucester. Here Richard III. was acclaimed king, and the mansion was used by Henry VII. and Henry VIII. Its name is kept in a wharf and a ward of the City.

The survival of names of obliterated physical features or characteristics is illustrated in Section I.; but additional instances are found in the Strand, which originally ran close to the sloping bank of the Thames, and in Smithfield, now the central meat market, but for long the "smooth field" where a cattle and hay market was held, and the scene of tournaments and games, and also of executions. Here in 1381 Wat Tyler the rebel was killed by Sir William Walworth during the parley with Richard II. In the West End of London the majority of important street-names are naturally of a later derivation than those in the ancient City, though Charing Cross (*q.v.*) is an instance of an exception. The derivation commonly accepted for Piccadilly is from *pickadil*, a stiff collar or hem in fashion in the early part of the 17th century (Span. *picca*, a spear-head). In Pall Mall and the neighbouring Mall in St James' Park is found the title of a game resembling croquet (Fr. *paille maille*) in favour at or before the time of Charles I., though the Mall was laid out for the game by Charles II. Other names pointing to the existence of pastimes now extinct are found elsewhere in London, as in Balls Pond Road, Islington, where in the 17th century was a proprietary pond for the sport of duck-hunting. An entertainment of another form is recalled in the name of Spring Gardens, St James' Park, where at the time of James I. there was a fountain or spring so arranged as to besprinkle those who trod unwarily on the valve which opened it. Many of the names of the rich residential streets and squares in the west have associations with the various owners of the properties; but Mayfair is so called from a fair held on this ground in May as early as the reign of Charles II. Finally there are several survivals, in street-names, of former private mansions and other buildings. Thus the district of the Adelphi, south of Charing Cross, takes name from the block of dwellings and offices erected in 1768 by the brothers (Gr. *adelphi*) Robert and William Adam, Scottish architects. In Piccadilly Clarendon House, erected in 1664 by Edward Hyde, earl of Clarendon, became Albemarle House when acquired by the duke of Albemarle in 1675. Northumberland House, from which is named Northumberland Avenue, opening upon Trafalgar Square, was built *c.* 1605 by Henry Howard, earl of Northampton, and was acquired by marriage by Algernon Percy, earl of Northumberland, in 1642. It took name from this family, and stood until 1874. Arundel House, originally a seat of the bishops of Bath, was the residence of Thomas Howard, earl of Arundel, whose famous collection of sculpture, the Arundel Marbles, was housed here until presented to Oxford University in 1667. The site of the house is marked by Arundel Street, Strand.

Railways.—The trunk railways leaving London, with their termini, are as follows: (1) *Northern*. The Great Northern, Midland and London & North-Western systems have adjacent termini, namely King's Cross, St Pancras and Euston, in Euston Road, St Pancras. The terminus of the Great Central railway is Marylebone, in the road of that name. (2) *Western*. The terminus of the Great Western railway is Paddington (Praed Street); and that of the London & South-Western, Waterloo, south of the Thames in Lambeth. (3) *Southern.* The London, Brighton & South Coast railway has its western terminus at Victoria, and its central terminus at London Bridge, on the south side of the Thames. The South-Eastern & Chatham railway has four terminal stations, all on or close to the north bank of the river—Victoria, Charing Cross,[2] Holborn Viaduct and Cannon Street (City). St Paul's Station on the Holborn branch is also terminal in part. (4) *Eastern.* The principal terminus of the Great Eastern Railway is in Liverpool Street (City), but the company also uses Fenchurch Street (City), the terminus of the London, Tilbury & Southend railway, and St Pancras. These lines, especially the southern lines, the Great Eastern, Great Northern and South-Western carry a very heavy suburban traffic. Systems of joint lines and running powers are maintained to afford communication between the main lines. Thus the West London Extension line carries local traffic between the North Western and Great Western and the Brighton and South-Western systems, while the Metropolitan Extension through the City connects the Midland and Great Northern with the South-Eastern & Chatham lines.

The railways whose systems are mainly or wholly confined within the metropolitan area are as follows. The North London railway has a terminal station at Broad Street, City, and serves the parts of London implied by its name. The company possesses running powers over the lines of various other companies: thus its trains run as far north as Potter's Bar on the Great Northern line, while it serves Richmond on the west and Poplar on the east. The East London line connects Shoreditch with New Cross (Deptford) by way of the Thames Tunnel, a subway under the river originally built for foot-passengers. The London & India Docks line connects the city with the docks on the north bank of the river as far as North Woolwich. The Metropolitan railway has a line from Baker Street through north-west London to Harrow, continuing to Uxbridge, while the original main line runs on to Rickmansworth, Aylesbury and Verney Junction, but has been worked by the Metropolitan and Great Central companies jointly since 1906. Another line serves the western outskirts (Hammersmith, Richmond, &c.) from the city. Metropolitan trains also connect at New Cross with the south-eastern railway system. This company combines with the Metropolitan District to form the Inner Circle line, which has stations close to all the great railway termini north of the Thames. The Metropolitan District (commonly called the District) system serves Wimbledon, Richmond, Ealing and Harrow on the west, and passes eastward by Earl's Court, South Kensington, Victoria and Mansion House (City) to Whitechapel and Bow. The Metropolitan and the District lines within London are for the most part underground (this feature supplying the title of "the Underground" familiarly applied to both systems); the tunnels being constructed of brick. The earliest part of the system was opened in 1863. Although these railways, as far as concerns the districts they serve, form the fastest method of communication from point to point, their discomfort, arising mainly from the impossibility of proper ventilation, and various other disadvantages attendant upon the use of steam traction, led to a determination to adapt the lines to electrical working. Experiments on a short section of the line were made in 1900, and later schemes were set on foot to electrify the District system and bring under one general control this railway, other lines in deep level "tubes" between Baker Street and Waterloo, between Charing Cross, Euston and Hampstead, and between Hammersmith, Brompton, Piccadilly, King's Cross and Finsbury Park, and the London United Tramways Company. The Underground Electric Railways Company, which acquired a controlling influence over these concerns, undertook the construction of a great power station at Chelsea; while the Metropolitan Company, which had fallen into line with the District (not without dispute over the system of electrification to be adopted) erected a station at Neasden on the Aylesbury branch. Electric traction was gradually introduced on the Metropolitan and the District lines in 1906. The former company combined with the Great Western Company as regards the electrification of, and provision of stock for, the lines which they had previously worked jointly, from Edgware Road by Bishop's Road to Hammersmith, &c. The Baker Street & Waterloo railway (known as the "Bakerloo") was opened in 1906 and subsequently extended in one direction to Paddington and in the other to the Elephant and Castle. The Great Northern, Piccadilly & Brompton line, from Finsbury Park to Hammersmith, was opened early in 1907, and the Charing Cross, Euston & Hampstead line later in the same year. Deep-level electric railways ("tubes"), communicating with the surface by lifts, were already familiar in London. The first opened was the City & South London (1890), subsequently extended to run between Euston, the Angel, Islington, the Bank (City) and Clapham. Others are the Waterloo & City (1898) running from the terminus of the South-Western railway without intermediate stations to the Bank; the Central London (1900), from the Bank to Shepherd's Bush, Hammersmith; and the Great Northern & City (1904) from Finsbury Park (which is an important suburban junction on the Great Northern railway) to Moorgate Street.

Tramways.—The surface tramway system of London cannot be complete, as, within an area roughly represented by the boroughs of Chelsea, Kensington and Fulham, the city of Westminster and a considerable district north thereof, and the city of London, the existing streets could not accommodate tram lines along with other traffic over any great distance consecutively, and in point of fact there are few, beyond the embankment line from Blackfriars Bridge to Westminster Bridge, which connects with the southern system. Another line, running south from Islington, uses the shallow-level subway under Kingsway and connects with the embankment line. The northern, western and eastern outskirts and London south of the Thames are extensively served by trams. On the formation of the London County Council there were thirteen tramway companies in existence. Powers under the Tramways Act of 1870 were given to the council, enabling it to acquire possession of these undertakings, and within the county of London they have been for the most part so acquired, and are worked by the council. Outside the county both companies and local authorities own and work tramways. Both electric and horse traction are used; the latter, however, has been in great part displaced by the former. The total mileage for greater London is about 240.

Omnibuses.—The omnibus system is very extensive, embracing all the principal streets throughout the county and extending over a large part of Greater London. The two principal omnibus companies are the London General Omnibus and the London Road Car. The first omnibus ran between the Bank and Paddington in 1829. In 1905 and following years motor omnibuses (worked mostly by internal combustion engines) began to a large extent to supplant horse traction. The principal existing companies adopted them, and new companies were formed to work them exclusively. With their advantages of greater speed and carrying capacity over the horsed vehicles, their introduction was a most important development, though their working at first imposed a severe financial strain on many companies.

Cabs.—The horse-drawn cabs which ply for hire in the streets, or wait at authorized "cab-stands," are of two kinds, the "hansom," a two-wheeled vehicle so named after its inventor (1834) and the "four-wheeler." "Hackney coaches" for hire are first mentioned in 1625, when they were kept at inns, and numbered 20. Until 1832 their numbers were restricted, in 1662 to 400, in 1694 to 700, in 1771 to 1000. In some cases a driver owns his cab, but the majority of vehicles are let to drivers by owners, and the adjustment of terms between them has led to disputes from time to time. In 1894 a dispute necessitated the formulation of the "Asquith award" by the Rt. Hon. H. H. Asquith as home secretary, and subsequent modifications of this were only arrived at, as in 1904, after a strike of the drivers affected. A long-standing cause of complaint on the part of the public has been the common refusal of cab-drivers to accept their legal fares, but, on the other hand, several attempts to introduce cabs with an automatic taximeter failed, until the introduction of motor cabs, of which a few had already been plying for some time when in 1907 a large number, provided with taximeters, were put into service. Subsequently, as the number of "taxicabs" (see Motor Vehicles) increased, that of horse-cabs decreased.

Traffic Problem.—One of the most serious administrative problems met with in London is that of locomotion, especially as regards the regulation of traffic in the principal thoroughfares and at the busiest crossings. The police have powers of control over vehicles and exercise them admirably; their work in this respect is a constant source of wonder to foreign visitors. But this control does not meet the problem of actually lessening the number of vehicles in the main arteries of traffic. At such crossings as that of the Strand and Wellington Street, Ludgate Circus and south of the Thames, the Elephant and Castle, as also in the narrow streets of the City, congestion is often exceedingly severe, and is aggravated when any main street is under repair, and diversion of traffic through narrow side streets becomes necessary. Many street improvements were carried out, it is true, in the last half of the 19th century, the dates of the principal being as follows: 1854, Cannon Street; 1864, Southwark Street; 1870, Holborn Viaduct; 1871, Hamilton Place, Queen Victoria Street; 1876, Northumberland Avenue; 1882, Tooley Street; 1883, Hyde Park Corner; 1884, Eastcheap; 1886, Shaftesbury Avenue; 1887, Charing Cross Road; 1890-1892, Rosebery Avenue. At the beginning of the 20th century several important local widenings of streets were put in hand, as for example between Sloane Street and Hyde Park Corner, in the Strand and at the Marble Arch (1908). At the same period a great work was undertaken to meet the want of a proper central communication between north and south, namely, the construction of a broad thoroughfare, called Kingsway in honour of King Edward VII., from High Holborn opposite Southampton Row southward to the Strand, connexion with which is established at two points through a crescent named Aldwych. The idea of such a thoroughfare is traceable back to the time of William IV. The magnitude of the traffic problem as a whole may be best appreciated by examples of the vast schemes of improvement which from time to time have been put forward by responsible individuals. Thus Sir John Wolfe Barry, as chairman of the Council of the Society of Arts in 1899, proposed to alleviate congestion of traffic by bridges over and tunnels under the streets at six points, namely—Hyde Park Corner, Piccadilly Circus, Ludgate Circus, Oxford Street and Tottenham Court Road, Strand and Wellington Street, and Southwark Bridge and Upper Thames Street. Another scheme seriously suggested in 1904, to meet existing disabilities of communication between north and south by linking the northern and southern tramway services, involved the removal of the Charing Cross terminus of the South Eastern and Chatham railway to the south side of the river, and the construction of a new bridge in place of the railway bridge. The mere control of existing traffic, local street improvements and provision of new means of communication between casual points, were felt to miss the root of the problem, and in 1903 a Royal Commission was appointed to consider the whole question of locomotion and transport in London, expert evidence being taken from engineers, representatives of the various railway and other companies, of the County Council, borough councils and police, and others. The commission reported in 1905.[3] With regard to street improvements the most important recommendation was that of the construction of two main avenues 140 ft. wide, one running west and east, from Bayswater Road to Whitechapel, and passing through the city in the neighbourhood of London Wall, and another from Holloway to the Elephant and Castle, to cross the Thames by a new bridge above Blackfriars. Four lines of surface tramways and four railway lines in shallow tunnels were proposed along these avenues. Many widenings and other improvements of existing thoroughfares, and extensions of tramways were proposed, and detailed recommendations were made as regards urban and suburban railways, and the rehousing of the working population on the outskirts of London. Finally, the commission made the important recommendation that a traffic board should be established for London, to exercise a general supervision of traffic, and to act as a tribunal to which all schemes of railway and tramway construction should be referred.

Traffic commission 1903.

Thames Steamers.—A local passenger steamboat service on the Thames suffers from the disadvantage that the river does not provide the shortest route between points at any great distance apart, and that the main thoroughfares between east and west do not touch its banks, so that passengers along those thoroughfares are not tempted to use it as a channel of communication. High pier dues, moreover, contributed to the decline of the traffic, and attempts to overcome the disinclination of passengers to use the river (at any rate in winter) show a record of failure. The London, Westminster and Vauxhall Steamboat Company established in 1840 a service of seven steamboats between London Bridge and Vauxhall. This company was bought up by the Citizen and Iron Steamboat Companies in 1865. The City Steamboat Company, established in 1848, began with eight boats, and by 1865 had increased their fleet to seventeen, running from London Bridge to Chelsea. This company was taken over by the London Steamboat Company in 1875. The sinking of the “Princess Alice” in 1878 was a serious blow to the London Steamboat Company, which collapsed, and was succeeded by the River Thames Steamboat Navigation Company, which went into liquidation in 1887. The fleet was bought by a syndicate and sold to the Victoria Steamboat Association. The Thames Steamboat Company then took up the service, but early in 1902 announced that it would be discontinued, although in 1904 it was temporarily resumed. Meanwhile, however, in 1902 the London County Council had promoted a bill in Parliament to enable them to run a service of boats on the Thames. The bill was thrown out on this occasion, but was revived and passed in 1904, and on the 17th of June 1905 the service was put into operation. The boats, however, were worked at a loss, and the service was discontinued in 1909.

Foreign Communications.—A large pleasure traffic is maintained by the steamers of the New Palace Company and others in summer between London Bridge and Southend, Clacton and Harwich, Ramsgate, Margate and other resorts of the Kent coast, and Calais and Boulogne. Passenger steamers sail from the port of London to the principal ports of the British Isles and northern Europe, and to all parts of the world, but the most favoured passenger services to and from Europe and North America pass through other ports, to which the railways provide special services of trains from London. The principal travelling agency in London is that of Messrs Cook, whose head office is at Ludgate Circus. A number of sub-offices of large steamship lines are congregated in Cockspur Street, Trafalgar Square, and several of the principal railway companies have local offices throughout the centre of the metropolis for the issue of tickets and the collection and forwarding of luggage and parcels.

Post Office.—The General Post Office lies in the centre of the City on either side of the street called St Martin’s le Grand. The oldest portion of the buildings, Ionic in style, was designed by Sir Robert Smirke and erected in 1829. Here are the central offices of the letter, newspaper and telegraph departments, with the office of the Postmaster General; but the headquarters of the parcels department are at Mount Pleasant, Clerkenwell; those of the Post Office Savings Bank at Blythe Road, West Kensington, and those of the Money Order department in Queen Victoria Street. The postal area is divided into eight districts, commonly designated by initials (which it is customary to employ in writing addresses)—East Central (E.C., the City, north to Pentonville and City Roads, west to Gray’s Inn Road and the Law Courts); West Central (W.C., from Euston Road to the Thames, and west to Tottenham Court Road); West (W., from Piccadilly and Hyde Park north to Marylebone and Edgware Roads; the greater part of Paddington and Kensington, north part of Fulham and Hammersmith); South-west (S.W., City of Westminster south of Piccadilly, Chelsea, South Kensington, the greater part of Fulham, and London south of the Thames and west of Vauxhall Bridge); South-east (S.E., remainder of London south of the Thames); East (E., east of the City and Kingsland Road); North (N., west of Kingsland Road; Islington); North-west (N.W., greater part of St Pancras and St Marylebone, and Hampstead). The postal area excludes part of Woolwich within the county; but includes considerable areas outside the county in other directions, as West Ham, Leyton, &c., on the east; Woodford, Chingford, &c., on the north-east; Wood Green, Southgate and Finchley on the north; Hendon and Willesden on the north-west; Acton and Ealing, Barnes and Wimbledon on the west; and Penge and Beckenham on the south, wholly or in part. There are ten district head offices and about a thousand local offices in the metropolitan district.

Telephones.—The National Telephone Company, working under licence expiring on the 31st of December 1911, had until 1901 practically a monopoly of telephonic communication within London, though the Post Office owned all the

trunk lines connecting the various telephone areas of the company. The company's management did not give satisfaction, and the use of the telephone was consequently restricted in the metropolis, when in 1898 a Select Committee on Telephones reported that "general immediate and effective" competition by either the government or local authority was necessary to ensure efficient working. The Post Office thereupon instituted a separate system of exchanges and lines, intercommunication between the two systems being arranged. Charges were reduced and efficiency benefited by this movement. The area covered by the local as distinct from the trunk service is about 630 sq. m. extending to Romford, Enfield, Harrow, &c., north of the Thames, and to Dartford Reigate, Epsom, &c., south of it. Public call offices are provided in numerous shops, railway stations and other public places, and at many post offices. The District Messengers Company affords facilities through local offices for the use of special messengers.

IV. Population, Public Health, &c.

The population of Greater London by the census of 1901 was 6,581,402.

The following table gives comparisons between the figures of certain census returns for Greater London and its chief component parts, namely, the City, the county and the outer ring (*i.e.* Greater London outside the county). All the figures before those of 1901 are adjusted to these areas.

Year.	City.	County.	Outer Ring.	Greater London.
1801	128,129	831,181	155,334	1,114,644
1841	123,563	1,825,714	286,067	2,235,344
1881	50,569	3,779,728	936,364	4,766,661
1901	26,923	4,509,618	2,044,864	6,581,402

The reason for the decrease in the resident City population is to be found in the rapid extension of business premises, while the widening ramifications of the outer residential areas are illustrated by the increase in the later years of the population of the Outer Ring. The growth and population of London previous to the 19th century is considered under *History, ad. fin.*

Aliens.

The foreign-born population of London was 60,252 in 1881, and 135,377 in 1901. During 1901, 27,070 aliens (excluding sailors) arrived at the port, and in 1902, 33,060. Of these last Russians and Poles numbered 21,013; Germans, 3386; Austrians and Hungarians, 2197; Dutch, 1902; Norwegians, Swedes and Danes, 1341; and Rumanians, 1016. Other nationalities numbered below one thousand each. The foreign-born population shows a large increase in percentage to the whole, being 1.57 in 1881 and 2.98 in 1901. Residents of Irish birth have decreased since 1851; those of Scottish birth have increased steadily, and roughly as the population. German residents are found mainly in the western and west central districts; French mainly in the City of Westminster (especially the district of Soho), St Pancras and St Marylebone; Italians in Holborn (Saffron Hill), Soho and Finsbury; and Russians and Poles in Stepney and Bethnal Green.

Vital Statistics.—The following table shows the average birth rate and death-rate per thousand at stated periods.

Years.	Births.	Deaths.
1861-1880*	35.4	23.4
1891-1900*	30.3	19.2
1901-1904*	28.5	16.5
1905	27.1	15.6

* Average.

A comparison of the death-rate of London and those of other great towns in England and abroad is given here:—

	Average 1895-1904.	1905.
Leicester	16.7	13.3
Brussels	16.7	14.5
Bristol	16.9	14.6
Bradford	17.7	15.2
Leeds	19.1	15.2
London	18.2	15.6
Birmingham	20.2	16.2
Nottingham	18.4	16.5
Newcastle	20.9	16.8
Sheffield	19.6	17.0
Berlin	17.8	17.2
Paris	19.2	17.4
Manchester	22.6	18.0
New York	20.2	18.3
Vienna	20.0	19.0
Liverpool	23.2	19.6
Rome	19.1	20.6
St Petersburg	25.9	25.3

In 1905 the lowest death-rates among the metropolitan boroughs were returned by Hampstead (9.3), Lewisham (11.7), Wandsworth (12.6), Woolwich (12.8), Stoke Newington (12.9), and the highest by Shoreditch (19.7), Finsbury (19.0), Bermondsey (18.7), Bethnal Green (18.6) and Southwark (18.5). A return of the percentage of inhabitants dwelling in over-crowded tenements shows 2.7 for Lewisham, 4.5 for Wandsworth, 5.5 for Stoke Newington, and 6.4 for Hampstead, against 35.2 for Finsbury and 29.9 for Shoreditch.

Sanitation.—As regards sanitation London is under special regulations. When the statutes relating to public health were consolidated and amended in 1875 London was excluded; and the law applicable to it was specially consolidated and amended in 1891. The London County Council is a central sanitary authority; the City and metropolitan boroughs are sanitary districts, and the Corporation and borough councils are local sanitary authorities. The County Council deals directly with matters where uniformity of administration is essential, *e.g.* main drainage, housing of working classes, infant life protection, common lodging-houses and shelters, and contagious diseases of animals. With a further view to uniformity it has certain powers of supervision and control over local authorities, and can make by-laws respecting construction of local sewers, sanitary conveniences, offensive trades, slaughter-houses and dairies, and

prevention of nuisances outside the jurisdiction of local authorities. A medical officer of health for the whole county is appointed by the Council, which also pays half the salaries of local medical officers and sanitary inspectors. The Council may also act in cases of default by the local authorities, or may make representations to the Local Government Board respecting such default, whereupon the Board may direct the Council to withhold payment due to the local authority under the Equalization of Rates Act 1894.

The first act providing for a commission of sewers in London dates from 1531. Various works of a more or less imperfect character were carried out, such as the bridging over in 1637 of the river Fleet, which as early as 1307 had become inaccessible to shipping through the accumulation of filth. Scavengers were employed in early times, and sewage was received into wells and pumped into the kennels of the streets. A system of main drainage was inaugurated by the Commissioners of Sewers in 1849, but their work proceeded very slowly. It was carried on more effectively by the Metropolitan Board of Works (1856-1888) which expended over six-and-a-half millions sterling on the work. The London County Council maintained, completed and improved the system. The length of sewers in the main system is about 288 m., and their construction has cost about eight millions. The system covers the county of London, West Ham, Penge, Tottenham, Wood Green, and parts of Beckenham, Hornsey, Croydon, Willesden, East Ham and Acton. There are actually two distinct systems, north and south of the Thames, having separate outfall works on the north and south banks of the river, at Barking and Crossness. The clear effluent flows into the Thames, and the sludge is taken 50 m. out to sea. The annual cost of maintenance of the system exceeds £250,000. The sanitary authorities are concerned only with the supervision of house drainage, and the construction and maintenance of local sewers discharging into the main system. The Thames and the Lea Conservancies have powers to guard against the pollution of the rivers.

Drainage.

Hospitals.—The Metropolitan Asylums Board, though established in 1867 purely as a poor-law authority for the relief of the sick, insane and infirm paupers, has become a central hospital authority for infectious diseases, with power to receive into its hospitals persons, who are not paupers, suffering from fever, smallpox or diphtheria. Both the Board and the County Council have certain powers and duties of sanitary authority for the purpose of epidemic regulations. The local sanitary authorities carry out the provisions of the Infectious Diseases (Notification and Prevention) Acts, which for London are embodied in the Public Health (London) Act 1891. The Board has asylums for the insane at Tooting Bec (Wandsworth), Ealing (for children); King's Langley, Hertfordshire; Caterham, Surrey; and Darenth, Kent. There are twelve fever hospitals, including northern and southern convalescent hospitals. For smallpox the Board maintains hospital ships moored in the Thames at Dartford, and a land establishment at the same place. There are land and river ambulance services.

Metropolitan Asylums Board.

There are three regular funds in London for the support of hospitals. (1) King Edward's Hospital Fund (1897) founded by King Edward VII. as Prince of Wales in commemoration of the Diamond Jubilee of Queen Victoria. The League of Mercy, under royal charter, operates in conjunction with the Fund in the collection of small subscriptions. The Order of Mercy was instituted by the King as a reward for distinguished personal service. (2) The Metropolitan Hospital Sunday Fund, founded in 1873, draws the greater part of its revenue from collections in churches on stated occasions. (3) The Metropolitan Hospital Saturday Fund was founded in 1873, and is made up chiefly of small sums collected in places of business, &c. The following is a list of the principal London hospitals, with dates of foundation:—

1. *General Hospitals with Medical Schools* (all of which, with the exception of that of the Seamen's Hospital, are schools of London University):—

Charing Cross; Agar Street, Strand (1820).
Guy's; St Thomas Street, Southwark (1724).
King's College; Lincoln's Inn Fields (1839).
London; Whitechapel (1740).
Middlesex; Mortimer Street, Marylebone (1745).
North London, or University College; Gower Street (1833).
Royal Free; Gray's Inn Road (1828; on present site, 1842).
London School of Medicine for Women.
St Bartholomew's; Smithfield (1123; refounded 1547).
St George's; Hyde Park Corner (1733).
St Mary's; Paddington (1845).
St Thomas'; Lambeth (1213; on present site, 1871).
Seamen's Hospital Society; Greenwich (1821).
Westminster, facing the Abbey. (1720; on present site, 1834).

2. *General Hospitals without Schools*:—

Great Northern Central; Islington (1856; on present site, 1887).
Metropolitan; Hackney (1836).
Poplar Hospital for Accidents (1854).
West London; Hammersmith Road (1856).

3. *Hospitals for Special Purposes*:—

Brompton Consumption Hospital (1841).
Cancer Hospital; Brompton (1851).
City of London Hospital for diseases of the chest; Bethnal Green (1848).
East London Hospital for Children and Dispensary for Women; Shadwell (1868).
Hospital for Sick Children; Bloomsbury (1852).
London Fever Hospital; Islington (1802).
National Hospital for Paralysed and Epileptics; Bloomsbury (1859).
Royal Hospital for Incurables; Putney (1854).
Royal London Ophthalmic Hospital; City Road (1804; on present site, 1899).

(See also separate articles on boroughs.)

Water Supply.—In the 12th century London was supplied with water from local streams and wells, of which Holy Well, Clerk's Well (Clerkenwell) and St Clement's Well, near St Clement's Inn, were examples. In 1236 the magistrates purchased the liberty to convey the waters of the Tyburn from Paddington to the City by leaden pipes, and a great conduit was erected in West Cheap in 1285. Other conduits were subsequently built (cf. Conduit Street off Bond Street, Lamb's Conduit Street, Bloomsbury); and water was also supplied by the company of water-bearers in leathern panniers borne by horses. In 1582 Peter Moris, a Dutchman, erected a "forcier" on an arch of London Bridge, which he rented for 10s. per annum for 500 years. His works succeeded and increased, and continued in his family till 1701, when a company took over the lease. Other forciers had been set up, and in 1609, on an act of 1605, Sir Hugh Myddelton undertook the task of supplying reservoirs at Clerkenwell through the New river from springs near Ware,

Hertfordshire; and these were opened in 1613. In 1630 a scheme to bring water from Hoddesdon on the Lea was promoted by aid of a lottery licensed by Charles I. The Chelsea Water Company opened its supply from the Thames in 1721; the Lambeth waterworks were erected in 1783; the Vauxhall Company was established in 1805, the West Middlesex, near Hammersmith, and the East London on the river Lea in 1806, the Kent on the Ravensbourne (Deptford) in 1810, the Grand Junction in 1811, and the Southwark (which amalgamated with the Vauxhall) in 1822.

For many years proposals to amalgamate the working of the companies and displace them by a central public authority were put forward from time to time. The difficulty of administration lay in the fact that of the area of 620 sq. m. constituting what is known as "Water London" (see map in *London Statistics*, vol. xix., issued by the L.C.C., 1909) the London County Council has authority over little more than one-third, and therefore when the Council proposed to acquire the eight undertakings concerned its scheme was opposed not only by the companies but by the county councils and local authorities outside the County of London. The Council had a scheme of bringing water to London from Wales, in view of increasing demands on a stationary supply. This involved impounding the headwaters of the Wye, the Towey and the Usk, and the total cost was estimated to exceed fifteen millions sterling. The capacity of existing sources, however, was deemed sufficient by a Royal Commission under Lord Balfour of Burleigh in 1893, and this opinion was endorsed by a further Commission under Lord Llandaff. The construction of large storage reservoirs was recommended, and this work was put in hand jointly by the New River, West Middlesex and Grand Junction companies at Staines on the Thames. As regards administration, Lord Llandaff's Commission recommended the creation of a Water Trust, and in 1902 the Metropolis Water Act constituted the Metropolitan Water Board to purchase and carry on the undertakings of the eight companies, and of certain local authorities. It consists of 66 members, appointed by the London County Council (14), the City of London and the City of Westminster (2 each), the other Metropolitan boroughs (1 each), the county councils of Middlesex, Hertfordshire, Essex, Kent and Surrey (l each), borough of West Ham (2), various groups of other boroughs and urban districts, and the Thames and the Lea Conservancies. The first election of the Board took place in 1903. The 24th of June, 1904, was the date fixed on which control passed to the Board, and in the meantime a Court of Arbitration adjudicated the claims of the companies for compensation for the acquisition of their properties.

Metropolitan Water Board.

"Water London" is an irregular area extending from Ware in Hertfordshire to Sevenoaks in Kent, and westward as far as Ealing and Sunbury.

A constant supply is maintained generally throughout "Water London," although a suspension between certain hours has been occasionally necessitated, as in 1895 and 1898, when, during summer droughts, the East London supply was so affected. During these periods other companies had a surplus of water, and in 1899 an act was passed providing for the interconnexion of systems. The Thames and Lea are the principal sources of supply, but the Kent and (partially) the New River Company draw supplies from springs. The systems of filtration employed by the different companies varied in efficacy, but both the Royal Commissions decided that water as supplied to the consumer was generally of a very high standard of purity. The expenditure of the Water Board for 1907-1908 amounted to £2,846,265. Debt charges absorbed £1,512,718 of this amount.

Public baths and washhouses are provided by local authorities under various acts between 1846 and 1896, which have been adopted by all the borough councils.

Lighting.—From 1416 citizens were obliged to hang out candles between certain hours on dark nights to illuminate the streets. An act of parliament enforced this in 1661; in 1684 Edward Heming, the inventor of oil lamps, obtained licence to supply public lights; and in 1736 the corporation took the matter in hand, levying a rate. Gas-lighting was introduced on one side of Pall Mall in 1807, and in 1810 the Gas Light & Coke Company received a charter, and developed gas-lighting in Westminster. The City of London Gas Company followed in 1817, and seven other companies soon after. Wasteful competition ensued until in 1857 an agreement was made between the companies to restrict their services to separate localities, and the Gas Light & Coke Company, by amalgamating other companies, then gradually acquired all the gas-lighting north of the Thames, while a considerable area in the south was provided for by another great gas company, the South Metropolitan. Various acts from 1860 onwards have laid down laws as to the quality and cost of gas. Gas must be supplied at 16-candle illuminating power, and is officially tested by the chemists' department of the London County Council. The amalgamations mentioned were effected subsequently to 1860, and there are now three principal companies within the county, the Gas Light & Coke, South Metropolitan and Commercial, though certain other companies supply some of the outlying districts. As regards street lighting, the extended use of burners with incandescent mantles has been of good effect. The Metropolitan Board of Works, and the commissioners of sewers in the City, began experiments with electric light. At the close of the 19th and the beginning of the 20th century a large number of electric light companies came into existence, and some of the metropolitan borough councils, and local authorities within Greater London, also undertook the supply. An extensive use of the light resulted in the principal streets and in shops, offices and private houses.

Fire.—In 1832 the fire insurance companies united to maintain a small fire brigade, and continued to do so until 1866. The brigade was confined to the central part of the metropolis; for the rest, the parochial authorities had charge of protection from fire. The central brigade came under the control of the Metropolitan Board of Works; and the County Council now manages the Metropolitan Fire Brigade, under a chief officer and a staff numbering about 1300. The cost of maintenance exceeds £200,000 annually; contributions towards this are made by the Treasury and the fire insurance companies. The Council controls the provision of fire escapes in factories employing over 40 persons, under an act of 1901; it also compels the maintenance of proper precautions against fire in theatres and places of entertainments. A Salvage Corps is independently maintained by the Insurance Companies.

Cemeteries.—The administrative authorities of cemeteries for the county are the borough councils and the City Corporation and private companies. The large cemetery at Brompton is the property of the government. Kensal Green cemetery, the burial-place of many famous persons, is of great extent, but several large cemeteries outside the metropolis have come into use. Such are that of the London Necropolis Company at Brookwood near Woking, Surrey, and that of the parishes of St Mary Abbots, Kensington, and St George, Hanover Square, at Hanwell, Middlesex. Crematoria are provided at certain of the companies' cemeteries, and the Cremation Act 1902 enabled borough councils to provide crematoria.

V. Education and Recreation

Education.—The British and Foreign School Society (1808) and the National Society (1811), together with the Ragged Schools Union (1844), were the only special organizations providing for the education of the poorer classes until 1870. To meet the demand for elementary education, increasing as it did with population, was beyond the powers of these societies, the churches and the various charitable institutions. Thus a return of 1871 showed that the schools were capable of accommodating only 39% of the children of school-going age. In 1870, however, a School Board had been created in addition, and this body carried out much good work during its thirty-four years of existence. In 1903 the Education (London) Act was passed in pursuance of the general system, put into operation by the Education Act (1902) of bringing education within the scope of municipal government. The County Council was created a local education authority, and given control of secular

Elementary education.

education in both board and voluntary schools. It appoints an education committee in accordance with a scheme approved by the Board of Education. This scheme must allow of the Council selecting at least a majority of the committee, and must provide for the inclusion of experts and women. Each school or group of schools is under a body of managers, in the appointment of whom the borough council and the County Council share in the following proportions:—(*a*) *Board or provided schools*; borough council, two-thirds; county council, one-third: (*b*) *Voluntary or non-provided schools*; the foundation, two-thirds; borough council and county council, each one-sixth. The total number of public elementary schools was 963 in 1905, with 752,487 scholars on the register. Other institutions include higher elementary schools for pupils certified to be able to profit by higher instruction; and schools for blind, deaf and defective children. Instruction for teachers is provided in pupil teachers' centres (preparatory), and in residential and day training colleges. There are about 15 such colleges. Previous to the act of 1903 the County Council had educational powers under the Technical Instructions Acts which enabled it to provide technical education through a special board, merged by the act of 1903 in the education committee. The City and Guilds of London Institute, Gresham College, also maintains various technical institutions. The establishment of polytechnics was provided for by the City of London Parochial Charities Act 1883; the charities being administered by trustees. The model institution was that of Mr Quintin Hogg (1880) in Regent Street, where a striking statue by George Frampton (1906) commemorates him. The general scope of the polytechnics is to give instruction both in general knowledge and special crafts or trades by means of classes, lectures and laboratories, instructive entertainments and exhibitions, and facilities for bodily and mental exercise (gymnasia, libraries, &c.). Other similar institutions exist primarily for special purposes, as the St Bride Foundation Institute, near Fleet Street, in immediate proximity to the great newspaper offices, for the printing trade, and the Herolds' Institute, a branch of the Borough Polytechnic situated in Bermondsey, for the purposes of the leather trade. The County Council also aids numerous separate schools of art, both general and special, such as the Royal School of Art Needlework and the School of Art Woodcarving; the City and Guilds Institute maintains similar establishments at some of its colleges, and art schools are also generally attached to the polytechnics.

Technical education.

The London County Council maintains a number of industrial schools and reformatories, both in London and in the country, for children who have shown or are likely to be misled into a tendency towards lawlessness. The City Corporation has separate responsibilities in the same direction, but has no schools of its own. The expenditure of the London County Council on education for 1907-1908 was £4,281,291 for elementary education, and £742,962 for higher education.

Philanthropical institutions.

The work of private philanthropists and philanthropical bodies among the poor of East London, Southwark and Bermondsey, and elsewhere, fails to be noticed at this point. The labours of the regular clergy here lie largely in the direction of social reform, and churches and missions have been established and are maintained by colleges, such as Christ Church, Oxford, schools and other bodies. There are, further, "settlements" where members of the various bodies may reside in order to devote themselves to philanthropical work; and these include clubs, recreation rooms and other institutions for the use of the poor. Such are the Oxford House, Bethnal Green; the Cambridge House, Camberwell Road; Toynbee Hall, Whitechapel; Mansfield House, Canning Town; the Robert Browning Settlement, Southwark; and the Passmore Edwards Settlement, St Pancras. There are also several women's settlements of a similar character. The People's Palace, Mile End Road, opened in 1887, is both a recreative and an educational institution (called East London College) erected and subsequently extended mainly through the liberality of the Drapers' Company and of private donors.

In early times the priories and other religious houses had generally grammar schools attached to them. Those at St Peter's, Westminster, and St Paul's, attained a fame which has survived, while other similar foundations lapsed, such as St Anthony's (Threadneedle Street, City), at which Sir Thomas More, Archbishop Whitgift and many other men of eminence received education. Certain of the schools were re-endowed after the dissolution of the monasteries. St Peter's College or Westminster School (see WESTMINSTER) is unique among English public schools of the highest rank in maintaining its original situation in London. Other early metropolitan foundations have been moved in accordance with modern tendencies either into the country or to sites aloof from the heart of London. Thus Charterhouse school, part of the foundation of Sir Thomas Sutton (1611), was moved from Finsbury to Godalming, Surrey; St Paul's School occupies modern buildings at Hammersmith, and Christ's Hospital is at Horsham, Sussex. Of other schools, Merchant Taylors' was founded by the Company of that name in 1561, and has occupied, since 1875, the premises vacated by Charterhouse School. The Mercers' School, Dowgate, was originally attached to the hospital of St Thomas of Acon, which was sold to the Mercers' Company in 1522, on condition that the company should maintain the school. The City of London School, founded in Milk Street, Cheapside, by the City Corporation in 1835, occupies modern buildings on the Victoria Embankment. Dulwich College originated in the foundation of the College of God's Gift by Edward Alleyn in 1626, and is now constituted as one of the principal English public schools. St Olave's and St Saviour's grammar school, Southwark, received its charter in 1571. Both classical and modern education is provided; a large number of scholarships are maintained out of the foundation, and exhibitions from the school to the universities and other higher educational institutions.

Public schools.

London University.—The University of London was incorporated by royal charter in 1836, as an examining body for conferring degrees. Its scope and powers were extended by subsequent charters, and in 1900, under the University of London Act 1898, it was reorganized as both a teaching and an examining body. The function of the academic department is to control the teaching branch, internal examinations, &c., and that of the external department to control external examinations, while the university extension system occupies a third department. The university is governed by a senate consisting of a chancellor, chairman of convocation and 54 members, whose appointment is shared by the Crown, convocation, the Royal Colleges of Physicians and of Surgeons, the Inns of Court, the Law Society, the London County Council, City Corporation, City and Guilds Institute, University and King's Colleges and the faculties. The faculties are theology, arts, law, music, medicine, science, engineering and economics. The schools of the University include University College, Gower Street, and King's College, Somerset House (with both of which preparatory schools are connected), East London College and numerous institutions devoted to special faculties both within and without London. The university in part occupies buildings which formerly belonged to the Imperial Institute.

Other Educational Institutions.—The Board of Education directly administers the following educational institutions—the Victoria and Albert Museum, South Kensington, with its branch at Bethnal Green, from both of which objects are lent to various institutions for educational purposes; the Royal College of Science, South Kensington, with which is incorporated the Royal School of Mines; the Geological Survey of the United Kingdom and the Museum of Practical Geology, Jermyn Street; the Solar Physics Observatory, South Kensington; and the Royal College of Art, South Kensington. At Gresham College, Basinghall Street, City, founded in 1597 by Sir Thomas Gresham, and moved to its present site in 1843, lectures are given in the principal branches of science, law, divinity, medicine, &c.

Some further important establishments and institutions may be tabulated here:—

Architecture.—The Royal Institute of British Architects, Conduit Street, conducts examinations and awards diplomas.

Education.—The College of Preceptors, Bloomsbury, conducts examinations of persons engaged in education and awards diplomas.

Engineering.—A School of Practical Engineering is maintained at the Crystal Palace, Sydenham.

Law.—The Inns of Court are four—Middle Temple, Inner Temple, Lincoln's Inn, Gray's Inn. A joint board of examiners examines students previous to admission. The Council of Legal Education superintends the education and subsequent examination of students. (See Inns of Court.) The Law Society is the superintending body for examination and admission in the case of solicitors.

Medical.—The Royal College of Physicians is in Pall Mall East, and the Royal College of Surgeons is in Lincoln's Inn Fields. The Society of Apothecaries is in Water Lane, City. The Royal College of Veterinary Surgeons is in Red Lion Square, and the Royal Veterinary College at Camden Town. (The principal hospitals having schools are noted in the list of hospitals, Section VII.)

Military and Naval.—The Royal Military College and the Ordnance College are at Woolwich; the Royal Naval College at Greenwich.

Music.—The principal educational institutions are—the Royal Academy of Music, Tenterden Street, Hanover Square; the Royal College of Music, South Kensington; Guildhall School, City, near the Victoria Embankment; London College, Great Marlborough Street; Trinity College, Manchester Square; Victoria College, Berners Street; and the Royal College of Organists, Bloomsbury.

Scientific Societies.—Numerous learned societies have their headquarters in London, and the following may especially be noticed here. Burlington House, in Piccadilly, built in 1872 on the site of a mansion of the earls of Burlington, houses the Royal Society, the Chemical, Geological, Linnaean and Royal Astronomical Societies, the Society of Antiquaries and the British Association for the Advancement of Science, of which the annual meetings take place at different British or colonial towns in succession. The Royal Society, the most dignified and influential of all, was incorporated by Charles II. in 1663. It originally occupied rooms in Crane Court, City, and was moved in 1780 to Somerset House, where others of the societies named were also located. The Society of Arts, John Street, Adelphi, was established in 1754 for the encouragement of arts, manufactures and commerce. The Royal Institution, Albemarle Street, was founded in 1799, maintains a library and laboratories and promotes research in connexion with the experimental sciences. The Royal Geographical Society, occupying a building close to Burlington House in Savile Row, maintains a map-room open to the public, holds lectures by prominent explorers and geographers, and takes a leading part in the promotion of geographical discovery. The Royal Botanic Society has private gardens in the midst of Regent's Park, where flower shows and general entertainments are held. The Royal Horticultural Society maintains gardens at Wisley, Surrey, and has an exhibition hall in Vincent Square, Westminster. The exhibitions of the Royal Agricultural Society are held at Park Royal, near Willesden. The Zoological Society maintains a magnificent collection of living specimens in the Zoological Gardens, Regent's Park, a popular resort.

Museums, Art Galleries, Libraries.—In the British Museum London possesses one of the most celebrated collections in the world, originated in 1753 by the purchase of Sir Hans Sloane's collection and library by the government. The great building in Bloomsbury (1828-1852) with its massive Ionic portico, houses the collections of antiquities, coins, books, manuscripts and drawings, and contains the reading-rooms for the use of readers. The natural history branch was removed to a building at South Kensington (the Natural History Museum) in 1881, where the zoological, botanical and mineralogical exhibits are kept. Close to this museum is the Victoria and Albert Museum (formerly South Kensington Museum, 1857) for which an extension of buildings, from a fine design by Sir Aston Webb, was begun in 1899 and completed in ten years. Here are collections of pictures and drawings, including the Raphael cartoons, objects of art of every description, mechanical and scientific collections, and Japanese, Chinese and Persian collections, and an Indian section. In the vicinity, also, is the fine building of the Imperial Institute, founded in 1887 as an exhibition to illustrate the resources of all parts of the Empire, as well as an institution for the furtherance of imperial intercourse; though not developed on the scale originally intended. Other museums are Sir John Soane's collection in Lincoln's Inn Fields and the Museum of Practical Geology in Jermyn Street, while the scientific societies have libraries and in some cases collections of a specialized character, such as the museums of the Royal College of Surgeons, the Royal Architectural Society, and the Society of Art and the Parkes Museum of the Sanitary Institute. Among permanent art collections the first place is taken by the National Gallery in Trafalgar Square. This magnificent collection was originated in 1824, and the building dates from 1838, but has been more than once enlarged. The building of the National Portrait Gallery, adjoining it, dates from 1896, but the nucleus of the collection was formed in 1858. The munificence of Sir Henry Tate provided the gallery, commonly named after him, by the Thames near Vauxhall Bridge, which contains the national collection of British art. The Wallace collection of paintings and objects of art, in Hertford House, Manchester Square, was bequeathed to the nation by the widow of Sir Richard Wallace in 1897. Dulwich College possesses a fine series of paintings, of the Dutch and other schools, bequeathed by Sir P. F. Bourgeois in 1811. There are also notable collections of pictures in several of the mansions of the nobility, government buildings, halls of the City Companies and elsewhere. No gallery in London is exclusively or especially devoted to sculpture. Of the periodical art exhibitions that of the Royal Academy is most noteworthy. It is held annually at Burlington House from the first Monday in May to the first Monday in August. It consists mainly of paintings, but includes a few drawings and examples of sculpture. Earlier in each year exhibitions of works by deceased British artists and by old masters are held, and the Gibson and Diploma Galleries are permanent exhibitions. At the Guildhall special exhibitions are held from time to time. There are a number of art galleries in and about Bond Street and Piccadilly, Regent Street and Pall Mall, such as the New Gallery, where periodical exhibitions are given by the New English Art Club, the Royal Society of Painters in Water-Colours, the Royal Institute of Painters in Water-Colours, other societies and art dealers.

Municipal provision of public libraries under acts of 1892 and 1893 is general throughout London, and these institutions are exceedingly popular for purposes both of reference and of loan. The acts are extended to include the provisions of museums and art galleries, but the borough councils have not as a rule availed themselves of this extension. The London County Council administers the Horniman Museum at Forest Hill, Lewisham. The City Corporation maintains the fine Guildhall library and museum. A few free libraries are supported by donations and subscriptions or charities. Besides the Government reference libraries at the British Museum and South Kensington there are other such libraries, of a specialized character, as at the Patent Office and the Record Office. Among lending libraries should be noticed the London Library in St James's Square, Pall Mall.

Theatres and Places of Entertainment.—The principal London theatres lie between Piccadilly and Temple Bar, and High Holborn and Victoria Street, the majority being in Shaftesbury Avenue, the Haymarket, the neighbourhood of Charing Cross and the Strand. At these central theatres successful plays are allowed to "run" for protracted periods, but there are numerous fine houses in other parts of London which are generally occupied by a succession of touring companies presenting either revivals of popular plays or plays successful at the moment in the central theatres. The principal music halls (variety theatres) are in Shaftesbury Avenue, Piccadilly Circus, Leicester Square and the Strand. The Covent Garden theatre is the principal home of grand opera; the building, though spacious, suffers by comparison with the magnificence of opera houses in some other capitals, but during the opera season the scene within the theatre is brilliant. The chief halls devoted mainly to concerts are the Royal Albert Hall, close to the South Kensington museums, and Queen's Hall in Langham Place, Regent Street. For a long time St James's Hall (demolished in 1905) between Regent Street and Piccadilly was the chief concert hall. Oratorio is given usually in the Albert Hall, the vast area of which is especially suited for a large chorus and orchestra, and at the Crystal Palace (*q.v.*). This latter building, standing on high ground at Sydenham, and visible from far over the metropolis, is devoted not only to concerts, but to general entertainment, and the extensive grounds give accommodation for a variety of sports and amusements. Among

other popular places of entertainment may be mentioned the exhibition grounds and buildings at Earl's Court; similar grounds at Shepherd's Bush, where a Franco-British Exhibition was held in 1908, an Imperial Exhibition in 1909, and an Anglo-Japanese in 1910; the great Olympia hall, West Kensington; the celebrated wax-work exhibition of Madame Tussaud in Marylebone Road; the Alexandra Palace, Muswell Hill, an institution resembling the Crystal Palace; and the Agricultural Hall, Islington, where agricultural and other exhibitions are held. The well-known Egyptian Hall in Piccadilly was taken down in 1906, and the permanent conjuring entertainment for which (besides picture exhibitions) it was noted was removed elsewhere. Theatres, music halls, concert halls and other places of entertainment are licensed by the County Council, except that the licence for stage-plays is granted by the lord chamberlain under the Theatres Act 1843. The council provides for inspection of places of entertainment in respect of precautions against fire, structural safety, &c. The principal clubs are in and about Piccadilly and Pall Mall (see CLUB). A club for soldiers, sailors and marines in London, called the Union Jack Club, was opened in Waterloo Road by King Edward VII. in 1907.

Parks and Open Spaces: Administration.—The administration of parks and open spaces in and round London, topographical details of the principal of which are given in Section I., is divided between the Office of Works, the London County Council, the City Corporation and the borough councils. The Office of Works controls the Royal parks, the County Council controls the larger parks and open spaces not under Government or City control, and the borough councils the smaller; while the City Corporation controls certain public grounds outside the County of London. There are a few other bodies controlling particular open spaces, as the following list of public grounds exceeding 50 acres (in 1910) will show:—

1. *Under the Office of Works:—*		
Green Park	52¾	acres
Greenwich Park	185	”
Hyde Park	363¾	”
Kensington Gardens	274½	”
Regent's Park	472¼	”
St James's Park	93	”
2. *Under the War Office:—*		
Woolwich Common	159	”
3. *Under the London County Council:—*		
Avery Hill, Eltham	80	”
Battersea Park	199½	”
Blackheath	267	”
Bostall Heath and Woods, Woolwich	133¾	”
Brockwell Park, Herne Hill	127¼	”
Clapham Common	205	”
Clissold Park	54½	”
Dulwich Park	72	”
Finsbury Park	115	”
Hackney Marsh	339	”
Hainault Forest, Essex	805	”
Hampstead Heath	320½	”
Ladywell Ground, Lewisham	51½	”
Marble Hill, Twickenham	66	”
Millfields, Hackney	62½	”
Parliament Hill	267¼	”
Peckham Rye and Park	112¾	”
Plumstead Common	103	”
Southwark Park	63	”
Streatham Common	66¼	”
Tooting Bec Common	151¾	”
Tooting Graveney Common	66	”
Victoria Park, East London	217	”
Wandsworth Common	155	”
Wormwood Scrubbs	193	”
4. *Under the City Corporation:—*		
Burnham Beeches, Buckinghamshire	375	”
Coulsdon Commons, Surrey	347	”
Epping Forest, Essex	5559½	”
Highgate Woods	69	”
West Ham Park	77	”

Wimbledon and Putney Commons are under a board of conservators. The London County Council's parks and open spaces increased in number from 40 in 1890 to 114 in 1907, and in acreage from 2656 to 5006 in the same years. The expenditure in 1907-1908 was £131,582, which sum included £11,987 for bands. (See also separate articles on boroughs.)

Bathing (at certain hours) and boating are permitted in the ornamental waters in several of the parks, music is provided and much attention is paid to the protection of waterfowl and other birds, while herds of deer are maintained in some places, and also botanical gardens. Surplus plants and cuttings are generally distributed without charge to educational or charitable institutions, and to the poor. Provision is made for cricket, football and other games in a number of the parks. Large gatherings of spectators are attracted to the first-class cricket matches played at Lord's ground, St John's Wood, by the Marylebone Club and the Middlesex County teams, Eton College against Harrow School, and Oxford against Cambridge University; to the Kennington Oval for the matches of the Surrey club, and the Leyton ground for those of the Essex club. In the Crystal Palace grounds the final match for the English Association Football cup is generally played, and huge crowds from both the metropolis and the provinces witness the game. At Queen's Club, West Kensington, the annual Oxford and Cambridge athletic meeting and others take place, besides football matches, and there is covered accommodation for tennis and other games. Professional association football teams are maintained locally in several parts of London, and much popular interest is taken in their matches. Rugby football is upheld by such notable teams as Blackheath and Richmond. Fashionable society takes its pastimes at such centres as the grounds of the Hurlingham and Ranelagh clubs, at Fulham and Barnes respectively, where polo and other games are played; and Rotten Row, the horse-track in Hyde Park, is the favourite resort of riders. In summer, boating on the lovely reaches of the Thames above the metropolis forms the recreation of thousands. The growth of popularity of the cycle, and later of the motor-car, has been a principal factor in the wide development of a tendency to leave London during the "week-end," that is to say, as a rule, for Saturday afternoon and Sunday. With many this is a practice at all seasons, and the railway companies foster the habit by means of tickets at reduced fares to all parts. The watering-places of the Sussex, Kent and Essex coasts, and pre-eminently Brighton, are specially favoured for these

brief holidays.

VI. Commerce

Port of London.—The extent of the Port of London has been variously defined for different purposes, but for those of the Port Authority it is taken to extend from Teddington Lock to a line between Yantlet Creek in Kent and the City Stone opposite Canvey Isle and in Essex. London Bridge is to outward appearance the up-river limit of the port. There are wharves and a large carrying trade in barges above this point, but below it the river is crowded with shipping, and extensive docks open on either hand.

Towards the close of the 19th century evidence was accumulating that the development of the Port of London was not keeping pace with that of shipping generally. In 1900 a Royal Commission was appointed to investigate the existing administration of the port, the alleged inadequacy of accommodation for vessels and kindred questions, and to advance a scheme of reform. The report, issued in 1902, showed apprehension to be well founded. The river, it was ascertained, was not kept sufficiently dredged; the re-export trade was noted as showing an especially serious decline, and the administration was found to suffer from decentralization. The recommendations of the Commission included the creation of a single controlling authority to take over the powers of the Thames Conservancy Watermen's Company, and Trinity House and the docks of the companies already detailed. This authority, it was advised, should consist of 40 members, of whom 11 should be nominated by the London County Council and 3 by the Corporation of the City (supposing these bodies to accept certain financial responsibilities proposed in the direction of river improvements), 5 by the governors of the Bank of England from the mercantile community, 2 by the London Chamber of Commerce, and 1 each by the Admiralty, Board of Trade and Trinity House. The remaining members should be elected by various groups, *e.g.* shipowners, barge owners, the railway companies interested, &c. Rival schemes, however, were proposed by the London County Council, which proposed to take over the entire control through a committee, by the City Corporation, which suggested that it should appoint 10 instead of 3 members to the new board; and by the London Chamber of Commerce, which proposed a Harbour Trust of *ex-officio* and elected members. The Thames Conservancy also offered itself as the public authority. In 1902 a Mansion House Conference was convened by the lord mayor and a deputation was appointed which in 1903 pressed the solution of the matter upon the government.

A noteworthy scheme to improve the condition of the Thames, first put forward in 1902-1903, was that of constructing a dam with four locks across the river between Gravesend and Tilbury. The estimated cost was between three and four millions sterling, to be met by a toll, and it was urged that a uniform depth, independent of tides, would be ensured above the dam, that delay of large vessels wishing to proceed up river would thus be obviated, that the river would be relieved of pollution by the tides, and the necessity for constant dredging would be abolished. This "barrage scheme" was discussed at considerable length, and its theoretical advantages were not universally admitted. The scheme included a railway tunnel beneath the dam, for which, incidentally, a high military importance was claimed.

Thames barrage scheme.

In 1904 the Port of London Bill, embodying the recommendations of the Royal Commission with certain exceptions, was brought forward, but it was found impossible to carry it through. In 1908, however, the Port of London Act was passed, and came into force in 1909. This act provided for the establishment of a Port Authority, the constitution of which is detailed below, which took over the entire control of the port, together with the docks and other property of the several existing companies.

Port authorities before 1909.

The principal dock companies, with the docks owned by them, were as follows:—

1. *London and India Company.*—This company had amalgamated all the docks on the north side of the river except the Millwall Docks. Following the river down from the Tower these docks, with dates of original opening and existing extent, are—St Katherine's (1828; 10½ acres), London (1805; 57½ acres), West India, covering the northern part of the peninsula called the Isle of Dogs (1802; 121½ acres), East India, Blackwall (1806; 38 acres), Royal Victoria and Albert Docks (1876 and 1880 respectively), parallel with the river along Bugsby's and Woolwich Reaches, nearly 3 m. in distance (181 acres) and Tilbury Docks, 25 m. below London Bridge, constructed in 1886 by the East and West India Docks Company (65 acres). Tilbury Docks are used by the largest steamers trading with the port.

2. *Millwall Docks* (1868), in the south part of the Isle of Dogs, are 36 acres in extent.

3. *Surrey Commercial Docks*, Rotherhithe (Bermondsey), occupy a peninsula between the Lower Pool and Limehouse Reach. There have been docks at Rotherhithe since the middle of the 17th century. The total area is 176 acres, a large new dock, the Greenland, being opened in 1904.

The principal railways have wharves and through connexions for goods traffic, and huge warehouses are attached to the docks. The custom house stands on the north bank, a short distance from London Bridge, in Lower Thames Street. It dates from 1817, the body of the building being by Laing, but the Corinthian façade was added by Smirke. It includes a museum containing ancient documents and specimens of articles seized by the customs authorities.

The chief authorities concerned in the government of the Port of London till 1909 were:—

1. *Thames Conservancy.*—For conservancy purposes, regulation of navigation, removal of obstruction, dredging, &c.

2. *City Corporation.*—Port sanitary purposes from Teddington Lock seawards.

3. *Trinity House.*—Pilotage, lighting and buoying from London Bridge seawards.

4. *The Watermen's and Lightermen's Company.*—The licensing authority for watermen and lightermen.

Besides these authorities, the London County Council, the Board of Trade, the Admiralty, the Metropolitan and City Police, police of riparian boroughs, Kent and Essex Fisheries Commissioners, all the dock companies and others played some part in the government and public services of the port.

Port Authority.—The Port of London Authority, as constituted by the act of 1908, is a body corporate consisting of a chairman, vice-chairman, 17 members elected by payers of dues, wharfingers and owners of river craft, 1 member elected by wharfingers exclusively, and 10 members appointed by the following existing bodies—Admiralty (one); Board of Trade (two); London County Council (two from among its own members and two others); City Corporation (one from among its own members and one other); Trinity House (one). The Board of Trade and the County Council must each, under the act, consult with representatives of labour as to the appointment of one of the members, in order that labour may be represented on the Port Authority. The first "elected" members were actually, under the act, appointed by the Board of Trade. The undertakings of the three dock companies mentioned above were transferred to and vested in the Port Authority, an equivalent amount of port stock created under the act being issued to each. The Port Authority has full powers to authorize construction works. All the rights, powers and duties of the Thames Conservancy, so far as concerns the Thames below Teddington Lock, were transferred to the Port Authority under the act, as also were the powers of the Watermen's Company in respect of the registration and licensing of vessels, and the

regulation of lightermen and watermen. The Port Authority fixes the port rates, which, however, must not in any two consecutive years exceed one-thousandth part of the value of all imports and exports, or a three-thousandth of the value of goods discharged from or taken on board vessels not within the premises of a dock. Preferential dock charges are prohibited and a port fund established under the act. The authority has powers to borrow money, but for certain purposes in this connexion, as in other matters, it can only act subject to the approval of the Board of Trade.

Commerce.—The following figures may be quoted for purposes of comparison at different periods:—

Value of Exports of Home Produce (1840), £11,586,037; (1874), £60,232,118; (1880), £52,600,929; (1902-1905 average), £60,095,294. Imports (1880), £141,442,907; (1902-1905), £174,059,316. These figures point to the fact that London is essentially a mart, and neither is itself, nor is the especial outlet for, a large manufacturing centre; hence imports greatly exceed exports.

Vessels entered and cleared (foreign and colonial trade):—

Year.	Entered.	Cleared.
	Tonnage.	Tonnage.
1694	135,972	81,148
1750	511,680	179,860
1800	796,632	729,554
1841-1850 (average)	1,596,453	1,124,793
1881	5,810,043	4,478,960
1895	8,435,676	6,110,325
1905	10,814,115	7,913,115

In the coastwise trade, in 1881, 38,953 vessels of 4,545,904 tons entered; in 1895, 43,704 vessels of 6,555,618 tons; but these figures include vessels trading within the Thames estuary (ports of London, Rochester, Colchester and Faversham), which later returns do not. Omitting such vessels, therefore, the number which entered in the coastwise trade in 1905 was 16,358 of 6,374,832 tons.

Business.—The City has been indicated as the business centre of the metropolis. Besides the Royal Exchange, in the building of which are numerous offices, including “Lloyd’s,” the centre of the shipping business and marine insurance, there are many exchanges for special articles. Among these are the Corn Exchange in Mark Lane, where the privilege of a fair was originally granted by Edward I.; the Wool Exchange, Coleman Street; the Coal Exchange, Lower Thames Street; the Shipping Exchange, Billiter Street; and the auction mart for landed property in Tokenhouse Yard. The Hop Exchange is across the river in Southwark. In Mincing Lane are the commercial salerooms. Besides the Bank of England there are many banking houses; and the name of Lombard Street, commemorating the former money dealers of Lombardy, is especially associated with them. The majority of the banks are members of the Clearing House, Post Office Court, where a daily exchange of drafts representing millions of pounds sterling is effected. The Royal Mint is on Tower Hill. The Stock Exchange is in Capel Court, and numbers of brokers have their offices in the vicinity of the Royal Exchange and the Bank of England.

Manufactures and Retail Trade.—No part of London can be pointed out as essentially a manufacturing quarter, and there is a strong tendency for manufacturing firms to establish their factories outside the metropolis. There are, however, several large breweries, among which that of Messrs Barclay & Perkins, on the riverside in Southwark, may be mentioned; engineering works are numerous in East London by the river, where there are also shipbuilding yards; the leather industry centres in Bermondsey, the extensive pottery works of Messrs Doulton are in Lambeth, there are chemical works on the Lea, and paper-mills on the Wandle. Certain industries (not confined to factories) have long been associated with particular localities. Thus, clock-makers and metal-workers are congregated in Finsbury, especially Clerkenwell and in Islington; Hatton Garden, near Holborn Viaduct, is a centre for diamond merchants; cabinet-making is carried on in Bethnal Green, Shoreditch and the vicinity; and large numbers in the East End are employed in the match industry. Silk-weaving is still carried on in the district of Spitalfields (see Stepney). West of the City certain streets are essentially connected with certain trades. The old-established collection of second-hand book-shops in Holywell Street was only abolished by the widening of the Strand, and a large proportion then removed to Charing Cross Road. In the Strand, and more especially in Fleet Street and its offshoots, are found the offices of the majority of the most important daily newspapers and other journals. Carriage and motor-car warehouses congregate in Long Acre. In Tottenham Court Road are the showrooms of several large upholstering and furnishing firms. Of the streets most frequented on account of their fashionable shops Bond Street, Regent Street, Oxford Street, Sloane Street and High Street, Kensington, may be selected. In the East End and other poor quarters a large trade in second-hand clothing, flowers and vegetables, and many other commodities is carried on in the streets on movable stalls by costermongers and hawkers.

Markets.—The City Corporation exercises a control over the majority of the London markets, which dates from the close of the 14th century, when dealers were placed under the governance of the mayor and aldermen. The markets thus controlled are:

Central Markets, Smithfield, for meat, poultry, provisions, fruit, vegetables, flowers and fish. These extend over a great area north of Newgate Street and east of Farringdon Road. Beneath them are extensive underground railway sidings. A market for horses and cattle existed here at least as early as the time of Henry II.

Leadenhall Market, Leadenhall Street, City, for poultry and meat. This market was in existence before 1411 when it came into the possession of the City.

Billingsgate Market, by the Thames immediately above the custom house, for fish. Formerly a point of anchorage for small vessels, it was made a free market in 1699.

Smithfield Hay Market.

Metropolitan Cattle Market, Copenhagen Fields, Islington.

Deptford Cattle Market (foreign cattle).

Spitalfields Market (fruit, vegetables and flowers).

Shadwell Market (fish).

Of other markets, the Whitechapel Hay Market and Borough Market, Southwark, are under the control of trustees; and Woolwich Market is under the council of that borough. Covent Garden, the great mart in the west of London for flowers, fruit and vegetables, is in the hands of private owners. It appears to have been used as a market early in the 17th century. Scenes of remarkable activity may be witnessed here and at Billingsgate in the early hours of the morning when the stock is brought in and the wholesale distributions are carried on.

Administration before 1888.—The middle of the 19th century found the whole local administration of London still of a medieval character. Moreover, as complete reform had always been steadily resisted, homogeneity was entirely wanting. Outside the City itself a system of local government can hardly be said to have existed.

Vestries.

Greater London (in the sense in which that name might then have been applied) was governed by the inhabitants of each parish in vestry assembled, save that in some instances parishes had elected select vestries under the provisions of the Vestries Act 1831. In neither case had the vestry powers of town management. To meet the needs of particular localities, commissioners or trustees having such powers had been from time to time created by local acts. The resulting chaos was remarkable. In 1855 these local acts numbered 250, administered by not less than 300 bodies, and by a number of persons serving on them computed at 10,448. These persons were either self-elected, or elected for life, or both, and therefore in no degree responsible to the ratepayers. There were two bodies having jurisdiction over the whole metropolis except the City, namely, the officers appointed under the Metropolitan Building Act of 1844, and the Metropolitan Commissioners of Sewers, appointed under the Commissioners of Sewers Act 1848. Neither body was responsible to the ratepayers. To remedy this chaotic state of affairs, the Metropolis Management Act 1855 was passed. Under that act a vestry elected by the ratepayers of the parish was established for each parish in the metropolis outside the City. The vestries so elected for the twenty-two larger parishes were constituted the local authorities. The fifty-six smaller parishes were grouped together in fifteen districts, each under a district board, the members of which were elected by the vestries of the constituent parishes. A central body, styled the Metropolitan Board of Works, having jurisdiction over the whole metropolis (including the City) was also established, the members of which were elected by the Common Council of the City, the vestries and district boards, and the previously established local board of Woolwich (*q.v.*). Further the area of the metropolis for local government purposes was for the first time defined, being the same as that adopted in the Commissioners of Sewers Act, which had been taken from the area of the weekly bills of mortality. The Metropolitan Board of Works was also given certain powers of supervision over the vestries and district boards, and superseded the commissioners of sewers as authority for main drainage. By an act of the same session it became the central authority for the administration of the Building Acts, and subsequently had many additional powers and duties conferred upon it. The vestries and district boards became the authorities for local drainage, paving, lighting, repairing and maintaining streets, and for the removal of nuisances, &c.

Metropolitan Board of Works.

Acts of 1888 and 1899.—An objection to the Metropolitan Board of Works soon became manifest, inasmuch as the system of election was indirect. Moreover, some of its actions were open to such suspicion that a royal commission was appointed to inquire into certain matters connected with the working of the board. This commission issued an interim report in 1888 (the final report did not appear until 1891), which disclosed the inefficiency of the board in certain respects, and also indicated the existence of corruption. Reform followed immediately. Already in 1884 Sir William Harcourt had attempted to constitute the metropolis a municipal borough under the government of a single council. But in 1888 the Local Government Act, dealing with the area of the metropolis as a separate county, created the London County Council as the central administrative body, possessing not only the powers of an ordinary county council, but also extensive powers of town management, transferred to it from the abolished Board of Works. Here, then, was the central body, under their direct control, which inhabitants of London had hitherto lacked. The question of subsidiary councils remained to be settled. The wealthier metropolitan parishes became discontented with the form of local government to which they remained subject, and in 1897 Kensington and Westminster petitioned to be created boroughs by the grant of charters under the Municipal Corporation Acts. These, however, were inapplicable to London, and it was realized that the bringing of special legislation to bear on special cases (as the petition of these two boroughs would have demanded) would be inexpedient as making against homogeneity. Instead, the London Government Act of 1899 was evolved. It brought into existence the twenty-eight Metropolitan boroughs enumerated at the outset of this article. The county of London may thus be regarded from the administrative standpoint as consisting of twenty-nine contiguous towns, counting the City of London. As regards the distribution of powers and duties between the County Council and the Borough Councils, and the constitution and working of each, the underlying principle may be briefly indicated as giving all powers and duties which require uniformity of action throughout the whole of London to the County Council, and powers and duties that can be locally administered to the Borough Councils.

London County Council.

Metropolitan boroughs.

Summary of Administrative Bodies.—The administrative bodies of the County of London may now be summarized:

1. *London County Council.*—Consists of 118 councillors, 2 elected by each parliamentary division (but the City of London elects 4); and 19 aldermen, with chairman, vice-chairman and deputy-chairman, elected in council. Triennial elections of councillors by householders (male and female) on the rate-books. Aldermen hold office for 6 years.

2. *Metropolitan Boroughs.*—Councils consist of a mayor and aldermen and councillors in proportion as 1 to 6. The commonest numbers, which cannot be exceeded, are 10 and 60 (see separate article on each borough). Triennial elections.

3. *Corporation of the City of London.*—The legislation of 1855, 1888 and 1899 left the government of the small area of the City in the hands of an unreformed Corporation. Here at least the medieval system, in spite of any anomalies with respect to modern conditions, has resisted reform, and no other municipal body shares the traditions and peculiar dignity of the City Corporation. This consists of a Lord Mayor, 26 aldermen and 206 common councilmen, forming the Court of Common Council, which is the principal administrative body. Its scope may be briefly indicated as including (*a*) duties exercised elsewhere by the Borough Councils, and by the London County Council (although that body is by no means powerless within the City boundaries); and (*b*) peculiar duties such as control of markets and police. The election of common councilmen, whose institution dates from the reign of Edward I., takes place annually, the electors being the ratepayers, divided among the twenty-five wards of the City. An alderman (*q.v.*) of each ward (save that the wards of Cripplegate within and without, share one) is elected for life. The Lord Mayor (*q.v.*) is elected by the Court of Aldermen from two aldermen nominated in the Court of Common Hall by the Livery, an electorate drawn from the members of the ancient trade gilds or Livery Companies (*q.v.*), which, through their control over the several trades or manufactures, had formerly an influence over the government of the city which from the time of Edward III. was paramount.

Non-administrative Arrangements.—The Local Government Act of 1888 dealt with the metropolis for non-administrative purposes as it did for administrative, that is to say, as a separate county. The arrangements of quarter-sessions, justices, coroners, sheriffs, &c., were thus brought into line with other counties, except in so far as the ordinary organization is modified by the existence of the central criminal court, the metropolitan police, police courts and magistrates, and a paid chairman of quarter-sessions. The powers of the governing body of the City, moreover, are as peculiar in this direction as in that of municipal administration, and the act left the City as a county of a city practically unchanged. Thus the Lord Mayor and aldermen possess judicial authority, and the police of London are

divided into two separate bodies, the Metropolitan and the City Police (see POLICE).

Courts.

The chief courts for the trial of criminal cases are the Central Criminal Court and the Court of Quarter-sessions. The Central Criminal Court, taking the place of the provincial Assizes, was established by an act of 1834. There are twelve sessions annually, under the Lord Mayor, aldermen and judges. They were formerly held in the "Old Bailey" sessions-house, but a fine new building from designs of E. W. Mountford took the place of this in 1906. Quarter-sessions for the county of London are held thirty-six times annually, for the north side of the Thames at the Sessions-house in Clerkenwell (Finsbury) and for the south side at that in Newington Causeway, Southwark. For judicial purposes Westminster was merged with the county of London in 1889, and the Liberty of the Tower was abolished in 1894. The separate court of the Lord Mayor and Aldermen is held at the Guildhall. The Metropolitan police courts are fourteen in number, namely—Bow Street, Covent Garden; Clerkenwell; Great Marlborough Street (Westminster); Greenwich and Woolwich; Lambeth; Marylebone; North London, Stoke Newington Road; Southwark; South Western, Lavender Hill (Battersea); Thames, Arbour Street East (Stepney); West Ham; West London, Vernon Street (Fulham); Westminster, Vincent Square; Worship Street (Shoreditch). The police courts of the City are held at the Mansion House, the Lord Mayor or an alderman sitting as magistrate, and at the Guildhall, where the aldermen preside in rotation. The prisons within the metropolis are Brixton, Holloway, Pentonville, Wandsworth and Wormwood Scrubbs. In the county of London there are 12 coroners' districts, 19 petty sessional divisions (the City forming a separate one) and 13 county court districts (the City forming a separate one). The boundaries of these divisions do not in any way correspond with each other, or with the police divisions, or with the borough or parish boundaries. The registration county of London coincides with the administrative county.

Parliamentary Representation.—The London Government Act contains a saving clause by which "nothing in or done under this act shall be construed as altering the limits of any parliamentary borough or parliamentary county." The parliamentary boroughs are thus in many cases named and bounded differently from the metropolitan boroughs. The parliamentary arrangements of each metropolitan borough are indicated in the separate articles on the boroughs. In the following list the boroughs which extend outside the administrative county of London are noted. Each division of each borough, or each borough where not divided, returns one member, save that the City of London returns two members.

(*a*) *North of the Thames.* (1) Bethnal Green—*Divs.*: North-eastern, South-western. (2) Chelsea (detached portion in administrative county of Middlesex, Kensal Town). (3) Finsbury (detached portion in Middlesex, Muswell Hill)—*Divs.*: Holborn, Central, Eastern. (5) Fulham. (6) Hackney—*Divs.*: North, Central, South. (7) Hammersmith. (8) Hampstead. (9) Islington—*Divs.*: Northern, Southern, Eastern, Western. (10) Kensington—*Divs.*: Northern, Southern. (11) City of London. (12) Marylebone—*Divs.*: Eastern, Western. (13) Paddington (extending into Middlesex)—*Divs.*: Northern, Southern. (14) St George's Hanover Square. (15) St Pancras—*Divs.*: Northern, Southern, Eastern, Western. (16) Shoreditch—*Divs.*: Hoxton, Haggerston. (17) Strand. (18) Tower Hamlets—*Divs.*: Bow and Bromley, Limehouse, Mile End, Poplar, St George, Stepney, Whitechapel. (19) Westminster.

A detached portion of the parliamentary division of Hornsey, Middlesex, is in the metropolitan borough of Hackney. London University returns a member.

(*b*) *South of the Thames.* (1) Battersea and Clapham—*Divs.*: Battersea, Clapham. (2) Camberwell (extending into Kent)—*Divs.*: Northern, Peckham, Dulwich. (3) Deptford. (4) Greenwich. (5) Lambeth—*Divs.*: Northern, Kennington, Brixton, Norwood. (6) Lewisham. (7) Newington—*Divs.*: Western, Walworth. (8) Southwark—*Divs.*: Western, Rotherhithe, Bermondsey. (9) Wandsworth. (10) Woolwich.

Part of the Wimbledon parliamentary division of Surrey is in the metropolitan borough of Wandsworth.

Ecclesiastical Divisions and Denominations.—London north of the Thames is within the Church of England bishopric of London, the bishop's palace being at Fulham. In this diocese, which covers nearly the whole of Middlesex and a very small portion of Hertfordshire, are the suffragan bishoprics of Islington, Kensington and Stepney. The bishopric of Southwark was created in 1904, having been previously a suffragan bishopric in the diocese of Rochester. The county contains 612 ecclesiastical parishes. Westminster is the seat of the Roman Catholic archbishopric in England, and Southwark is a bishopric. Among the numerous chapels of dissenting bodies there may be mentioned the City Temple, Congregational, on Holborn Viaduct; the Metropolitan Tabernacle, Baptist, in Southwark, the creation of which was the outcome of the labours of the famous preacher Charles Spurgeon (d. 1892); and Wesley's Chapel, City Road, in the graveyard of which is the tomb of John Wesley; his house, which adjoins the chapel, being open as a memorial museum. In 1903 the Wesleyans acquired the site of the Royal Aquarium, near Westminster Abbey, for the erection of a central hall. The Great Synagogue of the Jews is in St James' Place, Aldgate. The headquarters of the Salvation Army are in Queen Victoria Street, City. There are numerous foreign churches, among which may be mentioned the French Protestant churches in Monmouth Road, Bayswater and Soho Square; the Greek church of St Sophia, Moscow Road, Bayswater; and the German Evangelical church in Montpelier Place, Brompton Road, opened in 1904.

(O. J. R. H.)

VIII. FINANCE

In addition to the provisions that have been mentioned above (Section VII.), the London Government Act 1899 simplified administration in two respects. The duties of overseers in London had been performed by most diverse bodies. In some parishes overseers were appointed in the ordinary manner; in others the vestry, by local acts and by orders under the Local Government Act 1894, was appointed to act as, or empowered to appoint, overseers, whilst in Chelsea the guardians acted as overseers. The act of 1899 swept away all these distinctions, and constituted the new borough councils in every case the overseers for every parish within their respective boroughs, except that the town clerk of each borough performs the duties of overseers with respect to the registration of electors.[4] Again, with regard to rates, there were in all cases three different rates leviable in each parish—the poor rate, the general rate and the sewers rate—whilst in many parishes in addition there was a separate lighting rate. From the sewers rate and lighting rate, land, as opposed to buildings, was entitled to certain exemptions. Under the act of 1899 all these rates are consolidated into a single rate, called the general rate, which is assessed, made, collected and levied as the poor rate, but the interests of persons previously entitled to exemptions are safeguarded. Further, every precept sent by an authority in London for the purpose of obtaining money (these authorities include the London County Council, the receiver of the Metropolitan Police, the Central Unemployed Body and the Boards of Guardians) which has ultimately to be raised out of a rate within a borough is sent direct to the council of the borough instead of filtering through other authorities before reaching the overseers. The only exceptions to this rule are: (1) precepts issued by the local government board for raising the sums to be contributed to the metropolitan common poor fund; and (2) precepts issued by poor law authorities representing two or more poor-law unions; in both these cases the precept has of necessity to be first sent to the guardians. The metropolitan borough councils make one general rate, which includes the amount necessary to meet their own expenditure, as well as to meet the demands of the various precepting authorities. There was thus raised in the year 1906-1907 a sum of £15,393,956 (in 1898-1899 the amount was £10,401,441); of this £11,012,424 was for central rates, which was subdivided into £7,930,275 for county services and

£3,082,149 for local services, leaving a balance of £4,381,532, strictly local rates. The total local expenditure of London for the year 1906-1907 was £24,703,087 (in 1898-1899 it was only £14,768,757), the balance of £9,761,734 being made up by receipts-in-aid and imperial subventions. This expenditure was divided among the following bodies:

London County Council	£9,491,271
Metropolitan Borough Councils	5,009,982
Boards of Guardians	3,587,429
Metropolitan Water Board	2,318,618
Metropolitan Police	1,903,441
City Corporation	1,270,406
Metropolitan Asylums Board	934,463
Central (Unemployed) Body	141,284
Overseers—City of London	34,757
Market Trustees (Southwark)	10,680
Local Government Board—Common Poor Fund	756
	£24,703,087

(1) *Rate and Debt Accounts.*

Estimated Income.		*Estimated Expenditure.*		
Balances	£967,740	Debt (including management)		£3,905
Receipts in aid of expenditure (local taxation licences and estate duty, beer and spirit duties, &c.)	513,541	Grants (mostly guardians)		645
Government grants in aid of education	1,515,663	Pensions		75
Interest on loans advanced to local authorities, &c.	586,065	Establishment charges		232
Rents, &c.	427,767	Judicial expenses		52
Contributions from revenue-producing undertaking for interest and repayment of debt	685,948	Services—		
Miscellaneous	3,633	Main drainage	£295,650	
Rate contributions—		Fire brigade	263,575	
General, for other than education	2,698,610	Parks and open spaces	140,715	
For education	3,675,694	Bridges, tunnels, ferry	49,925	
Special	407,946	Embankments	14,940	
		Pauper lunatics	78,870	
		Inebriates Acts	14,045	
		Coroners	30,925	
		Weights and measures	14,830	
		Gas testing	13,785	
		Building Acts	25,595	
		Diseases of Animals Acts	19,260	
		Miscellaneous	63,060	
			£1,025,175	
		Education	4,025,442	
		Steamboats	14,805	
		Works Dept.	12,100	5,889
		Parliamentary expenses		22
		Miscellaneous		6
		Total expenditure		10,829
		Balances		652
	£11,482,607			£11,482

(2) *Revenue Producing Undertakings.*

Estimated Income.			*Estimated Expenditure.*		
Balances		£4,055	Working expenses—		
Receipts—			Working class dwellings	£56,060	
Working class dwellings	£173,443		Tramways	1,318,620	
Tramways	2,089,955		Small Holdings and Allotments	621	
Small Holdings and Allotments	410		Parks boating	2,965	£1,378
Parks boating	5,100	2,268,908	Renewals		163
Transfers		6,214	Reserve		44
			Interest on and repayment of debts		685
			Transfer in relief of rates (parks boating)		2
			Balances		4
		£2,279,177			£2,279

The total expenditure was equal to a rate in the pound of 11s. 4.4d.; the actual amount raised in rates was equivalent to a rate of 7s. 1.0d., receipts-in-aid were equivalent to a rate of 3s. 2.5d., and imperial subventions to a rate of 1s. 3.4d. Practically the whole amount contributed towards the support of public local expenditure, and a considerable amount of that contributed to public national expenditure is based on the estimated annual value of the immovable property situated within the county of London, which in 1876 was £23,240,070; in 1886 £30,716,719; in 1896 £35,793,672; and in 1909 £44,666,651. The produce of a penny rate was, in the metropolitan police district in 1908-1909, £226,739, and in the county of London (excluding the City) £161,806. A complete re-valuation of properties in the county of London is made every five years, valuation lists being prepared in duplicate by the borough councils acting as overseers of the parishes in their respective boroughs. They are revised by statutory assessment committees, who hear any objections by ratepayers against their valuation. These lists when revised are sent to the clerk of the County Council, who publishes the totals. By the Metropolitan Poor Act 1867, the metropolitan common poor fund, to which each union in London contributes in proportion to its rateable value, was established. Out of this fund certain expenses of guardians in connexion with the maintenance of indoor paupers and lunatics, the salaries of officers, the maintenance of children in poor-law schools, valuation, vaccination, registration, &c., are paid. The payments amounted in 1906-1907 to £1,662,942. Under the Local Government Act 1888, the London County Council makes grants to boards of guardians, sanitary authorities and overseers in London in respect of certain services. This grant is in lieu of the grants formerly made out of the exchequer grant in aid of local rates, and amounted in 1906-1907 to £619,489. Finally, in 1894, the fund called the Equalization Fund was established. This fund is raised by the rate of 6d. in the pound on the assessable value of the county of London, and redistributed among the boroughs in proportion to their population. It amounted in

1906-1907 to £1,094,946. But, in spite of attempts at equalization, rates remain very unequal in London, and varied in 1908 from 6s. 2d. in St Anne's, Westminster, to 11s. 6d. in Poplar. The London County Council levied in 1909-1910 to meet its estimated expenditure for the year a total rate of 36.75d.; 14.50d. of this was for general county purposes, 19.75d. for education purposes and 2.50d. for special county purposes. The preceding tables show the estimated income and expenditure of the London County Council for 1909-1910.

Besides the annual expenditure of the various authorities large sums have been borrowed to defray the cost of works of a permanent nature. The debt of London, like that of other municipalities, has considerably increased and shows a tendency to go on increasing, although certain safeguards against too ready borrowing have been imposed. Every local authority has to obtain the sanction of some higher authority before raising a loan, and there are in addition certain statutory limits of borrowing. Metropolitan borough councils have to obtain the sanction of the Local Government Board to loans for baths, washhouses, public libraries, sanitary conveniences and certain other purposes under the Public Health Acts; for cemeteries the sanction of the Treasury is required, and for all other purposes that of the London County Council; poor law authorities, the metropolitan asylums board, the metropolitan water board and the central (unemployed) body require the sanction of the Local Government Board; the receiver for the metropolitan police district that of the Home Office, and the London County Council that of parliament and the Treasury. The following table gives the net loans outstanding of the several classes of local authorities in London at the 31st of March 1908:

Local Authorities.	Loans outstanding 31st March 1908.
London County Council (*excluding loans advanced to other authorities*)	£49,938,131
Metropolitan Asylums Board	3,113,612
Metropolitan Police (London's proportion)	226,131
Metropolitan Water Board (proportion)	38,726,514
Central (Unemployed) Body	31,845
City of London Corporation	5,553,173
Metropolitan Borough Councils	12,551,204
Guardians and sick asylum managers	4,029,013
	£114,169,623

AUTHORITIES.—Full details and figures relating to the finance of London will be found in the parliamentary papers *Local Taxation Returns* (*England and Wales*), part iv. published annually; *Returns relating to the London County Council*, published annually; the annual report and accounts of the Metropolitan Water Board, and the metropolitan police accounts. The publications of the London County Council, especially the tramways accounts, the annual estimates, *London Statistics*, and the *Financial Abstract* (10 years ended 31st March 1908) have much valuable information.

(T. A. I.)

IX. HISTORY

1. *British and Roman to A.D. 449.*—There is practically no record of British London, and considerable difference of opinion exists among antiquaries as to its very existence. Bishop Stillingfleet held that London was of Roman foundation and not older than the time of Claudius (*Origines Brit.*, 1685, p. 43); and Dr Guest affirmed that the notion of a British town having "preceded the Roman camp has no foundation to rest upon" (*Archaeological Journal*, xxiii. 180). J. R. Green expressed the same opinion in *The Making of England* (p. 101). On the other side Kemble held that it was difficult to believe that Cair Lunden was an unimportant place even in Caesar's day (*Saxons in England*, ii. 266); and Thomas Lewin believed that London had attained prosperity before the Romans came; and held that it was probably the capital of Cassivellaunus, which was taken and sacked by Julius Caesar (*Archaeologia*, xl. 59). The origin of London will probably always remain a subject of dispute for want of decisive facts.

The strongest reason for believing in a British London is to be found in the name, which is undoubtedly Celtic, adopted with little alteration by the Romans. It is also difficult to believe that Londinium had come to be the important commercial centre described by Tacitus (A.D. 61) if it had only been founded a few years before the conquest of Claudius.

The discovery by General Pitt Rivers in 1867 of the remains of pile dwellings both on the north and on the south of the Thames gives ground for an argument of some force in favour of the date of the foundation of London having been before the Roman occupation of Britain. Of Roman London we possess so many remains that its appearance can be conjectured with little difficulty.

During the centuries when Britain was occupied by the Romans (A.D. 43-409) there was ample time for cities to grow up from small beginnings, to overflow their borders and to be more than once rebuilt. The earliest Roman London must have been a comparatively small place, but it probably contained a military fort of some kind intended to cover the passage of the river.

The Roman general Paulinus Suetonius, after marching rapidly from Wales to put down a serious insurrection, found Londinium unfitted for a base of military operations, and therefore left the place to the mercy of Boadicea, who entirely destroyed it, and killed the inhabitants. After this the need of fortifying Londinium must have been apparent, and a walled city of small dimensions arose soon after the defeat of the British queen. The earliest Roman city probably extended as far as Tower Hill on the east, and there is reason to believe that it did not include any ground to the west of Leadenhall. The excavations at the latter place in 1881 threw great light upon the early history of London. The foundation walls of a basilica were discovered, and from the time when that was built until the present day the ground has always been devoted to public uses. How far north the first wall was placed it is difficult to guess. One help towards a settlement of the question may be found in the discovery of burial places. As it was illegal in Roman times to bury within the walls, we are forced to the conclusion that the places where these sepulchral remains have been found were at one time extramural. Now no such remains have been found between Gracechurch Street and the Tower. The northern wall was placed by Roach Smith somewhere along the course of Cornhill and Leadenhall Street. The second extension of the city westwards was probably to Wallbrook.

Extent of Roman London.

In the latest or third Roman enclosure the line of the wall ran straight from the Tower to Aldgate, where it bent round somewhat to Bishopsgate. On the east it was bordered by the district subsequently called the Minories and Houndsditch. The line from Bishopsgate ran eastward to St Giles's churchyard (Cripplegate), where it turned to the south as far as Falcon square; again westerly by Aldersgate round the site of the Greyfriars (afterwards Christ's

Hospital) towards Giltspur Street, then south by the Old Bailey to Ludgate, and then down to the Thames, where Dr Edwin Freshfield suggests that a Roman fortress stood on the site of Baynard's Castle. This is most probable, because the Romans naturally required a special protection on the river at the west as well as at the east. So in later times when William the Conqueror planned the Tower he gave the site at the western extremity to his follower Ralph Baynard, where was erected the stronghold known as Baynard's Castle. Roach Smith pointed out that the enclosure indicated above gives dimensions far greater than those of any other town in Britain. There can be no doubt that within the walls there was originally much unoccupied space, for with the single exception of the larger circuit south of Ludgate, up to where the river Fleet ran, made in 1276 for the benefit of the Black Friars, the line of the walls, planned by the later Romans, remained complete until the Great Fire (1666). The Thames formed the natural barrier on the south, but the Romans do not appear to have been content with this protection, for they built a wall here in addition, which remained for several centuries. Portions of this wall have been discovered at various times.

It is difficult even to guess when the third wall was erected. The emperor Theodosius came to London from Boulogne to mature his plan for the restoration of the tranquillity of the province. As Theodosius is said to have left Britain in a sound and secure condition it has been suggested that to him was due the wall of the later Londinium, but there is little or no evidence for this opinion, and according to an old tradition Constantine the Great walled the city at the request of his mother Helena, presumed to be a native of Britain. There is, however, some evidence in favour of the supposition that the wall was built at a much earlier date. It is not improbable that early in the 2nd century the wall was finished at the west portion and enclosed a cemetery near Newgate. Sir William Tite, in describing a tessellated pavement found in 1854 on the site of the Excise Office (Bishopsgate Street), expresses the opinion that the finished character of the pavement points to a period of security and wealth, and fixes on the reign of Hadrian (A.D. 117-138), to which the silver coin found on the floor belongs, as the date of its foundation.

The historians of the Roman Empire have left us some particulars of the visits of emperors and generals to Britain, but little or nothing about what happened in London, and we should be more ignorant than we are of the condition of Londinium if it had not been that a large number of excavations have been made in various parts of the city which have disclosed a considerable amount of its early history. From these remains we may guess that London was a handsome city in the reign of Hadrian, and probably then in as great a position of importance as it ever attained. This being so, there seems to be reason in attributing the completed walls to this period.

Remains of Roman Wall.

The persistence of the relics of the walls of London is one of the most remarkable facts of history. Pieces of the wall are to be seen in various parts of the city, and are frequently found when extensive excavations are made for new buildings. In some places where the Roman wall is not to be seen there still exist pieces of the old wall that stand upon Roman foundations. In Amen Court, where the residences of canons of St Paul's and the later houses of the minor canons are situated, there stretches such a piece of wall, dividing the gardens of the Court from the Old Bailey. Of the few accessible fragments of the Roman wall still existing special mention may be made of the bastion in the churchyard of St Giles's, Cripplegate; a little farther west is a small fragment in St Martin's Court, Ludgate Hill (opposite the Old Bailey), but the best specimen can be seen near Tower Hill just out of George Street, Trinity Square. Early in the 20th century a fragment nearly 40 ft. long, together with the base of a bastion, was brought to light in digging for the foundation of some large warehouses in Camomile Street, at a depth of 10 ft. below the level of the present street. A considerable portion of the old wall was laid bare by the excavations for the new Post Office in St Martin's-le-Grand. From a comparison of these fragments with the descriptions of Woodward, Maitland and others, who in the early part of the 18th century examined portions of the wall still standing, we learn that the wall was from 9 to 12 ft. thick, and formed of a core of rough rubble cemented together with mortar (containing much coarse gravel) of extraordinary hardness and tenacity, and a facing for the most part of stone—Kentish rag, freestone or ironstone—but occasionally of flints; about 2 ft. apart are double layers of tiles or bricks which serve as bonding courses. The wall appears to have been about 20 ft. high, the towers from 40 to 50 ft., but when described only the base was Roman. Upon that was raised a wall of rough rubble rudely faced with stone and flint, evidently a medieval work and about 2½ ft. thick; then succeeded a portion wholly of brick, terminating in battlements topped with copings of stone.

Gates and buildings.

Although the course of the later Roman walls is clear, we do not know with any certainty the position of the Roman gates. They were not the same as the medieval gates which have left the record of their names in modern London nomenclature. It follows, therefore, that the main streets also are not in line with the Roman ways, except perhaps in a few instances. Many ineffectual attempts have been made to connect the Watling street in the city with the great Roman road so named in medieval times. The name of the small street is evidently a corruption, and in the valuable Report of the MSS. of the Dean and Chapter of St Paul's (*Ninth Report of the Historical MSS. Commission*, Appendix, p. 4) the original name is given as "Atheling Street," and instances of this spelling are common in the 13th century. The form Watling Street seems to occur first in 1307. Stow spells it Watheling Street (Kingsford's edition of Stow's *Survey*, 1908, vol. ii. p. 352). Sir William Tite gave reasons for believing that Bishopsgate Street was not a Roman thoroughfare, and in the excavations at Leadenhall the basilica to which allusion has already been made was found apparently crossing the present thoroughfare of Gracechurch Street. Tite also agreed with Dr Stukeley's suggestion that on the site of the Mansion House (formerly Stocks Market) stood the Roman forum, and he states that a line drawn from that spot as a centre would pass by the pavements found on the site of the Excise Office. Besides the forum Stukeley suggested the sites of seven other buildings—the *Arx Palatina* guarding the south-eastern angle of the city where the Tower now stands, the grove and temple of Diana on the site of St Paul's, &c. No traces of any of these buildings have been found, and they are therefore purely conjectural. Stukeley's industrious researches into the history of Roman London cannot be said to have any particular value, although at one time they enjoyed considerable vogue. As to the Temple of Diana, Sir Christopher Wren formed an opinion strongly adverse to the old tradition of its existence (*Parentalia*, p. 266). Although we know that the Christian church was established in Britain during the later period of the Roman domination, there is little to be learnt respecting it, and the bishop Restitutus, who is said to have attended an Ecclesiastical Council, is a somewhat mythical character. In respect to the discovery of the position of the Roman gates, the true date of the *Antonini Itinerarium* (*q.v.*) is of great importance, as it will be seen from it that Londinium was either a starting-point or a terminus in nearly half the routes described in the portion relating to Britain. This would be remarkable if the work dated back to the 2nd century. Probably in the later, as in the earlier time, Londinium had the usual four gates of a Roman city, with the main roads to them. The one on the east was doubtless situated near where Aldgate afterwards stood. On the south the entrance to Londinium must always have been near where London Bridge was subsequently built. On the west the gate could not have been far from the place afterwards occupied by Newgate. As to Ludgate there is reason to believe that if there was an opening there in Roman times it was merely a postern. On the north the gate may have been near Bishopsgate or at Aldersgate. If we take from the *Itinerary* the last station before Londinium in all the routes we shall be able to obtain some idea of the position of the gate entered from each route by drawing a line on the map of London to the nearest point. Ammianus Marcellinus (about A.D. 390) speaks twice of Londinium as an ancient town to which the honourable title of Augusta had been accorded. Some writers have been under the misapprehension that this name for a time superseded that of Londinium. The anonymous Chorographer of Ravenna calls the place Londinium Augusta,

and doubtless this was the form adopted.

The most interesting Roman relic is “London Stone.” It has generally been supposed to be a “milliarium” or central point for measuring distances, but Sir Christopher Wren believed it was part of some more considerable monuments in the forum (*Parentalia*, pp. 265, 266). Holinshed (who was followed by Shakespeare in *2 Henry VI.*, act 4 sc. 6) tells us that when Cade, in 1450, forced his way into London, he first of all proceeded to London Stone, and having struck his sword upon it, said in reference to himself and in explanation of his own action, “Now is Mortimer lord of this city.” Mr H. C. Coote, in a paper published in the *Trans. London and Middlesex Arch. Soc.* for 1878, points out that this act meant something to the mob who followed the rebel chief, and was not a piece of foolish acting. Mr Laurence Gomme (*Primitive Folk-Moots*, pp. 155, 156) takes up the matter at this point, and places the tradition implied by Cade’s significant action as belonging to times when the London Stone was, as other great stones were, the place where the suitors of an open-air assembly were accustomed to gather together and to legislate for the government of the city. Corroborative facts have been gathered from other parts of the country, and, although more evidence is required, such as we have is strongly in favour of the supposition that the London Stone is a prehistoric monument.

London Stone.

One of the most important questions in the history of London that requires settlement is the date of the building of the first bridge, that is whether it was constructed by Britons or by Romans. If the Britons had not already made the bridge before the Romans arrived it must have been one of the first Roman works. As long as there was no bridge to join the north and south banks of the Thames the great object of Roman rule remained unfulfilled. This object was the completion of a system of roads connecting all parts of the Empire with Rome.

The first London Bridge.

Dio Cassius, who lived in the early part of the 3rd century (*Hist. Rom.* lib. lx. c. 20), states that there was a bridge over the Thames at the time of the invasion of Claudius (A.D. 43), but he places it a little above the mouth of the river (“higher up”). The position is vague, but the mouth of the Thames in these early times may be considered as not far from the present position of London Bridge. Sir George Airy held that this bridge was not far from the site of London Bridge (*Proceedings of Institut. Civil Engineers*, xlix. 120), but Dr Guest was not prepared to allow that the Britons were able to construct a bridge over a tidal river such as the Thames, some 300 yds. wide, with a difference of level at high and low water of nearly 20 ft. He therefore suggested that the bridge was constructed over the marshy valley of the Lea, probably near Stratford. It needs some temerity to differ from so great an authority as Dr Guest, but it strikes one as surprising that, having accepted the fact of a bridge made by the Britons, he should deny that these Britons possessed a town or village in the place to which he supposes that Aulus Plautius retired.

As the Welsh word for “bridge” is “pont,” and this was taken directly from the Latin, the inference is almost conclusive that the Britons acquired their knowledge of bridges from the Romans. Looking at the stage of culture which the Britons had probably reached, it would further be a natural inference that there was no such thing as a bridge anywhere in Britain before the Roman occupation; but, if Dion’s statement is correct, it may be suggested as a possible explanation that the increased intercourse with Gaul during the hundred years that elapsed between Julius Caesar’s raids and Claudius Caesar’s invasion may have led to the construction of a bridge of some kind across the Thames at this point, through the influence and under the guidance of Roman traders and engineers. If so, the word “pont” may have been borrowed by the Britons before the commencement of the Roman occupation. Much stronger are the reasons for believing that there was a bridge in Roman times. Remains of Roman villas are found in Southwark, which was evidently a portion of Londinium, and it therefore hardly seems likely that a bridge-building people such as the Romans would remain contented with a ferry. Roach Smith is a strong advocate for the bridge, and remarks, “It would naturally be erected somewhere in the direct line of road into Kent, which I cannot but think pointed towards the site of Old London Bridge, both from its central situation, from the general absence of the foundations of buildings in the approaches on the northern side, and from discoveries recently made in the Thames on the line of the old bridge” (*Archaeologia*, xxix. 160). Smith has, however, still stronger arguments, which he states as follows: “Throughout the entire line of the old bridge, the bed of the river was found to contain ancient wooden piles; and when these piles, subsequently to the erection of the new bridge, were pulled up to deepen the channel of the river, many thousands of Roman coins, with abundance of broken Roman tiles and pottery, were discovered, and immediately beneath some of the central piles brass medallions of Aurelius, Faustina and Commodus. All these remains are indicative of a bridge. The enormous quantities of Roman coins may be accounted for by consideration of the well-known practice of the Romans to make these imperishable monuments subservient towards perpetuating the memory, not only of their conquests, but also of those public works which were the natural result of their successes in remote parts of the world. They may have been deposited either upon the building or repairs of the bridge, as well as upon the accession of a new emperor” (*Archaeological Journal*, i. 113).

At the beginning of the 5th century the Roman legions left Britain, and the *Saxon Chronicle* gives the exact date, stating that never since A.D. 409 “have the Romans ruled in Britain”—the chronicler setting down the Roman sway at 470 winters and dating from Julius Caesar’s invasion. We learn that in the year 418 “the Romans collected all the treasures that were in Britain, and hid some of them in the earth, that no man might afterwards find them, and conveyed some with them into Gaul.”

2. *Saxon* (449-1066).—We are informed in the *Saxon Chronicle* that about A.D. 449 or 450 the invaders settled in Britain, and in 457 Hengist and Aesc fought against the Britons at Crayford, driving them out of Kent. The vanquished fled to London in terror and apparently found a shelter there. After this entry there is no further mention of London in the *Chronicle* for a century and a half. This silence has been taken by some historians of weight to imply that London practically ceased to exist. Dr Guest asserted “that good reason may be given for the belief that even London itself for a while lay desolate and uninhabited” (*Archaeological Journal*, xix. 219). J. R. Green and Mr Loftie strongly supported this view, and in Sir Walter Besant’s *Early London* (1908) the idea of the desolation of the city is taken for granted.

In answer to this contention it may be said that, although the silence of the *Chronicle* is difficult to understand, it is almost impossible to believe that the very existence of the most important city in the country could suddenly cease and the inhabitants disappear without some special notice. Battles and scenes of destruction are so fully described in other instances that one must believe that when nothing is related nothing special occurred. No doubt the coming of the Saxons, which entirely changed the condition of the country, must have greatly injured trade, but although there was not the same freedom of access to the roads, the Londoners had the highway of the river at their doors. Although the Saxons hated towns and refused to settle in London, they may have allowed the original inhabitants to continue their trade on condition that they received some share of the profits or a tribute. The only question really is whether London being an exceptional city received exceptional treatment.

Along the banks of the Thames are several small havens whose names have remained to us, such as Rotherhithe, Lambhith (Lambeth), Chelchith (Chelsea), &c., and it is not unlikely that the Saxons, who would not settle in the city itself, associated themselves with these small open spots. Places were thus founded

Saxon

Settlement. over a large space which otherwise might have remained unsettled.

If what is here suggested really occurred it may be that this separation of London from the surrounding country originated the remarkable position of London with its unparalleled privileges, which were continued for many centuries and kept it not only the leader among cities but distinct from all others. Laurence Gomme, in *The Governance of London* (1907), opposes the view that the city was for a time left deserted (a view which, it may be remarked, is a comparatively modern one, probably originating with Dr Guest). H. C. Coote in his *Romans of Britain* elaborated a description of the survival of Roman influence in English institutions, but his views did not obtain much support from London historians. Mr Gomme's contention is to some extent a modification of Mr Coote's view, but it is original in the illustrations that give it force. Londinium was a Roman city, and (as in the case of all such cities) was formed on the model of ancient Rome. It may therefore be expected to retain evidence of the existence of a Pomoerium and Territorium as at Rome. The Pomoerium marked the unbuilt space around the walls. Gomme refers to an open space outside the western wall of Dorchester still called the Pummery as an indication of the Pomoerium in that place; and he considers that the name of Mile End, situated 1 m. from Aldgate and the city walls, marks the extent of the open space around the walls of London known as the Pomoerium. This fact throws a curious light upon the growth of the "Liberties." It has always been a puzzle that no note exists of the first institution of these liberties. If this open space was from the earliest times attached to the city there would be no need when it was built upon for any special act to be passed for its inclusion in London. "The *Territorium* of the city was its special property, and it extended as far as the limits of the territorium of the nearest Roman city or as near thereto as the natural boundaries." This explains the position of Middlesex in relation to London. In connexion with these two features of a Roman city supposed to be found in Ancient London the author argues for the continuity of the city through the changes of Roman and Saxon dominion.

Origin of the Liberties.

One of the most striking illustrations of the probable continuity of London history is to be found in the contrast between York and London. This is only alluded to in Gomme's book, but it is elaborated in an article in the *Cornhill Magazine* (November 1906). These two were the chief Roman cities in Britain, one in the north and the other in the south. They are both equally good examples of important cities under Roman domination. York was conquered and occupied by the Saxons, and there not only are the results of English settlement clear but all records of Roman government were destroyed. In London the Saxon stood outside the government for centuries, and the acceptance of the Roman survival explains much that is otherwise unintelligible.

Gomme finds important evidence of the independence of London in the existence of a merchant law which was opposed to Anglo-Saxon law. He reprints and discusses the celebrated *Judicia Civitatis Lundoniae* of King Æthelstan's reign—"the ordinance" (as it declares itself) "which the bishop and the reeves belonging to London have ordained." He holds that the Londoners passed "their own laws by their own citizens without reference to the king at all," and in the present case of a king who according to Kemble "had carried the influence of the crown to an extent unexampled in any of his predecessors." He adds: "What happened afterwards was evidently this: that the code passed by the Londoners was sent to the king for him to extend its application throughout the kingdom, and this is done by the eleventh section." The view originated by Gomme certainly explains many difficulties in the history of the transition from Roman to English London, which have hitherto been overlooked by historians.

Independence of London.

When the city is next referred to in the *Saxon Chronicle* it appears to have been inhabited by a population of heathens. Under the date 604 we read: "This year Augustine consecrated two bishops: Mellitus and Justus. He sent Mellitus to preach baptism to the East Saxons, whose king was called Sebert, son of Ricole the sister of Æthelbert, and whom Æthelbert had then appointed king. And Æthelbert gave Mellitus a bishop's see in Lundenevic and to Justus he gave Rochester, which is twenty-four miles from Canterbury." The Christianity of the Londoners was of an unsatisfactory character, for, after the death of Sebert, his sons who were heathens stirred up the multitude to drive out their bishop. Mellitus became archbishop of Canterbury, and London relapsed into heathenism. In this, the earliest period of Saxon history recorded, there appears to be no relic of the Christianity of the Britons, which at one time was well in evidence. What became of the cathedral which we may suppose to have existed in London during the later Roman period we cannot tell, but we may guess that it was destroyed by the heathen Saxons. Bede records that the church of St Paul was built by Æthelbert, and from that time to this a cathedral dedicated to St Paul has stood upon the hill looking down on Ludgate.

Arrival of Christianity.

After the driving out of Mellitus London remained without a bishop until the year 656, when Cedda, brother of St Chad of Lichfield, was invited to London by Sigebert, who had been converted to Christianity by Finan, bishop of the Northumbrians. Cedda was consecrated bishop of the East Saxons by Finan and held the see till his death on the 26th of October 664. He was succeeded by Wini, bishop of Winchester, and then came Earconuald (or St Erkenwald), whose shrine was one of the chief glories of old St Paul's. He died on the 30th of April 693, a day which was kept in memory in his cathedral for centuries by special offices. The list of bishops from Cedda to William (who is addressed in the Conqueror's Charter) is long, and each bishop apparently held a position of great importance in the government of the city.

In the 7th century the city seems to have settled down into a prosperous place and to have been peopled by merchants of many nationalities. We learn that at this time it was the great mart of slaves. It was in the fullest sense a free-trading town; neutral to a certain extent between the kingdoms around, although the most powerful of the kings conquered their feebler neighbours. During the 8th century, when a more settled condition of life became possible, the trade and commerce of London increased in volume and prosperity. A change, however, came about towards the end of the century, when the Scandinavian freebooters known as Danes began to harry the coasts. The Saxons had become law-abiding, and the fierce Danes treated them in the same way as in former days they had treated the Britons. In 871 the chronicler affirms that Alfred fought nine great battles against the Danes in the kingdom south of the Thames, and that the West Saxons made peace with them. In the next year the Danes went from Reading to London, and there took up their winter quarters. Then the Mercians made peace with them. In 886 Alfred overcame the Danes, restored London to its inhabitants, rebuilt its walls, reannexed the city to Mercia, and committed it to Ethelred, alderman of Mercia. Then, as the chronicler writes, "all the Angle race turned to him (Alfred) that were not in bondage of the Danish men." In 896 the Londoners came off victorious in their encounters with the Danes. The king obstructed the river so that the enemy could not bring up their ships, and they therefore abandoned them. The Londoners broke up some, and brought the strongest and best to London. In 912 Æthelred, the alderman of the Mercians, who had been placed in authority by Alfred, died, and Edward the Elder took possession of London and Oxford, "and all the lands which thereto belonged."

Danish Invasions.

Under Æthelstan we find the city increasing in importance and general prosperity. There were then eight mints at work, a fact which exhibits evidence of great activity and the need of coin for the purposes of trade. The folk-moot met in the precincts of St Paul's at the sound of the bell of the famous bell-tower, which also rang out when the armed levy was required to march under St Paul's banner. For some years after the decisive battle of Brunanburh (A.D. 937) the

Danes ceased to trouble the country. Fire, however, was almost as great an enemy to London as the Dane. Fabyan when recording the entire destruction of London by fire in the reign of Æthelred (981) makes this remarkable statement—"Ye shall understand that this daye the cytie of London had more housynge and buyldinge from Ludgate toward Westmynstre and lytel or none wher the chief or hart of the citie is now, except (that) in dyvers places were housyng, but they stod without order."

In the reign of Æthelred II., called the Unready (but more correctly the Redeless), the Danes were more successful in their operations against London, but the inhabitants resisted stoutly. Snorre the Icelander tells us that the Danes fortified Southwark with ditch and rampart, which the English assailed in vain. In 982 London was burnt, and in 994 Olaf and Sweyn (the father of Canute) came with ninety-four ships to besiege it. They tried to set the city on fire, but the townsmen did them more harm than they "ever weened." The chronicler piously adds that "the holy Mother of God on that day manifested her mercy to the townsmen, and delivered them from their foes." The Danes went from the town and ravaged the neighbourhood, so that in the end the king and his witan agreed to give sixteen thousand pounds to be relieved of the presence of the enemy. This was the origin of the Danegelt. In the year 1009 the Danes frequently attacked London, but they had no success, and fared ill in their attempts. The Londoners withstood Sweyn in 1013, but in the end they submitted and gave him hostages. Three years after this, Æthelred died in London, and such of the witan as were there and the townsmen chose Edmund Ironside for king, although the witan outside London had elected Canute. Canute's ships were then at Greenwich on their way to London, where they soon afterwards arrived. The Danes at once set to work to dig a great ditch by Southwark, and then dragged their ships through to the west side of the bridge. They were able after this to keep the inhabitants from going either in or out of the town. In spite of all this, after fighting obstinately both by land and by water, the Danes had to raise the siege of London and take the ships to the river Orwell. After a glorious reign of seven months Edmund died in London, and Canute became master of England. The tribute which the townsmen of London had to pay was £10,500, about one-seventh of the amount which was paid by all the rest of the English nation. This shows the growing importance of the city. From this time there appears to have been a permanent Danish settlement in London, probably Aldwich, referred to below.

There is little more to be said of the history of Saxon London than that Edward the Confessor held his Witanagemot there. On his death the Witan which had attended his funeral elected to succeed him Harold, the foremost man in England, and the leader who had attempted to check the spread of the Norman influence fostered by the Confessor. After his defeat and death on the hill on the Sussex Downs then called Senlac, the duke of Normandy had the country at his mercy, but he recognized the importance of London's position, and moved forward with the greatest caution and tact.

Before proceeding with the history of London during the Norman period it is necessary to say something of the counties more especially connected with London.

The "Home Counties."

The walled city of London was a distinct political unit, although it owed a certain allegiance to that one of the kingdoms around it which was the most powerful for the time being. This allegiance therefore frequently changed, but London retained its identity and individuality all through. Essex seems seldom to have held an independent position, for when London first appears as connected with the East Saxons the real power was in the hands of the king of Kent. According to Bede, Wini, being expelled from his bishopric of Wessex in 635, took refuge with Wulfhere, king of the Mercians, of whom he purchased the see of London. Hence the Mercian king must then have been the overlord of London. Not many years afterwards the king of Kent again seems to have held some jurisdiction here. From the laws of the Kentish kings Lhothhere and Eadric (673-685) we learn that the Wic-reeve was an officer of the king of Kent, who exercised a jurisdiction over the Kentish men trading with or at London, or was appointed to watch over their interests.

The origin of the two counties in which London is chiefly situated opens up an interesting question. It is necessary to remember that London is older than these counties, whose names, Middlesex and Surrey, indicate their relative positions to the city and the surrounding county. We have neither record of their settlement nor of the origin of their names. Both must have been peopled from the river. The name Middle Saxons plainly shows that Middlesex must have been settled after the East and West Saxons had given their names to their respective districts. The name Surrey clearly refers to the southern position of the county.

Aldwich.

Reference has already been made to a Danish settlement, and there seems some reason for placing it on the ground now occupied by the parishes of St Clement Danes and St Giles's. For many centuries this district between London and Westminster was a kind of "no man's land" having certain archaic customs. Gomme in his *Governance of London* (1907) gives an account of the connexion of this with the old village of Aldwich, a name that survived in Wych Street, and has been revived by the London County Council in Aldwych, the crescent which leads to Kingsway.

The Conquest.

3. *Norman* (1066-1154).—To return to the condition of things after the great battle. The citizens of London were a divided body, and Duke William knowing that he had many friends in the city saw that a waiting game was the best for his cause in the end. The defeated chiefs retired on the city, led by Ansgar the Staller, under whom as sheriff the citizens of London had marched to fight for Harold at Senlac. They elected Edgar Atheling, the grandson of Edmund Ironside, as king, which the *Saxon Chronicle* says "was indeed his natural right." On hearing of this action William marched towards London, when the citizens sallied forth to meet him. They were repulsed by the Norman horse, but with such loss to the latter that the duke thought it imprudent to lay siege to the city at that time, and he retired to Berkhampstead.[5] It is reported that William sent a private message to Ansgar asking for his support. The result was that Edgar and Earls Edwin and Morkere and "the best men of London" repaired to Berkhampstead, where they submitted themselves and swore fealty to the Conqueror.

Changes in the City.

Thus ends the Saxon period, and the Norman period in London begins with the submission of the citizens as distinct from the action of the rest of the kingdom, which submission resulted soon afterwards in the Conqueror's remarkable charter to William the bishop and Gosfrith the portreeve, supposed to be the elder Geoffrey de Mandeville. A great change was at once made both in the appearance and in the government of the city under Norman rule. One of the earliest acts of the Conqueror was to undertake the erection of a citadel which should overawe the citizens and give him the command of the city. The Tower was situated at the eastern limit of the city, and not far from the western extremity Castle Baynard was built.

The position of the city grew in importance, but the citizens suffered from severe laws and from serious restrictions upon their liberties. In August 1077 occurred a most extensive fire, such a one, says the *Chronicle*, as "never was before since London was founded." This constant burning of large portions of the city is a marked feature of its early history, and we must remember that, although stone buildings were rising on all sides, these were churches, monasteries, and other public edifices; the ordinary houses remained as before, small wooden structures. The White Tower, the famous keep of the Tower of London, was begun by Gundulph, bishop of Rochester, *c.* 1078. In 1083 the old cathedral of St Paul's was begun on the site of the church which Æthelbert is said to have founded in 610. But four

years afterwards the chronicler tells us “the holy monastery of St Paul, the episcopal see of London, was burnt, and many other monasteries, and the greatest and fairest part of the whole city.” In this same year (1087) william the Conqueror died. In 1090 a tremendous hurricane passed over London, and blew down six hundred houses and many churches. The Tower was injured, and a portion of the roof of the church of St Mary-le-Bow, Cheapside, was carried off and fell some distance away, being forced into the ground as much as 20 ft., a proof of the badness of the thoroughfares as well as of the force of the wind, William Rufus inherited from his father a love for building, and in the year 1097 he exacted large sums of money from his subjects with the object of carrying on some of the undertakings he had in hand. These were the walling round of the Tower and the rebuilding of London Bridge, which had been almost destroyed by a flood. In 1100 Rufus was slain, and Henry I. was crowned in London. This king granted the citizens their first real charter, but this was constantly violated, when Stephen seized the crown on the death of Henry I., he tried successfully to obtain the support of the people of London. He published a charter confirming in general terms the one granted by Henry, and commanding that the good laws of Edward the Confessor should be observed. The citizens, however, did not obtain their rights without paying for them, and in 1139 they paid Stephen one hundred marks of silver to enable them to choose their own sheriffs. In this reign the all-powerfulness of the Londoners is brought prominently forward. Stephen became by the shifting fortune of war a prisoner, and the empress Matilda might, if she had had the wisdom to favour the citizens, have held the throne, which was hers by right of birth. She, however, made them her enemies by delivering up the office of justiciary of London and the sheriffwick to her partisan Geoffrey, earl of Essex, and attempting to reduce the citizens to the enslaved condition of the rest of the country. This made her influential enemies, who soon afterwards replaced Stephen upon the throne. The Norman era closes with the death of Stephen in 1154.

One of the most striking changes in the appearance of Norman London was caused by the rebuilding of old churches and the building of new ones, and also by the foundation of the great monastic establishments. The early history of the parishes of London is one of great difficulty and complexity. Although some of the parishes must be of great antiquity, we have little authentic information respecting them before the Conquest. The dedications of many of the churches indicate their great age, but the constant fires in London destroyed these buildings. The original churches appear to have been very small, as may be judged from their number. It is not easy, however, to understand how it was that when the first parishes were formed so small an area was attached to each. The parish church of which we have the most authentic notice before the Conquest is St Helen’s, Bishopsgate. It was in existence many years before the priory of the nuns of St Helen’s was founded. Bishop Stubbs in his Introduction to the Historical Works of Ralph de Diceto writes: “St Paul’s stood at the head of the religious life of London, and by its side, at some considerable interval, however, St Martin’s le Grand (1056), St Bartholomew’s, Smithfield (1123) and the great and ancient foundation of Trinity, Aldgate” (1108). The great Benedictine monastery of Black Monks was situated away from the city at Westminster, and it was the only monastic house subject to the rule of St Benedict in the neighbourhood of London, although the houses of nuns, of which there were many dotted over the suburbs of London, were governed by this rule. In course of time there was a widespread desire in Europe for a stricter rule among the monks, and reforms of the Benedictine rule were instituted at Cluni (910), Chartreuse (about 1080) and Citeaux (1098). All these reforms were represented in London.

Early parishes.

Religious foundations.

Cluniac Order.—This order was first brought to England by William, earl of Warren (son-in-law of William the Conqueror), who built the first house at Lewes in Sussex about 1077. The priory of Bermondsey in Surrey was founded by Aylwin Child, citizen of London about 1082.

Carthusians.—When this order was brought to England in 1178 the first house was founded at Witham in Somersetshire. In all there were nine houses of the order in England. One of these was the Charterhouse of London which was not founded until 1371 by Sir Walter Manny, K.G.

Cistercians.—It was usual to plant these monasteries in solitary and uncultivated places, and no other house, even of their own order, was allowed to build within a certain distance of the original establishment. This makes it surprising to learn that there were two separate houses of this order in the near neighbourhood of London. A branch of the order came to England about 1128 and the first house was founded at Waverley in Surrey. Very shortly after (about 1134) the abbey of Stratford Langthorne in Essex was founded by William de Montfichet, who endowed it with all his lordship in West Ham. It was not until two centuries afterwards that the second Cistercian house in the immediate neighbourhood of London was founded. This was the Abbey of St Mary Graces, East-Minster or New Abbey without the walls of London, beyond Tower Hill, which Edward III. instituted in 1350 after a severe scourge of plague (the so-called Black Death).

The two great Military Orders—the Knights Hospitallers of St John of Jerusalem and the Templars—followed the Augustinian rule and were both settled in London. The Hospital or Priory of St John was founded in 1100 by Jordan Briset and his wife Muriel, outside the northern wall of London, and the original village of Clerkenwell grew up around the buildings of the knights. A few years after this the Brethren of the Temple of Solomon at Jerusalem or Knights of the Temple came into being at the Holy City, and they settled first on the south side of Holborn near Southampton Row. They removed to Fleet Street or the New Temple in 1184. On the suppression of the order by command of the pope the house in Fleet Street was given in 1313 by Edward II. to Aymer de Valence, earl of Pembroke, at whose death in 1324 the property passed to the knights of St John, who leased the new Temple to the lawyers, still the occupants of the district.

The queen of Henry I. (Matilda or Maud) was one of the chief founders of religious houses, and so great was the number of monasteries built in this king’s reign that it was said almost all the labourers became bricklayers and carpenters and there was much discontent in consequence.

4. *Plantagenet* (*1154-1485*).—Henry II. appears to have been to a certain extent prejudiced against the citizens of London on account of their attitude towards his mother, and he treated them with some severity. In 1176 the rebuilding of London Bridge with stone was begun by Peter of Colechurch. This was the bridge which was pulled down early in the 19th century. It consisted of twenty stone arches and a drawbridge. There was a gatehouse at each end and a chapel or crypt in the centre, dedicated to St Thomas of Canterbury, in which Peter of Colechurch was buried in 1205. The large amount of building at this time proves that the citizens were wealthy. Fitzstephen, the monk of Canterbury, has left us the first picture of London. He speaks of its wealth, commerce, grandeur and magnificence—of the mildness of the climate, the beauty of the gardens, the sweet, clear and salubrious springs, the flowing streams, and the pleasant clack of the watermills. Even the vast forest of Middlesex, with its densely wooded thickets, its coverts of game, stags, fallow deer, boars and wild bulls is pressed into the description to give a contrast which shall enhance the beauty of the city itself. Fitzstephen tells how, when the great marsh that washed the walls of the city on the north (Moorfields) was frozen over, the young men went out to slide and skate and sport on the ice. Skates made of bones have been dug up in this district. This sport was allowed to fall into disuse, and was not again prevalent until it was introduced from Holland after the Restoration.

Fitzstephen’s description of London.

In spite of Fitzstephen's glowing description we must remember that the houses of London were wholly built of wood and thatched with straw or reeds. These houses were specially liable to be destroyed by fire, and in order to save the city from this imminent danger the famous Assize of Building known as "Fitz-Ailwyne's Assize" was drawn up in 1189. In this document the following statement was made: "Many citizens, to avoid such danger, built according to their means, on their ground, a stone house covered and protected by thick tiles against the fury of fire, whereby it often happened that when a fire arose in the city and burnt many edifices and had reached such a house, not being able to injure it, it then became extinguished, so that many neighbours' houses were wholly saved from fire by that house."

Various privileges were conceded to those who built in stone, but no provision was made as to the material to be used in roofing tenements. This Assize, which has been described as the earliest English Building Act, is of great value from an historical point of view, but unfortunately it had little practical effect, and in 1212 what was called "Fitz-Ailwyne's Second Assize," with certain compulsory regulations, was enacted. Thenceforth everyone who built a house was strictly charged not to cover it with reeds, rushes, stubble or straw, but only with tiles, shingle boards or lead. In future, in order to stop a fire, houses could be pulled down in case of need with an alderman's hook and cord. For the speedy removal of burning houses each ward was to provide a strong iron hook, with a wooden handle, two chains and two strong cords, which were to be left in the charge of the bedel of the ward, who was also provided with a good horn, "loudly sounding."

Richard I. was a popular king, but his fighting in the Holy Land cost his subjects much. London had to pay heavily towards his ransom; and, when the king made his triumphal entry into London after his release from imprisonment, a German nobleman is said to have remarked that had the emperor known of the wealth of England he would have insisted on a larger sum. The Londoners were the more glad to welcome Richard back in that the head of the regency, Longchamp, bishop of Ely, was very unpopular from the encroachments he made upon the city with his works at the Tower.

The first charter by which the city claims the jurisdiction and conservancy of the river Thames was granted by Richard I. John granted several charters to the city, and it was expressly stipulated in Magna Charta that the city of London should have all its ancient privileges and free customs. The citizens opposed the king during the wars of the barons. In the year 1215 the barons having received intelligence secretly that they might enter London with ease through Aldgate, which was then in a very ruinous state, removed their camp from Bedford to Ware, and shortly after marched into the city in the night-time. Having succeeded in their object, they determined that so important a gate should no longer remain in a defenceless condition. They therefore spoiled the religious houses and robbed the monastery coffers in order to have means wherewith to rebuild it. Much of the material was obtained from the destroyed houses of the unfortunate Jews, but the stone for the bulwarks was obtained from Caen, and the small bricks or tiles from Flanders.

Allusion has already been made to the great change in the aspect of London and its surroundings made during the Norman period by the establishment of a large number of monasteries. A still more important change in the configuration of the interior of London was made in the 13th century, when the various orders of the friars established themselves there. The Benedictine monks preferred secluded sites; the Augustinians did not cultivate seclusion so strictly; but the friars chose the interior of towns by preference. At the beginning of the 13th century the remarkable evangelical revival, instituted almost simultaneously by St Dominic and St Francis, swept over Europe.

The four chief orders of Mendicant friars were magnificently housed in London:—

Mendicant friars.

Blackfriars.—The Black, Preaching or Dominican Friars came to England in 1221 and their first house was at Oxford. Shortly after this they came London and settled in Holborn near Lincoln's Inn, where they remained for more than fifty years. In 1276 they removed to the neighbourhood of Baynard Castle, and their house gave a name to a London district which it still retains.

Greyfriars.—The Greyfriars, Minorites or Franciscans, first settled in Cornhill, and in 1224 John Ewin made over to them an estate situated in the ward of Farringdon Within and in the parish of St Nicholas in the Shambles, where their friary was built. Christ Church, Newgate Street, occupies the site of the choir of the great church of the Greyfriars.

Austin Friars.—The house of the Austin Friars or Friars Eremites was founded in Broad Street ward in 1253.

White Friars.—The Friars of the Blessed Virgin of Mount Carmel or Carmelites or Whitefriars came to London in 1241, and made their home on land between Fleet Street and the Thames given by Edward I.

Besides the four chief orders of friars there were the Crutched Friars in the parish of St Olave, Hart Street (about 1298), and the Friars of the Sac first outside Aldersgate (about 1257) and afterwards in the Old Jewry.

The names of places in London form valuable records of the habitations of different classes of the population. The monasteries and friaries are kept in memory by their names in various parts of London. In the same way the residences of the Jews have been marked. When Edward I. expelled the Jews from England in 1290 the district in which they had lived since William the Conqueror's day came to be called the Old Jewry. On their return after many centuries of exile most of them settled in the neighbourhood of Aldgate and Aldersgate. There is a reminder of them in the names of Jewry Street near the former and of Jewin Street near the latter place. Jewin Street was built on the site of the burying-place of the Jews before the expulsion.

In the middle ages there was a constant succession of pageants, processions and tournaments. The royal processions arranged in connexion with coronations were of great antiquity, but one of the earliest to be described is that of Henry III. in 1236, which was chronicled by Matthew Paris. After the marriage at Canterbury of the king with Eleanor of Provence the royal personages came to London, and were met by the mayor, aldermen and principal citizens to the number of 360, sumptuously apparelled in silken robes embroidered, riding upon stately horses. After the death of Henry III. (1272) the country had to wait for their new king, who was then in the Holy Land. Edward I. came to London on the 2nd of August 1274, when he was received with the wildest expressions of joy. The streets were hung with rich cloths of silk arras and tapestry; the aldermen and principal men of the city threw out of their windows handsful of gold and silver, to signify their gladness at the king's return; and the conduits ran with wine, both white and red.

Pageants.

Dr Jessopp gives a vivid picture of what occurred when King Edward III. entered London in triumph on the 14th of October 1347. He was the foremost man in Europe, and England had reached a height of power and glory such as she had never attained before. Ten years after this, one of the most famous scenes in the streets of London occurred, when Edward the Black Prince brought the French King John and other prisoners after the battle of Poitiers to England. This was a scene unequalled until Henry V. returned from the glorious field of Agincourt in 1415. The mayor and aldermen apparelled in orient-grained scarlet, and four hundred commoners in murrey, well mounted, with rich collars and chains, met the king at Blackheath. At the entrance to London Bridge the towers were adorned with banners of the royal arms, and in the front of them was inscribed *Civitas Regis Justicie*.

During the troubles of the 15th century the authorities had seen the necessity of paying more attention to the security of the gates and walls of the city, and when Thomas Nevill, son of William, Lord Fauconberg, made his attack upon London in 1471 he experienced a spirited resistance. He first attempted to land from his ships in the city, but the Thames side from Baynard's Castle to the Tower was so well fortified that he had to seek a quieter and less prepared position. He then set upon the several gates in succession, and was repulsed at all. On the 11th of May he made a desperate attack upon Aldgate, followed by 500 men. He won the bulwarks and some of his followers entered into the city, but the portcullis being let down these were cut off from their own party and were slain by the enemy. The portcullis was drawn up, and the besieged issued forth against the rebels, who were soon forced to flee.

When Richard, duke of Gloucester, laid his plans for seizing the crown, he obtained the countenance of the lord mayor, Sir Edmund Shaw, whose brother Dr Shaw praised Richard at Paul's Cross. Crosby Hall, in Bishopsgate Street, then lately built, was made the lodging of the Protector. There he acted the accessible prince in the eyes of the people, for the last of the Plantagenets was another of the usurpers who found favour in the eyes of the men of London. His day, however, was short, and with the battle of Bosworth ends Plantagenet London.

5. *Tudor* (*1485-1603*).—It was during this period that the first maps of London were drawn. No representation of the city earlier than the middle of the 16th century has been discovered, although it seems more than probable that some plans must have been produced at an earlier period.[6] The earliest known view is the drawing of Van den Wyngaerde in the Bodleian Library (dated 1550). Braun and Hogenberg's map was published in 1572-1573, and the so-called Agas's map was probably produced soon afterwards, and was doubtless influenced by the publication of Braun and Hogenberg's excellent engraving; Norden's maps of London and Westminster are dated 1593. Some of these maps were pasted upon walls, and must have been largely destroyed by ordinary wear and tear. It is curious that the only two existing copies of Agas's map[7] were published in the reign of James I., although apparently they had not been altered from the earlier editions of Elizabeth's reign which have been lost. By the help of these maps we are able to obtain a clear notion of the extent and chief characteristics of Tudor London. Henry VII. did little to connect his name with the history of London, although the erection of the exquisite specimen of florid Gothic at Westminster Abbey has carried his memory down in its popular name of Henry VII.'s chapel. Soon after this king obtained the throne he borrowed the sum of 3000 marks from the city, and moreover founded the excellent precedent of repaying it at the appointed time. The citizens were so pleased at this unexpected occurrence that they willingly lent the king £6000 in 1488, which he required for military preparations against France. In 1497 London was threatened by the rebels favourable to Perkin Warbeck, who encamped on Blackheath on the 17th of June. At first there was a panic among the citizens, but subsequently the city was placed in a proper state of defence, and the king himself encamped in St George's Fields. On June 22 he entirely routed the rebels; and some time afterwards Perkin Warbeck gave himself up, and was conducted in triumph through London to the Tower.

First maps of London.

As the chief feature of Norman London was the foundation of monasteries, and that of Plantagenet London was the establishment of friaries, so Tudor London was specially characterized by the suppression of the whole of these religious houses, and also of the almost numberless religious gilds and brotherhoods. When we remember that more than half of the area of London was occupied by these establishments, and that about a third of the inhabitants were monks, nuns and friars, it is easy to imagine how great must have been the disorganization caused by this root and branch reform. One of the earliest of the religious houses to be suppressed was the hospital of St Thomas of Acon (or Acre) on the north side of Cheapside, the site of which is now occupied by Mercers' Hall. The larger houses soon followed, and the Black, the White and the Grey Friars, with the Carthusians and many others, were all condemned in November 1538.

Suppression of religious houses.

Love of show was so marked a characteristic of Henry VIII. that we are not surprised to find him encouraging the citizens in the same expensive taste. On the occasion of his marriage with Catherine of Aragon the city was gorgeously ornamented with rich silks and tapestry, and Goldsmiths' Row (Cheapside) and part of Cornhill were hung with golden brocades. When on the eve of St John's Day, 1510, the king in the habit of a yeoman of his own guard saw the famous march of the city watch, he was so delighted that on the following St Peter's Eve he again attended in Cheapside to see the march, but this time he was accompanied by the queen and the principal nobility. The cost of these two marches in the year was very considerable, and, having been suspended in 1528 on account of the prevalence of the sweating sickness, they were soon afterwards forbidden by the king, and discontinued during the remainder of his reign. Sir John Gresham, mayor in 1548, revived the march of the city watch, which was made more splendid by the addition of three hundred light horsemen raised by the citizens for the king's service.

The best mode of utilizing the buildings of the suppressed religious houses was a difficult question left unsolved by Henry VIII. That king, shortly before his death, refounded Rahere's St Bartholomew's Hospital, "for the continual relief and help of an hundred sore and diseased," but most of the large buildings were left unoccupied to be filled by his successor. The first parliament of Edward's reign gave all the lands and possessions of colleges, chantries, &c., to the king, when the different companies of London redeemed those which they had held for the payment of priests' wages, obits and lights at the price of £20,000, and applied the rents arising from them to charitable purposes. In 1550 the citizens purchased the manor of Southwark, and with it they became possessed of the monastery of St Thomas, which was enlarged and prepared for the reception of "poor, sick and helpless objects." Thus was refounded St Thomas's Hospital, which was moved to Lambeth in 1870-1871. Shortly before his death Edward founded Christ's Hospital in the Grey Friars, and gave the old palace of Bridewell to the city "for the lodging of poor wayfaring people, the correction of vagabonds and disorderly persons, and for finding them work." On the death of Edward VI. Lady Jane Grey was received at the Tower as queen, she having gone there by water from Durham House in the Strand. The citizens, however, soon found out their mistake, and the lord mayor, aldermen and recorder proclaimed Queen Mary at Cheapside. London was then gay with pageants, but when the queen made known her intention of marrying Philip of Spain the discontent of the country found vent in the rising of Sir Thomas Wyat, and the city had to prepare itself against attack. Wyat took possession of Southwark, and expected to have been admitted into London; but finding the gates shut against him and the drawbridge cut down he marched to Kingston, the bridge at which place had been destroyed. This he restored, and then proceeded towards London. In consequence of the breakdown of some of his guns he imprudently halted at Turnham Green. Had he not done so it is probable that he might have obtained possession of the city. He planted his ordnance on Hay Hill, and then marched by St James's Palace to Charing Cross. Here he was attacked by Sir John Gage with a thousand men, but he repulsed them and reached Ludgate without further opposition. He was disappointed at the resistance which was made, and after musing a while "upon a stall over against the Bell Savadge Gate" he turned back. His retreat was cut off, and he surrendered to Sir Maurice Berkeley, we have somewhat fully described this historical incident here because it has an important bearing on the history of London, and shows also the small importance of the districts outside the walls at that period.

We now come to consider the appearance of London during the reign of the last of the Tudors. At no other period were so many great men associated with its history; the latter years of Elizabeth's reign are specially interesting to us

Tudor London.

because it was then that Shakespeare lived in London, and introduced its streets and people into his plays. In those days the frequent visitation of plagues made men fear the gathering together of multitudes. This dread of pestilence, united with a puritanic hatred of plays, made the citizens do all they could to discountenance theatrical entertainments. The queen acknowledged the validity of the first reason, but she repudiated the religious objection provided ordinary care was taken to allow "such plays only as were fitted to yield honest recreation and no example of evil." On April 11, 1582, the lords of the council wrote to the lord mayor to the effect that, as "her Majesty sometimes took delight in those pastimes, it had been thought not unfit, having regard to the season of the year and the clearance of the city from infection, to allow of certain companies of players in London, partly that they might thereby attain more dexterity and perfection the better to content her Majesty" (Analytical Index to the *Remembrancia*). When theatres were established the lord mayor took care that they should not be built within the city. The "Theatre" and the "Curtain" were situated at Shoreditch; the "Globe," the "Swan," the "Rose" and the "Hope" on the Bankside; and the Blackfriars theatre, although within the walls, was without the city jurisdiction.

In 1561 St Paul's steeple and roof were destroyed by lightning, and the spire was never replaced. This circumstance allows us to test the date of certain views; thus Wyngaerde's map has the spire, but Agas's map is without it. In 1566 the first stone was laid of the "Burse," which owed its origin to Sir Thomas Gresham. In 1571 Queen Elizabeth changed its name to the Royal Exchange. The Strand was filled with noble mansions washed by the waters of the Thames, but the street, if street it could be called, was little used by pedestrians. Londoners frequented the river, which was their great highway. The banks were crowded with stairs for boats, and the watermen of that day answered to the chairmen of a later date and the cabmen of to-day. The Bankside was of old a favourite place for entertainments, but two only—the bull-baiting and the bear-baiting—were in existence when Agas's map was first planned. On Norden's map,[8] however, we find the gardens of Paris Garden, the bearhouse and the playhouse.

> The settled character of the later years of Elizabeth's reign appears to have caused a considerable change in the habits of the people. Many of the chief citizens followed the example of the courtiers, and built for themselves country residences in Middlesex, Essex and Surrey; thus we learn from Norden that Alderman Roe lived at Muswell Hill, and we know that Sir Thomas Gresham built a fine house and planned a beautiful park at Osterley. The maps show us much that remains somewhat the same as it was, but also much that has greatly altered. St Giles's was literally a village in the fields; Piccadilly was "the waye to Redinge," Oxford Street "the way to Uxbridge," Covent Garden an open field or garden, and Leicester Fields lammas land. Moorfields was drained and laid out in walks in Elizabeth's reign. At Spitalfields crowds used to congregate on Easter Monday and Tuesday to hear the Spital sermons preached from the pulpit cross. The ground was originally a Roman Cemetery, and about the year 1576 bricks were largely made from the clayey earth, the recollection of which is kept alive in the name of Brick Lane. Citizens went to Holborn and Bloomsbury for change of air, and houses were there prepared for the reception of children, invalids and convalescents. In the north were sprinkled the outlying villages of Islington, Hoxton and Clerkenwell.

6. *Stuart* (*1603-1714*).—The Stuart period, from the accession of James I. to the death of Queen Anne, extends over little more than a century, and yet greater changes occurred during those years than at any previous period. The early years of Stuart London may be said to be closely linked with the last years of Elizabethan London, for the greatest men, such as Raleigh, Shakespeare and Ben Jonson, lived on into James's reign. Much of the life of the time was then in the City, but the last years of Stuart London take us to the 18th century, when social life had permanently shifted to the west end. In the middle of the period occurred the civil wars, and then the fire which changed the whole aspect of London. When James came to the throne the term suburbs had a bad name, as all those disreputable persons who could find no shelter in the city itself settled in these outlying districts. Stubbs denounced suburban gardens and garden houses in his *Anatomy of Abuses*, and another writer observed "how happy were cities if they had no suburbs."

The preparations for the coronation of King James were interrupted by a severe visitation of the plague, which killed off as many as 30,578 persons, and it was not till March 15, 1604, that the king, the queen and Prince Henry passed triumphantly from the Tower to Westminster. The lord mayor's shows, which had been discontinued for some years, were revived by order of the king in 1609. The dissolved monastery of the Charterhouse, which had been bought and sold by the courtiers several times, was obtained from Thomas, earl of Suffolk, by Thomas Sutton for £13,000. The new hospital chapel and schoolhouse were begun in 1611, and in the same year Sutton died.

With the death of James I. in 1625 the older history of London may be said to have closed. During the reign of his successor the great change in the relative positions of London within and without the walls had set in. Before going on to consider the chief incidents of this change it will be well to refer to some features of the social life of James's reign. Ben Jonson places one of the scenes of *Every Man in his Humour* in Moorfields, which at the time he wrote the play had, as stated above, lately been drained and laid out in walks. Beggars frequented the place, and travellers from the village of Hoxton, who crossed it in order to get into London, did so with as much expedition as possible. Adjoining Moorfields were Finsbury Fields, a favourite practising ground for the archers. Mile End, a common on the Great Eastern Road, was long famous as a rendezvous for the troops. These places are frequently referred to by the old dramatists; Justice Shallow boasts of his doings at Mile End Green when he was Dagonet in Arthur's Show. Fleet Street was the show-place of London, in which were exhibited a constant succession of puppets, naked Indians and strange fishes. The great meeting-place of Londoners in the day-time was the nave of old St Paul's. Crowds of merchants with their hats on transacted business in the aisles, and used the font as a counter upon which to make their payments; lawyers received clients at their several pillars; and masterless serving-men waited to be engaged upon their own particular bench. Besides those who came on business there were gallants dressed in fashionable finery, so that it was worth the tailor's while to stand behind a pillar and fill his table-books with notes. The middle or Mediterranean aisle was the Paul's walk, also called the Duke's Gallery from the erroneous supposition that the tomb of Sir Guy Beauchamp, earl of Warwick, was that of the "good" Humphrey, duke of Gloucester. After the Restoration a fence was erected on the inside of the great north door to hinder a concourse of rude people, and when the cathedral was being rebuilt Sir Christopher Wren made a strict order against any profanation of the sacred building. St Paul's churchyard was from the earliest days of printing until the end of the 18th century the headquarters of the book trade, when it shifted to Paternoster Row. Another of the favourite haunts of the people was the garden of Gray's Inn, where the choicest society was to be met. There, under the shadow of the elm trees which Bacon had planted, Pepys and his wife constantly walked. Mrs Pepys went on one occasion specially to observe the fashions of the ladies because she was then "making some clothes."

Social life.

In those days of public conviviality, and for many years afterwards, the taverns of London held a very important place. The Boar's Head in Great Eastcheap was an inn of Shakespeare's own day, and the characters he introduces into his plays are really his own contemporaries. The "Mermaid" is sometimes described as in Bread Street, and at other times in Friday Street and also in Cheapside. We are thus able to fix its exact position; for a little to the west of Bow church is Bread Street, then came a block of houses, and the next thoroughfare was Friday Street. It was in this block that the "Mermaid" was situated, and there appear to have been entrances from each street. What makes this fact still more certain is the circumstance that a haberdasher in

Taverns.

Cheapside living "'twixt Wood Street and Milk Street," two streets on the north side opposite Bread and Friday Streets, described himself as "over against the Mermaid tavern in Cheapside." The Windmill tavern occupies a prominent position in the action of *Every Man in his Humour*.[9] The Windmill stood at the corner of the Old Jewry towards Lothbury, and the Mitre close by the Mermaid in Bread Street. The Mitre in Fleet Street, so intimately associated with Dr Johnson, also existed at this time. It is mentioned in a comedy entitled *Ram Alley* (1611) and Lilly the astrologer frequented it in 1640. At the Mermaid Ben Jonson had such companions as Shakespeare, Raleigh, Beaumont, Fletcher, Carew, Donne, Cotton and Selden, but at the Devil in Fleet Street, where he started the Apollo Club, he was omnipotent. Herrick, in his well-known *Ode to Ben*, mentions several of the inns of the day.

Theatres.

Under James I. the theatre, which established itself so firmly in the latter years of Elizabeth, had still further increased its influence, and to the entertainments given at the many playhouses may be added the masques so expensively produced at court and by the lawyers at the inns of court. In 1613 *The Masque of Flowers* was presented by the members of Gray's Inn in the Old Banqueting House in honour of the marriage of the infamous Carr, earl of Somerset, and the equally infamous Lady Frances, daughter of the earl of Suffolk. The entertainment was prepared by Sir Francis Bacon at a cost of about £2000.

The "West End."

It was during the reign of Charles I. that the first great exodus of the wealthy and fashionable was made to the West End. The great square or piazza of Covent Garden was formed from the designs of Inigo Jones about 1632. The neighbouring streets were built shortly afterwards, and the names of Henrietta, Charles, James, King and York Streets were given after members of the royal family. Great Queen Street, Lincoln's Inn Fields, was built about 1629, and named in honour of Henrietta Maria. Lincoln's Inn Fields had been planned some years before. With the Restoration the separation of fashionable from city life became complete.

When the Civil War broke out London took the side of the parliament, and an extensive system of fortification was at once projected to protect the town against the threatened attack of the royal army. A strong earthen rampart, flanked with bastions and redoubts, surrounded the City, its liberties, Westminster and Southwark, making an immense enclosure.

The Plague.

London had been ravaged by plague on many former occasions, but the pestilence that began in December 1664 lives in history as "the Plague of London." On the 7th of June 1665 Samuel Pepys for the first time saw two or three houses marked with the red cross and the words "Lord, have mercy upon us," on the doors. The deaths daily increased, and business was stopped. Grass grew in the area of the Royal Exchange, at Whitehall, and in the principal streets of the city. On the 4th of September 1665 Pepys writes an interesting letter to Lady Carteret from Woolwich: "I have stayed in the city till above 7400 died in one week, and of them about 6000 of the plague, and little noise heard day or night but tolling of bells." The plague was scarcely stayed before the whole city was in flames, a calamity of the first magnitude, but one which in the end caused much good, as the seeds of disease were destroyed, and London has never since been visited by such an epidemic. On the 2nd of September 1666 the fire broke out at one o'clock in the morning at a house in Pudding Lane. A violent east wind fomented the flames, which raged during the whole of Monday and great part of Tuesday. On Tuesday night the wind fell somewhat, and on Wednesday the fire slackened. On Thursday it was extinguished, but on the evening of that day the flames again burst forth at the Temple. Some houses were at once blown up by gunpowder, and thus the fire was finally mastered. Many interesting details of the fire are given in Pepys's *Diary*. The river swarmed with vessels filled with persons carrying away such of their goods as they were able to save. Some fled to the hills of Hampstead and Highgate, but Moorfields was the chief resort of the houseless Londoner. Soon paved streets and two-storey houses were seen in that swampy place. The people bore their troubles heroically, and Henry Oldenburg, writing to the Hon. Robert Boyle on September 10, says: "The citizens, instead of complaining, discoursed almost of nothing but of a survey for rebuilding the city with bricks and large streets." Within a few days of the fire three several plans were presented to the king for the rebuilding of the city, by Christopher Wren, John Evelyn and Robert Hooke. Wren proposed to build main thoroughfares north and south, and east and west, to insulate all the churches in conspicuous positions, to form the most public places into large piazzas, to unite the halls of the twelve chief companies into one regular square annexed to Guildhall and to make a fine quay on the bank of the river from Blackfriars to the Tower. His streets were to be of three magnitudes—90 ft., 60 ft. and 30 ft. wide respectively. Evelyn's plan differed from Wren's chiefly in proposing a street from the church of St Dunstan's in the East to the cathedral, and in having no quay or terrace along the river. In spite of the best advice, however, the jealousies of the citizens prevented any systematic design from being carried out, and in consequence the old lines were in almost every case retained. But though the plans of Wren and Hooke were not adopted, it was to these two fellows of the Royal Society that the labour of rebuilding London was committed. Wren's great work was the erection of the cathedral of St Paul's, and the many churches ranged round it as satellites. Hooke's task was the humbler one of arranging as city surveyor for the building of the houses. He laid out the ground of the several proprietors in the rebuilding of the city, and had no rest early or late from persons soliciting him to set out their ground for them at once. The first great impetus of change in the configuration of London was given by the great fire, and Evelyn records and regrets that the town in his time had grown almost as large again as it was within his own memory. Although for several centuries attempts had been made in favour of building houses with brick or stone, yet the carpenters continued to be the chief house-builders. As late as the year 1650 the Carpenters' Company drew up a memorial in which they "gave their reasons that tymber buildings were more commodious for this citie than brick buildings were." The Act of Parliament "for rebuilding the city of London" passed after the great fire, gave the *coup de grâce* to the carpenters as house-builders. After setting forth that "building with brick was not only more comely and durable, but also more safe against future perils of fire," it was enacted "that all the outsides of all buildings in and about the city should be made of brick or stone, except doorcases and window-frames, and other parts of the first story to the front between the piers," for which substantial oaken timber might be used "for conveniency of shops." In the winter of 1683-1684 a fair was held for some time upon the Thames. The frost, which began about seven weeks before Christmas and continued for six weeks after, was the greatest on record; the ice was 11 in. thick.

The Great Fire.

Rebuilding: Wren's scheme.

The revocation of the edict of Nantes in October 1685, and the consequent migration of a large number of industrious French Protestants, caused a considerable growth in the east end of London. The silk manufactories at Spitalfields were then established.

During the short reign of James II. the fortunes of the city were at their lowest, and nowhere was the arrival of the prince of Orange more welcomed.

William III. cared little for London, the smoke of which gave him asthma, and when a great part of Whitehall was burnt in 1691 he purchased Nottingham House and made it into Kensington Palace. Kensington was then an insignificant village, but the arrival of the court soon caused it to grow in importance.

Although the spiritual wants of the city were amply provided for by the churches built by Wren, the large districts outside the city and its liberties had been greatly neglected. The act passed in the reign of Queen Anne for building fifty new churches (1710) for a time supplied the wants of large districts.

7. *Eighteenth Century.*—London had hitherto grown up by the side of the Thames. In the 18th century other parts of the town were more largely built upon. The inhabitants used coaches and chairs more than boats, and the banks of the river were neglected. London could no longer be seen as a whole, and became a mere collection of houses. In spite of this the 18th century produced some of the most devoted of Londoners—men who considered a day lived out of London as one lost out of their lives. Of this class Dr Johnson and Hogarth are striking examples. The exhibitions of vice and cruelty that were constantly to be seen in the capital have been reproduced by Hogarth, and had they not been set down by so truthful an observer it would have been almost impossible to believe that such enormities could have been committed in the streets of a great city. A few days after his accession George I. addressed the representatives of the city in these words: "I have lately been made sensible of what consequence the city of London is, and therefore shall be sure to take all their privileges and interests into my particular protection." On the following lord mayor's day the king witnessed the show in Cheapside and attended the banquet at Guildhall. Queen Anne and the first three Georges were all accommodated, on the occasions of their visits to the city to see the show, at the same house opposite Bow church. In the time of Queen Anne and George I. David Barclay (the son of the famous apologist for the Quakers) was an apprentice in the house, but he subsequently became master, and had the honour of receiving George II. and George III. as his guests. There was a large balcony extending along the front of the house which was fitted with a canopy and hangings of crimson damask silk. The building, then numbered 108 Cheapside, was pulled down in 1861.

Extension in the 18th century.

Early in the 18th century there was a considerable extension of building operations in the West End. Still, however, the north of London remained unbuilt upon. In 1756 and for some years subsequently the land behind Montague House (now the British Museum) was occupied as a farm, and when in that year a proposal was made to plan out a new road the tenant and the duke of Bedford strongly opposed it. In 1772 all beyond Portland Chapel in Great Portland Street was country. Bedford House in Bloomsbury Square had its full view of Hampstead and Highgate from the back, and Queen's Square was built open to the north in order that the inhabitants might obtain the same prospect.

In 1737 the Fleet ditch between Holborn Bridge and Fleet Bridge was covered over, and Stocks Market was removed from the site of the Mansion House to the present Farringdon Street, and called Fleet market. On October 25, 1739, the first stone of the Mansion House was laid. Previously the first magistrates lived in several different houses. A frost almost as severe as the memorable one of 1683-1684 occurred in the winter of 1739-1740, and the Thames was again the scene of a busy fair. In 1758 the houses on London Bridge were cleared away, and in 1760-1762 several of the city gates were taken down and sold. Moorgate is said to have fetched £166, Aldersgate £91, Aldgate £177, Cripplegate £90, and Ludgate £148. The statue of Queen Elizabeth which stood on the west side of Ludgate was purchased by Alderman Gosling and set up against the east end of St Dunstan's church in Fleet Street, where it still remains.

8. *Nineteenth Century.*—In 1806 London saw the public funerals of three of England's greatest men. On the 8th February the body of Nelson was borne with great pomp from the Admiralty to St Paul's Cathedral, where it was interred in the presence of the prince of Wales and the royal dukes. Pitt was buried on the 22nd of February, and Fox on the 10th of October, both in Westminster Abbey.

The first exhibition of Winsor's system of lighting the streets with gas took place on the king's birthday (June 4) 1807, and was made in a row of lamps in front of the colonnade before Carlton House. Finsbury Square was the first public place in which gas lighting was actually adopted, and Grosvenor Square the last. In the winter of 1813-1814 the Thames was again frozen over. The frost began on the evening of December 27, 1813, with a thick fog. After it had lasted for a month, a thaw of four days, from the 26th to the 29th of January, took place, but this thaw was succeeded by a renewal of the frost, so severe that the river soon became one immovable sheet of ice. There was a street of tents called the City Road, which was daily thronged with visitors. In 1838 the second Royal Exchange was destroyed by fire; and on October 28, 1844, the Queen opened the new Royal Exchange, built by Mr (afterwards Sir William) Tite. The Great Exhibition of 1851 brought a larger number of visitors to London than had ever been in it before at one time. The great and continuous increase in the buildings and the enlargement of London on all sides dates from this period.

London within the walls has been almost entirely rebuilt, although in the neighbourhood of the Tower there are still many old houses which have only been refronted. From the upper rooms of the houses may be seen a large number of old tiled roofs.

Unlike many capitals of Europe which have shifted their centres the city of London in spite of all changes and the continued enlargement of the capital remains the centre and headquarters of the business of the country. The Bank of England, the Royal Exchange and the Mansion House are on the site of Ancient London.

In 1863 on the occasion of the marriage of King Edward VII. (when prince of Wales) the streets of London were illuminated as they had never been before. Among other events which made the streets gay and centred in processions to St Paul's may be specially mentioned the Thanksgiving Day on the 27th of February 1872 for the recovery of the prince of Wales after his dangerous illness; and the rejoicings at the Jubilee of Queen Victoria in 1887, and the Diamond Jubilee in 1897.

The first great emigration of the London merchants westward was about the middle of the 18th century, but only those who had already secured large fortunes ventured so far as Hatton Garden. At the beginning of the 19th century it had become common for the tradesmen of the city to live away from their businesses, but it was only about the middle of the 19th century that it became at all usual for those in the West End to do the same.

During the first half of the 19th century the position of the City Corporation had somewhat fallen in public esteem, and some of the most influential men in the city were unconnected with it, but a considerable change took place in the latter half of the century. Violent attacks were made upon the Livery Companies, but of late years, largely owing to the public spirit of the companies in devoting large sums of money towards the improvement of the several industries in connexion with which they were founded, and the establishment of the City and Guilds of London Technical Institute, a complete change has taken place as to the public estimation in which they are held.

Growth and Population

Medieval Population.

Much has been written upon the population of medieval London, but little certainty has resulted therefrom. We know the size of London at different periods and are able to guess to some extent as to the number of its inhabitants, but most of the figures which have come down to us are mere guesses. The results of the poll-tax have often been considered as trustworthy substitutes for population returns, but Professor Oman has shown that little trust can be placed in these results. As an instance he states that the commissioners of the poll-tax reported that there were only two-thirds as many contributaries in 1381 as in 1377.

The adult population of the realm had ostensibly fallen from 1,355,201 to 896,481. These figures were monstrous and incredible.[10]

The Bills of Mortality of the 16th and 17th centuries are of more value, and they have been considered and revised by such able statisticians as John Graunt and Sir William Petty. It was not, however, before the 19th century that accurate figures were obtainable. The circuit of the walls of London which were left by the Romans was never afterwards enlarged, and the population did not overflow into the suburbs to any extent until the Tudor period. Population was practically stationary for centuries owing to pestilences and the large proportion of deaths among infants. We have no materials to judge of the number of inhabitants before the Norman Conquest, but we can guess that there were many open spaces within the walls that were afterwards filled up. It is scarcely worth while to guess as to the numbers in Saxon London, but it is possible that in the early period there were about 10,000 inhabitants, growing later to about 20,000. During the latter part of the Saxon period the numbers of the population of the country began to decay; this decay, however, was arrested by the Norman Conquest. The population increased during ten peaceful years of Henry III., and increased slowly until the death of Edward II., and then it began to fall off, and continued to decrease during the period of the Wars of the Roses and of the Barons until the accession of the first Tudor monarch. The same causes that operated to bring about these changes in the whole kingdom were of course also at work in the case of the City of London.

One of the earliest statements as to the population of London occurs in a letter of about the year 1199 written to Pope Innocent III. by Peter of Blois, then archdeacon of London, and therefore a man of some authority on the subject. He states that the City contained 120 parish churches and 40,000 inhabitants. These numbers have been very generally accepted as fairly correct, and Dr Creighton[11] comes to the conclusion after careful consideration that the population of London from the reign of Richard I. to that of Henry VII. varied within a limit of about forty to fifty thousand inhabitants.

Plagues and Mortality.

Dr Creighton points out that the number given by certain chroniclers of the deaths from the early pestilences in London are incredible; such for instance as the statement that forty or fifty thousand bodies were buried in Charterhouse churchyard at the time of the Black Death in 1348-1349. These numbers have been taken as a basis for calculation of population, and one statistician reasoned that if 50,000 were buried in one churchyard 100,000 should represent the whole mortality of London. If this were allowed the population at this time must have been at least 200,000, an impossible amount.

Although the mortality caused by the different plagues had a great effect upon the population of the country at large the city soon recovered the losses by reason of the numbers who came to London from outside in hopes of obtaining work. Although there were fluctuations in the numbers at different periods there is evidence to show that on the average the amount of forty to fifty thousand fixed by Dr Creighton for the years between 1189 and 1509 is fairly correct. The medieval period closed with the accession of the Tudor dynasty, and from that time the population of London continued to increase, in spite of attempts by the government to prevent it. One of the first periods of increase was after the dissolution of the religious houses; another period of increase was after the Restoration.

A proclamation was issued in 1580 prohibiting the erection within 3 m. of the city gates of any new houses or tenements “where no former house hath been known to have been.” In a subsequent proclamation Queen Elizabeth commanded that only one family should live in one house, that empty houses erected within seven years were not to be let and that unfinished buildings on new foundations were to be pulled down. In spite of these restrictions London continued to grow. James I. and Charles I. were filled with the same fear of the increasing growth of London. In 1630 a similar proclamation to that of 1580 was published. During the greater part of the 18th century there was a serious check to the increase of population, but at the end of the century a considerable increase occurred, and in the middle of the 19th century the enormous annual increase became particularly marked. To return to the 16th century when the Bills of Mortality came into existence.[12] Mention is made of these bills as early as 1517, but the earliest series now known dates from 1532. Dr Creighton had access to the manuscript returns of burials and christenings for five years from 1578 to 1582 preserved in the library at Hatfield House. The history of the Bills of Mortality which in the early years were intermittent in their publication is of much interest, and Dr Creighton has stated it with great clearness. The Company of Parish Clerks is named in an ordinance of 1581 (of which there is a copy in the Record Office) as the body responsible for the bills, and their duties were then said to be “according to the Order in that behalf heretofore provided.” John Bell, clerk to the company, who wrote an essay during the great plague of 1665, had no records in his office of an earlier date than 1593, and he was not aware that his company had been engaged in registering births and deaths before that year. The fire of 1666 destroyed all the documents of the Parish Clerks Company, and in its hall in Silver Street only printed tables from about the year 1700 are to be found. There is a set of Annual Bills from 1658 (with the exception of the years 1756 to 1764) in the library of the British Museum.[13]

Bills of Mortality.

These bills were not analysed and general results obtained from them until 1662, when Captain John Graunt first published his valuable *Natural and Political Observations upon the Bills of Mortality*. Sir William Petty followed with his important inquiries upon the population (*Essay on Political Arithmetic*, 1683).

It is not worth while to refer to all the wild guesses that were made by various writers, but Dr Creighton shows the absurdity of one of these calculations made in 1554 by Soranzo, the Venetian ambassador for the information of the doge and senators of Venice. He estimates the population to have been 180,000 persons, which Dr Creighton affirms to be nearly three times the number that we obtain by a moderate calculation from the bills of mortality in 1532 and 1535.

Population in 16th and 17th centuries.

Following on his calculations from 1509, when the population may be supposed to have been about 50,000, Dr Creighton carries on his numbers to the Restoration in the following table:—

1532-1535	62,400	1605	224,275
1563	93,276	1622	272,207
1580	123,034	1634	339,824
1593-1595	152,478	1661	460,000

The numbers for 1661 are those arrived at by Graunt, and they are just about half the population given authoritatively in the first census 1801 (864,845). It therefore took 140 years to double the numbers, while in 1841 the numbers of 1801 were more than doubled.

These numbers were arrived at with much care and may be considered as fairly accurate although some other calculations conflict with a few of the figures. The first attempt at a census was in August 1631 when the lord mayor returned the number of mouths in the city of London and Liberties at 130,268, which is only about half the number given above. This is accounted for by the larger area contained in the bills of mortality compared with that containing

only the city and its liberties.[14] Howell's suggestion that the population of London in 1631 was a million and a half need only be mentioned as a specimen of the wildest of guesses.

Petty's numbers for 1682 are 670,000 and those of Gregory King for 1696, 530,000. The latter are corroborated by those of 1700, which are given as 550,000. Maitland gives the numbers in 1737 as 725,903. with regard to the relative size of great cities Petty affirms that before the Restoration the people of Paris were more in number than those of London and Dublin, whereas in 1687 the people of London were more than those of Paris and Rome or of Paris and Rouen.

18th century.

It is not necessary to give any further numbers for the population of the 18th century, as that has been already stated to have been almost stationary. This is proved by Gregory King's figures for 1696 (530,000) when compared with those of the first census for 1801 (864,035). A corroboration is also to be found in the report of the first census for 1801, where a calculation is made of the probable population of the years 1700 and 1750. These are given respectively as 674,350 and 676,250. These figures include (1) the City of London within and (2) without the walls, (3) the City and Liberties of Westminster, (4) the outparishes within the bills of mortality and (5) the parishes not within the bills of mortality. No. 5 is given as 9150 in 1700, and 22,350 in 1750. It is curious to find that already in the 18th century a considerable reduction in the numbers of the city of London is supposed to have taken place, as is seen in the following figures:—

	1700.	1750.
City of London within the walls	139,300	87,000
City of London without the walls	69,000	57,300

As the increase in Westminster is not great (130,000 in 1700 and 152,000 in 1750) and there is little difference in the totals it will be seen that the amount is chiefly made up by the increase in the parishes without the bills of mortality. The extraordinary growth of London did not come into existence until about the middle of the 19th century (see § IV. above).

Government

We know little of the government of London during the Saxon period, and it is only incidentally that we learn how the Londoner had become possessed of special privileges which he continued to claim with success through many centuries. One of the chief of these was the claim to a separate voice in the election of the king. The citizens did not dispute the right of election by the kingdom but they held that that election did not necessarily include the choice of London.

Saxon Period.

An instance of this is seen in the election of Edmund Ironside, although the Witan outside London had elected Canute. The remarkable instance of this after the Conquest was the election of Stephen, but William the Conqueror did not feel secure until he had the sanction of the Londoners to his kingship, and his attitude towards London when he hovered about the neighbourhood of the city for a time shows that he was anxious to obtain this sanction freely rather than by compulsion. His hopes and expectations were fulfilled when the gates of London were opened to receive him, as already related. Athelstan's acceptance of the London-made law for the whole kingdom, as pointed out by Mr Gomme, is another instance of the independence of the Londoner. When William the Conqueror granted the first charter to London he addressed the bishop and the portreeve—the bishop as the ecclesiastical governor and the portreeve as the representative of the civil power.

The word "port" in the title "portreeve" does not indicate the Port of London as might naturally be supposed, for Stubbs has pointed out that it is *porta* not *portus*, and "although used for the city generally, seems to refer to it specially in its character of a Mart or City of Merchants." The Saxon title of reeve was continued during the Norman period and the shire-reeve or sheriff has continued to our own time. There were originally several distinct reeves, all apparently officers appointed by the king. Some writers have supposed that a succession of portreeves continued in London, but J. H. Round holds that this title disappeared after the Conqueror's charter. Henry I. granted to the city by charter the right of appointing its own sheriffs; this was a great privilege, which, however, was recalled in the reigns of Henry II. and Richard I., to be restored by John in 1199.

J. H. Round holds that the office of Justiciar was created by Henry I.'s charter, and as he was the chief authority in the city this somewhat takes off from the value of the privilege of appointing sheriffs.

In the 12th century there was a great municipal movement over Europe. Londoners were well informed as to what was going on abroad, and although the rulers were always willing to wait for an opportunity of enlarging their liberties, they remained ready to take advantage of such circumstances as might occur. Their great opportunity occurred while Richard I. was engaged abroad as a crusader.

In 1889 a medal was struck to commemorate the 700th anniversary of the mayoralty which according to popular tradition was founded in 1189. With respect to this tradition Round writes (*Commune of London*, p. 223): "The assumption that the mayoralty of London dates from the accession of Richard I. is an absolute perversion of history," and he adds that "there is record evidence which completely confirms the remarkable words of Richard of Devizes, who declares that on no terms whatever would King Richard or his father have ever assented to the establishment of the *Communa* in London."

In October 1191 the conflict between John the king's brother and Longchamp the king's representative became acute. The latter bitterly offended the Londoners, who, finding that they could turn the scales to either side, named the Commune as the price of their support of John. A small party of the citizens under Henry of Cornhill remained faithful to the chancellor Longchamp, but at a meeting held at St Paul's on the 8th of October, the barons welcomed the archbishop of Rouen as chief justiciar (he having produced the king's sign manual appointing a new commission), and they saluted John as regent. Stubbs, in his introduction to the Chronicle of Roger de Hoveden, writes: "This done, oaths were largely taken: John, the Justiciar and the Barons swore to maintain the *Communa* of London; the oath of fealty to Richard was then sworn, John taking it first, then the two archbishops, the bishops, the barons, and last the burghers with the express understanding that should the king die without issue they would receive John as his successor." Referring to this important event Mr Round writes: "The excited citizens, who had poured out overnight, with lanterns and torches, to welcome John to the capital, streamed together on the morning of the eventful 8th of October at the well-known sound of the great bell swinging out from its campanile in St Paul's Churchyard. There they heard John take the oath to the 'Commune' like a French king or lord; and then London for the first time had a municipality of her own."

The Commune.

Little is known as to what the Commune then established really was. Round's remarkable discovery among the manuscripts of the British Museum of the Oath of the Commune proves for the first time that London in 1193 possessed a fully developed "Commune" of the continental pattern. A striking point in this municipal revolution is that the new privileges extended to the city of London were entirely copied from those of continental cities, and Mr Round shows that there is conclusive proof of the assertion that the

The Mayor and Échevins.

Commune of London derived its origin from that of Rouen. This MS. gives us information which was unknown before, but upsets the received opinions as to the early governing position of the aldermen. From this we learn that the government of the city was in the hands of a mayor and twelve échevins (*skivini*); both these names being French, seem for a time to have excluded the Saxon aldermen.

Twelve years later (1205-1206) we learn from another document, preserved in the same volume as the oath, that *alii probi homines* were associated with the mayor and échevins to form a body of twenty-four (that is, twelve *skivini* and an equal number of councillors). Round holds that the Court of Skivini and *alii probi homines*, of which at present we know nothing further than what is contained in the terms of the oaths, was the germ of the Common Council. We must not suppose that when the city of London obtained the privilege of appointing a mayor, and a citizen could boast in 1194 that "come what may the Londoners shall have no king but their mayor," that the king did not occasionally exert his power in suspending the liberties of the city. There were really constant disagreements, and sometimes the king degraded the mayor and appointed a custos or warden in his place. Several instances of this are recorded in the 13th and 14th centuries. It is very important to bear in mind that the mayors of London besides holding a very onerous position were mostly men of great distinction. They often held rank outside the city, and naturally took their place among the rulers of the country. They were mostly representatives of the landed interests as well as merchant princes.

There is no definite information as to when the mayor first received the title of lord. A claim has been set up for Thomas Legge, mayor for the second time in 1354, that he was the first lord mayor, but there is positively no authority whatever for this claim, although it is boldly stated that he was created lord mayor by Edward III. in this year. Apparently the title was occasionally used, and the use gradually grew into a prescriptive right. There is no evidence of any grant, but after 1540 the title had become general.

No record has been found of the date when the aldermen became the official advisers of the mayor. The various wards were each presided over by an alderman from an early period, but we cannot fix the time when they were united as a court of aldermen. Stubbs writes: "The governing body of London in the 13th century was composed of the mayor, twenty-five aldermen of the wards and two sheriffs."

Aldermen.

As we do not find any further evidence than the oath of the Commune alluded to of the existence of "échevins" in London, it is possible that aldermen were elected on the mayor's council under this title. This, however, is not the opinion of Mr Round, who, as before stated, is inclined to believe that the body of échevins became in course of time the Court of Common Council. The aldermen are not mentioned as the colleagues of the mayor until the very end of the 13th century, except in the case of Fitz-Ailwin's Assize of 1189, and this, of course, related specially to the duties of aldermen as heads of the wards of the city.

In March 1298-1299 letters were sent from "the Mayor and Commune of the City of London" to the municipalities of Bruges, Caen and Cambray. Although the official form of "The Mayor and Commune" was continued until the end of the 13th century, and it was not until early in the 14th century that the form "Mayor, Aldermen and Common Council" came into existence, there is sufficient evidence to show that the aldermen and common council before that time were acting with the mayor as governors of the city. In 1377 it was ordered that aldermen could be elected annually, but in 1384 the rule was modified so as to allow an alderman to be re-elected for his ward at the expiration of his year of office without any interval.

In 1394 the Ordinance respecting annual elections was repealed by the king (Richard II.). Distinct rank was accorded to aldermen, and in the *Liber Albus* we are told that "it is a matter of experience that ever since the year of our Lord 1350, at the sepulture of aldermen, the ancient custom of interment with baronial honours was observed." When the poll-tax of 1379 was imposed the mayor was assessed as an earl and the aldermen as barons.

The government of the city by reeves dates back to a very early period, and these reeves were appointed by the king. The prefix of the various kinds of reeves made but little difference in the duties of the office, although the area of these duties might be different. There was slight difference between the office of sheriff and that of portreeve, which latter does not appear to have survived the Conquest.

Sheriffs.

After the establishment of the Commune and the appointment of a mayor the sheriffs naturally lost much of their importance, and they became what they are styled in *Liber Albus* "the Eyes of the Mayor." When Middlesex was in farm to London the two sheriffs were equally sheriffs of London and Middlesex. There is only one instance in the city records of a sheriff of Middlesex being mentioned as distinct from the sheriffs, and this was in 1283 when Anketin de Betteville and Walter le Blond are described as sheriffs of London, and Gerin as sheriff of Middlesex. By the Local Government Act of 1888 the citizens of London were deprived of all right of jurisdiction over the county of Middlesex, which had been expressly granted by various charters.

In 1383 it was ordained and agreed "that no person shall from henceforth be mayor in the said city if he have not first been sheriff of the said city, to the end that he may be tried in governance and bounty before he attains such estate of the mayoralty."

The two courts—that of aldermen and that of the common council—were probably formed about the same time, but it is remarkable that we have no definite information on the subject. The number of members of the common council varied greatly at different times, but the right to determine the number was indirectly granted by the charter of Edward III. (1341) which enables the city to amend customs and usages which have become hard.

Common Council.

There have also been many changes in the mode of election. The common council were chosen by the wards until 1351, when the appointments were made by certain companies. In 1376 an ordinance was made by the mayor and aldermen, with the assent of the whole commons, to the effect that the companies should select men with whom they were content, and none other should come to the elections of mayors and sheriffs; that the greater companies should not elect more than six, the lesser four and the least two. Forty-seven companies nominated 156 members. In 1383 the right of election reverted to the wards, but was obtained again by the livery companies in 1467.

The Common Hall was the successor of the folkmote, the meetings of which were originally held in the open air at the east end of St Paul's and afterwards in the Guildhall. These general assemblies of the citizens are described in the old city records as *immensa communitas* or *immensa multitudo* civium. The elections in Common Hall were by the whole body of citizens until Edward I.'s reign, citizens were then specially summoned to Common Hall by the mayor. In Edward IV.'s reign the elections of mayor, sheriffs and other officers and members of parliament were transferred to liverymen. Various alterations were subsequently made and now the qualification of electors at the election of the corporate offices of lord mayor, sheriffs, chamberlain and minor offices in Common Hall is that of being a liveryman of a livery company and an enrolled freeman of London. The election of aldermen and common councilmen takes place in the wardmotes.

Common Hall.

The recorder, the chief official, is appointed for life. He was formerly appointed by the city, but since the Local Government Act of 1888 he is nominated by the city and approved by the lord chancellor. The common sergeant was formerly appointed by the city, but since 1888 by the lord chancellor. The town clerk is appointed by the city and re-elected annually.

Officials of the city.

The chamberlain or comptroller of the king's chamber is appointed by the livery. He was originally a king's officer and the office was probably instituted soon after the Conquest. The remembrancer is appointed by the common council.

The common hunt, an office abolished in 1807, was filled by John Courtenay in 1417. The sword-bearer is noticed in the *Liber Albus* (1419) and the first record of an appointment is dated 1426.

Later history of the corporation.

Few fundamental alterations have been made in the constitution of the city, but in the reign of Charles II. the most arbitrary proceedings were taken against its liberties. The king and his brother had long entertained designs against the city, and for the purpose of crushing them two pretexts were set up—(1) that a new rate of market tolls had been levied by virtue of an act of common council, and (2) that a petition to the king, in which it was alleged that by the prorogation of parliament public justice had been interrupted, had been printed by order of the Court of Common Council. Charles directed a writ *quo warranto* against the corporation of London in 1683, and the Court of King's Bench declared its charter forfeited. Soon afterwards all the obnoxious aldermen were displaced and others appointed in their room by royal commission. When James II. found himself in danger from the landing of the Prince of Orange he sent for the lord mayor and aldermen and informed them of his determination to restore the city charter and privileges, but he had no time to do anything before his flight. The Convention which was summoned to meet on the 22nd of January 1689 was converted by a formal act into a true parliament (February 23). One of the first motions put to the House was that a special Committee should be appointed to consider the violations of the liberties and franchises of all the corporations of the kingdom "and particularly of the City of London." The motion was lost but the House resolved to bring in a bill for repealing the Corporation Act, and ten years later (March 5) the Grand Committee of Grievances reported to the House its opinion (1) that the rights of the City of London in the election of sheriffs in the year 1682 were invaded and that such invasion was illegal and a grievance, and (2) that the judgment given upon the *Quo Warranto* against the city was illegal and a grievance. The committee's opinion on these two points (among others) was endorsed by the House and on the 16th of March it ordered a Bill to be brought in to restore all corporations to the state and condition they were in on the 29th of May 1660, and to confirm the liberties and franchises which at that time they respectively held and enjoyed.[15]

When the Act for the reform of Municipal Corporations was passed in 1835 London was specially excepted from its provisions. When the Metropolitan Board of Works was formed by the Metropolis Management Act of 1855 the city was affected to a certain extent, but by the Local Government Act of 1888 which founded the London County Council the right of appointing a sheriff for Middlesex was taken away from the city of London.

When the county of Middlesex was dissociated from the city of London one portion was joined to the administrative county of London, and the other to the county of Middlesex.

Privileges of the lord mayor.

The lord mayor of London has certain very remarkable privileges which have been religiously guarded and must be of great antiquity. It is only necessary to mention these here, but each of the privileges requires an exhaustive examination as to its origin. They all prove the remarkable position of Old London, and mark it off from all other cities of modern Europe. Shortly stated the privileges are four:

1. The closing of Temple Bar to the sovereign.
2. The mayor's position in the city, where he is second only to the king.
3. His summons to the Privy Council on the accession of a new sovereign.
4. His position of butler at the coronation banquets.

The last may be considered in abeyance as there has not been any coronation banquet since that of George IV. In the case of the coronation of King Edward VII. the claim was excluded from the consideration of the Court of Claims under the royal proclamation. The terms of the judgment on a further claim are as follows: "The Court considers and adjudges that the lord mayor has by usage a right, subject to His Majesty's pleasure, to attend the Abbey during the coronation and bear the crystal mace."

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The following are some of the Chronicles of London which have been printed, arranged in order of publication: R. Grafton, *Chronicle 1189-1558* (1809); R. Arnold, *London Chronicle* (1811); *A Chronicle of London from 1089 to 1483 written in the Fifteenth Century* (1827); *William Gregory's Chronicle of London, 1189-1469* (1876); *Historical Collections of a Citizen of London*, edited by James Gairdner (Camden Society, 1876); *Chronicles of London* [*1200-1516*], edited by C. L. Kingsford (Oxford, 1905).

Many books have been published on the government of London, of which the following is a selection: *City Law* (1647, 1658); *Lex Londinensis or the City Law* (1680); W. Bohun, *Privilegia Londini* (1723); Giles Jacob, *City Liberties* (1733); *Laws and Customs, Rights, Liberties and Privileges of the City of London* (1765); David Hughson, *Epitome of the*

Privileges of London (1816); George Norton, *Commentaries on the History, Constitution and Chartered Franchises of the City of London* (1829, 3rd ed. 1869); *Munimenta Gildhallae Londoniensis*, edited by H. T. Riley—vol. 1, *Liber Albus* (1419), vol. 2, *Liber Custumarum* (1859); *Liber Albus: the White Book of the City of London*, translated by H. T. Riley (1861); H. T. Riley, *Memorials of London and London Life in the 13th, 14th and 15th centuries* (1868); *De Antiquis Legibus Liber. Curante Thoma Stapleton* (Camden Society, 1846); *Chronicles of the Mayors and Sheriffs of London 1188-1274*, translated from the *Liber de Antiquis Legibus* by H. T. Riley. *French Chronicle of London* 1259-1343 (1863); *Analytical Index to the Series of Records known as the Remembrancia 1579-1664* (1888); *Calendar of Letter-Books* [*circa 1275-1399*] preserved among the Archives of the Corporation of London at the Guildhall, edited by Reginald R. Sharpe, D.C.L. (1899-1907); W. and R. Woodcock, *Lives of Lord Mayors* (1846); J. F. B. Firth, *Municipal London* (1876); Walter Delgray Birch, *Historical Charters and Constitutional Documents of the City of London* (1884, 1887); J. H. Round, *The Commune of London and other Studies* (1899); Reginald R. Sharpe, *London and the Kingdom; a History derived mainly from the Archives at Guildhall* (1894); G. L. Gomme, *The Governance of London. Studies on the Place occupied by London in English Institutions* (1907); Alfred B. Beaven, *The Aldermen of the City of London temp. Henry III.* (1908).

In connexion with the government of London may be noted works on the following: Inns of Court. William Herbert, *Antiquities of the Inns of Court and Chancery* (1804); Robert P. Pearce, *History* (1848). Artillery Company, Anthony Highmore, *History of the Hon. Artillery Co. of London to 1802* (1804); G. A. Raikes, *History of the Hon. Artillery Co.* (1878). William Herbert published in 1837 *History of the Twelve great Livery Companies of London*, and in 1869 Thomas Arundell published *Historical Reminiscences of the City and its Livery Companies*. Since then have appeared *The Livery Companies of the City of London*, by W. Carew Hazlitt (1892); *The City Companies of London*, by P. H. Ditchfield (1904); *The Gilds and Companies of London*, by George Unwin (1908). Separate histories have been published of the chief London companies.

The following are some of the chief works connected with the topography of London: Thomas Pennant, *Of London* (1790, 1793, 1805, 1813, translated into German 1791); John T. Smith, *Antient Topography of London* (1815); David Hughson [E. Pugh], *Walks through London* (1817); *London* (edited by Charles Knight 1841-1844, reprinted 1851, revised by E. Walford 1875-1877); J. H. Jesse, *Literary and Historical Memorials of London* (1847); Leigh Hunt, *The Town, its Memorable Character and Events* (1848, new ed. 1859); Peter Cunningham, *A Handbook of London past and present* (1849, 2nd ed. 1850, enlarged into a new work in 1891); Henry B. Wheatley, *London past and present; Vestiges of Old London, etchings* by J. W. Archer (1851); *A New Survey of London* (1853); G. W. Thornbury, *Haunted London* (1865, new ed. by E. Walford 1880); *Old and New London*, vols. i.-ii. by G. W. Thornbury, vols. iii.-vi. by Edward Walford (1873-1878); Walter Besant, *London, Westminster, South London, East London* (1891-1902); *East London Antiquities*, edited by Walter A. Locks (*East London Advertiser*, 1902); Philip Norman, *London vanished and vanishing* (1905); *Records of the London Topographical Society; Monographs of the Committee for the Survey of the Memorials of Greater London.*

The following books on the population of London have been published: John Graunt, *Natural and Political Observations on the Bills of Mortality* (1661, other editions 1662, 1665, 1676); *Essay in Political Arithmetick* (1683); *Five Essays on Political Arithmetick* (1687); *Several Essays in Political Arithmetick* (1699, 1711, 1751, 1755); *Essay concerning the Multiplication of Mankind* (1682, 1683, 1686), all by Sir William Petty; Corbyn Morris, *Observations on the past Growth and present State of the City of London* (1751); *Collection of the Yearly Bills of Mortality from 1657 to 1758* (ed. by T. Birch, D.D. 1759); Graunt's *Observations*, Petty's *Another Essay* and C. Morris's *Observations* are reprinted in this collection. Graunt and Petty's *Essays* are reprinted in *Economic Writings* of Sir W. Petty (1899).

(H. B. W.*)

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1 See map in *London Statistics* (vol. xix., 1909), an annual publication of the London County Council, which besides these divisions shows "Water London," the London main drainage area, and the Central Criminal Court district.

2 Charing Cross station was the scene of a remarkable catastrophe on the 5th of December 1905, when a large part of the roof collapsed, and the falling débris did very serious damage to the Avenue theatre, which stands close to the station at a lower level.

3 The report appeared in eight volumes, the first of which, containing the general conclusions to which allusion is here made, bore the number, as a blue-book. Cd. 2597.

4 Over 200 local acts were repealed by schemes made under the act of 1899.

5 A valuable article on "The Conqueror's Footprints in Domesday" was published in the *English Historical Review* in 1898 (vol. xiii. p. 17). This article contains an account of Duke William's movements after the battle of Senlac between Enfield, Edmonton, Tottenham and Berkhampstead.

6 "A map of London engraved on copper-plate, dated 1497," which was bought by Ferdinand Columbus during his travels in Europe about 1518-1525, is entered in the catalogue of Ferdinand's books, maps, &c., made by himself and preserved in the Cathedral Library at Seville, but there is no clue to its existence.

7 One is in the Guildhall Library, and the other among the Pepysian maps in Magdalene College, Cambridge.

8 This map of London by Norden is dated 1593, as stated above. The same topographer published in his *Middlesex* a map of Westminster as well as this one of the City of London.

9 Various changes in the names of the taverns are made in the folio edition of this play (1616) from the quarto (1601); thus the Mermaid of the quarto becomes the Windmill in the folio, and the Mitre of the quarto is the Star of the folio.

10 *The Great Revolt of 1381* (Oxford, 1906), p. 27.

11 In a valuable paper on "The Population of Old London" in *Blackwood's Magazine* for April 1891.

12 The old Bills of Mortality, although of value from being the only authority on the subject, were never complete owing to various causes: one being that large numbers of Roman Catholics and Dissenters were not registered in the returns of the parish clerk who was a church officer. The bills were killed by the action of the Registration Act for England and Wales, which came into operation July 1, 1837. The weekly Returns of the Registrar-General began in 1840.

13 "The invention of 'bills of mortality' is not so modern as has been generally supposed, for their proper designation may be found in the language of ancient Rome. Libitina was the goddess of funerals; her officers were the Libitinarii *our* undertakers; her temple in which all business connected with the last rites was transacted, in which the account of deaths—*ratio Libitinae*—was kept, served the purpose of a register office."—*Journal Statistical Society*, xvii. 117 (1854).

14 The return was made "by special command from the Right Honourable the Lords of His Majesty's Privy Council." The Privy Council were at this time apprehensive of an approaching scarcity of food. The numbers (130,268) were made up as follows: London Within the Walls 71,029, London Without the Walls 40,579, Old Borough of Southwark (Bridge Without) 18,660.

15 R. R. Sharpe, *London and the Kingdom* (1894), i. 541.

LONDON CLAY, in geology, the most important member of the Lower Eocene strata in the south of England. It is well developed in the London basin, though not frequently exposed, partly because it is to a great extent covered by more recent gravels and partly because it is not often worked on a large scale. It is a stiff, tenacious, bluish clay that becomes brown on weathering, occasionally it becomes distinctly sandy, sometimes glauconitic, especially towards the top; large calcareous septarian concretions are common, and have been used in the manufacture of cement, being dug for this purpose at Sheppey, near Southend, and at Harwich, and dredged off the Hampshire coast. Nodular lumps of pyrites and crystals of selenite are of frequent occurrence. The clay has been employed for making bricks, tiles and coarse pottery, but it is usually too tenacious for this purpose except in well-weathered or sandy portions. The base of the clay is very regularly indicated by a few inches of rounded flint pebbles with green and yellowish sand, parts of this layer being frequently cemented by carbonate of lime. The average thickness of the London Clay in the London basin is about 450 ft.; at Windsor it is 400 ft. thick; beneath London it is rather thicker, while in the south of Essex it is over 480 ft. In Wiltshire it only reaches a few feet in thickness, while in Berkshire it is some 50 or 60 ft. It is found in the Isle of Wight, where it is 300 ft. thick at Whitecliff Bay—here the beds are vertical and even slightly reversed—and in Alum Bay it is 220 ft. thick. In Hampshire it is sometimes known as the Bognor Beds, and certain layers of calcareous sandstone within the clays are called Barnes or Bognor Rock. In the eastern part of the London basin in east Kent the pebbly basement bed becomes a thick deposit (60 ft.), forming part of the Oldhaven and Blackheath Beds.

The London Clay is a marine deposit, and its fossils indicate a moderately warm climate, the flora having a tropical aspect. Among the fossils may be mentioned *Panopoea intermedia*, *Ditrupa plana*, *Teredina personata*, *Conus concinnus*, *Rostellaria ampla*, *Nautilus centralis*, *Belosepia*, foraminifera and diatoms. Fish remains include *Otodus obliquus*, *Sphyroenodus crassidens*; birds are represented by *Halcyornis Toliapicus*, *Lithornis* and *Odontopteryx*, and reptiles by *Chelone gigas*, and other turtles, *Palaeophis*, a serpent and crocodiles. *Hyracotherium leporinum*, *Palaeotherium* and a few other mammals are recorded. Plant remains in a pyritized condition are found in great abundance and perfection on the shore of Sheppey; numerous species of palms, screw pines, water lilies, cypresses, yews, leguminous plants and many others occur; logs of coniferous wood bored through by annelids and *Teredo* are common, and fossil resin has been found at Highgate.

See EOCENE; also W. Whitaker, "The Geology of London and part of the Thames Valley," *Mem. Geol. Survey* (1889), and *Sheet Memoirs of the Geol. Survey*, London, Nos. 314, 315, 268, 329, 332, and *Memoirs on the Geology of the Isle of Wight* (1889).

LONDONDERRY, EARLS AND MARQUESSES OF. The 1st earl of Londonderry was Thomas Ridgeway (*c.* 1565-1631), a Devon man, who was treasurer in Ireland from 1606 to 1616 and was engaged in the plantation of Ulster. Ridgeway was made a baronet in 1611, Baron Ridgeway in 1616 and earl of Londonderry in 1623. The Ridgeways held the earldom until March 1714, when Robert, the 4th earl, died without sons. In 1726 Robert's son-in-law, Thomas Pitt (*c.* 1688-1729), son of Thomas Pitt, "Diamond Pitt," governor at Madras and uncle of the great earl of Chatham, was created earl of Londonderry, the earldom again becoming extinct when his younger son Ridgeway, the 3rd earl of this line, died unmarried in January 1765. In 1796 Robert Stewart (1739-1821), of Mount Stewart, Co. Down, was made earl of Londonderry in the Irish peerage. He had been created Baron Londonderry in 1789 and Viscount Castlereagh in 1795; in 1816 he was advanced to the rank of marquess of Londonderry. The 3rd marquess married the heiress of the Vane-Tempests and took the name of Vane instead of Stewart; the 5th marquess called himself Vane-Tempest and the 6th marquess Vane-Tempest-Stewart.

LONDONDERRY, CHARLES WILLIAM STEWART (VANE), 3RD MARQUESS OF (1778-1854), British soldier and diplomatist, was the son of the 1st marquess by a second marriage with the daughter of the 1st Earl Camden. He entered the army and served in the Netherlands (1794), on the Rhine and Danube (1795), in the Irish rebellion (1798), and Holland (1799), rising to be colonel; and having been elected to parliament for Kerry he became under secretary for war under his half-brother Castlereagh in 1807. In 1808 he was given a cavalry command in the Peninsula, where he brilliantly distinguished himself. In 1809, and again in the campaigns of 1810, 1811, having become a major-general, he served under Wellington in the Peninsula as his adjutant-general, and was at the capture of Ciudad Rodrigo, but at the beginning of 1812 he was invalided home. Castlereagh (see LONDONDERRY, 2nd Marquess of) then sent him to Berlin as minister, to represent Great Britain in the allied British, Russian and Prussian armies; and as a cavalry leader he played an important part in the subsequent fighting, while ably seconding Castlereagh's diplomacy. In 1814 he was made a peer as Baron Stewart, and later in the year was appointed ambassador at Vienna, and was a member of the important congresses which followed. In 1822 his half-brother's death made him 3rd marquess of Londonderry, and shortly afterwards, disagreeing with Canning, he resigned, being created Earl Vane (1823), and for some years lived quietly in England, improving his Seaham estates. In 1835 he was for a short time ambassador at St Petersburg. In 1852, after the death of Wellington, when he was one of the pall-bearers, he received the order of the Garter. He died on the 6th of March 1854. He was twice married, first in 1808 to the daughter of the earl of Darnley, and secondly in 1819 to the heiress of Sir Harry Vane-Tempest (a descendant of Sir Piers Tempest, who served at Agincourt, and heir to Sir Henry Vane, Bart.), when he assumed the name of Vane. Frederick William Robert (1805-1872), his son by the first marriage, became 4th marquess; and on the latter's death in 1872, George Henry (1821-1884), the eldest son by the second marriage, after succeeding as Earl Vane (according to the patent of 1823), became 5th marquess. In 1884 he was succeeded as 6th marquess by his son Charles Stewart Vane-Tempest-Stewart (b. 1852), a prominent Conservative politician, who was viceroy of Ireland (1886-1889), chairman of the London School Board (1895-1897), postmaster-general (1900-1902), president of the Board of Education (1902-1905)

and lord president of the Council (1903-1905).

LONDONDERRY, ROBERT STEWART, 2ND MARQUESS OF (1769-1822), British statesman, was the eldest son of Robert Stewart of Ballylawn Castle, in Donegal, and Mount Stewart in Down, an Ulster landowner, of kin to the Galloway Stewarts, who became baron, viscount, earl and marquess in the peerage of Ireland. The son, known in history as Lord Castlereagh, was born on the 18th of June in the same year as Napoleon and Wellington. His mother was Lady Sarah Seymour, daughter of the earl of Hertford. He went from Armagh school to St John's College, Cambridge, but left at the end of his first year. With Lord Downshire, then holding sway over the County Down, Lord Stewart had a standing feud, and he put forward his son, in July 1790, for one of the seats. Young Stewart was returned, but at a vast cost to his family, when he was barely twenty-one. He took his seat in the Irish House of Commons at the same time as his friend, Arthur Wellesley, M.P. for Trim, but sat later for two close boroughs in England, still remaining member for Down at College Green.

From 1796, when his father became an earl, he took the courtesy title of Viscount Castlereagh, and becoming keeper of the privy seal in Ireland, he acted as chief secretary, during the prolonged absence of Mr Pelham, from February 1797. Castlereagh's conviction was that, in presence of threatened invasion and rebellion, Ireland could only be made safe by union with Great Britain. In Lord Camden, as afterwards in Lord Cornwallis, Castlereagh found a congenial chief; though his favour with these statesmen was jealously viewed both by the Irish oligarchy and by the English politicians who wished to keep the machine of Irish administration in their own hands. Pitt himself was doubtful of the expediency of making an Irishman chief secretary, but his view was changed by the influence of Cornwallis. In suppressing Lord Edward Fitzgerald's conspiracy, and the rebellion which followed in 1798, Castlereagh's vigilance and firmness were invaluable. His administration was denounced by a faction as harsh and cruel—a charge afterwards repudiated by Grattan and Plunket—but he was always on the side of lenity. The disloyal in Ireland, both Jacobins and priest-led, the Protestant zealots and others who feared the consequence of the Union, coalesced against him in Dublin. Even there Castlereagh, though defeated in a first campaign (1799), impressed Pitt with his ability and tact, with Cornwallis he joined in holding out, during the second Union campaign (1800), the prospect of emancipation to the Roman Catholics. They were aided by free expenditure of money and promises of honours, methods too familiar in Irish politics. When the Act of Union was carried through the Irish parliament, in the summer of 1800, Castlereagh's official connexion with his native land practically ended. Before the Imperial Parliament met he urged upon Pitt the measures which he and Cornwallis thought requisite to make the Union effective. In spite of his services and of Pitt's support, disillusion awaited him. The king's reluctance to yield to the Roman Catholic claims was underestimated by Pitt, while Cornwallis imprudently permitted himself to use language which, though not amounting to a pledge, was construed as one. George III. resented the arguments brought forward by Castlereagh—"this young man" who had come over to talk him out of his coronation oath. He peremptorily refused to sanction emancipation, and Pitt and his cabinet made way for the Addington administration. Thereupon Castlereagh resigned, with Cornwallis. He took his seat at Westminster for Down, the constituency he had represented for ten years in Dublin. The leadership of an Irish party was offered to him, but he declined so to limit his political activity. His father accepted, at Portland's request, an Irish marquessate, on the understanding that in the future he or his heirs might claim the same rank in the Imperial Legislature; so that Castlereagh was able to sit in the House of Commons as Marquess in 1821-1822. Wilberforce discussed with Pitt the possibility of sending out Castlereagh to India as governor-general, when the friction between Lord Wellesley and the directors became grave; but Pitt objected, as the plan would remove Castlereagh from the House of Commons, which should be "the theatre of his future fame."

In 1802, Castlereagh, at Pitt's suggestion, became president of the Board of Control in the Addington cabinet. He had, though not in office, taken charge of Irish measures under Addington, including the repression of the Rebellion Bill, and the temporary suspension of the Habeas Corpus in 1801, and continued to advocate Catholic relief, tithe reform, state payment of Catholic and dissenting clergy and "the steady application of authority in support of the laws." To Lord Wellesley's Indian policy he gave a staunch support, warmly recognized by the governor-general. On Pitt's return to office (May 1804), Castlereagh retained his post, and, next year, took over also the duties of secretary for war and the colonies. Socially and politically, the gifts of his wife, Lady Emily Hobart, daughter of a former Irish viceroy, whom he had married in 1794, assisted him to make his house a meeting-place of the party; and his influence in parliament grew notwithstanding his defects of style, spoken and written. As a manager of men he had no equal. After Pitt's death his surviving colleagues failed to form a cabinet strong enough to face the formidable combination known as "All the Talents," and Castlereagh acquiesced in the resignation. But to the foreign policy of the Fox-Greville ministry and its conduct of the war he was always opposed. His objections to the Whig doctrine of withdrawal from "Continental entanglements" and to the reduction of military expenditure were justified when Fox himself was compelled "to nail his country's colours to the mast."

The cabinet of "All the Talents," weakened by the death of Fox and the renewed quarrel with the king, went out in April 1807. Castlereagh returned to the War Office under Portland, but grave difficulties arose, though Canning at the Foreign Office was then thoroughly at one with him. A priceless opportunity had been missed after Eylau. The Whigs had crippled the transport service, and the operations to avert the ruin of the coalition at Friedland came too late. The Tsar Alexander believed that England would no longer concern herself with the Continental struggle, and Friedland was followed by Tilsit. The secret articles of that compact, denied at the time by the Opposition and by French apologists, have now been revealed from official records in M. Vandal's work, *Napoléon et Alexandre*. Castlereagh and Canning saw the vital importance of nullifying the aim of this project. The seizure of the Danish squadron at Copenhagen, and the measures taken to rescue the fleets of Portugal and Sweden from Napoleon, crushed a combination as menacing as that defeated at Trafalgar. The expedition to Portugal, though Castlereagh's influence was able only to secure Arthur Wellesley a secondary part at first, soon dwarfed other issues. In the debates on the Convention of Cintra, Castlereagh defended Wellesley against parliamentary attacks: "A brother," the latter wrote, "could not have done more." The depression produced by Moore's campaign in northern Spain, and the king's repugnance to the Peninsular operations, seemed to cut short Wellesley's career; but early in 1809, Castlereagh, with no little difficulty, secured his friend's appointment as commander-in-chief of the second Portuguese expedition. The merit has been claimed for Canning by Stapleton, but the evidence is all the other way.

Meanwhile, Castlereagh's policy led to a crisis that clouded his own fortunes. The breach between him and Canning was not due to his incompetence in the conduct of the Walcheren expedition, In fact, Castlereagh's ejection was decided by Canning's intrigues, though concealed from the victim, months before the armament was sent out to the

Scheldt. In the selection of the earl of Chatham as commander the king's personal preference was known, but there is evidence also that it was one of Canning's schemes, as he reckoned, if Chatham succeeded, on turning him into a convenient ministerial figurehead. Canning was not openly opposed to the Walcheren expedition, and on the Peninsular question he mainly differed from Castlereagh and Wellington in fixing his hopes on national enthusiasm and popular uprisings. Military opinion is generally agreed that the plan of striking from Walcheren at Antwerp, the French naval base, was sound. Napoleon heard the news with dismay; in principle Wellington approved the plan. Castlereagh's proposal was for a *coup de main*, under strict conditions of celerity and secrecy, as Antwerp was unable to make any adequate defence. But Chatham, the naval authorities and the cabinet proceeded with a deliberation explained by the fact that the war secretary had been condemned in secret. The expedition, planned at the end of March, did not reach Walcheren till the end of July 1809; and more time was lost in movements against Batz and Flushing, protracted until an unhealthy autumn prostrated the army, which was withdrawn, discredited and disabled, in September. Public opinion threw the whole blame upon Castlereagh, who then found that, in deference to Canning, his colleagues had decreed his removal half a year earlier, though they kept silence till the troops were brought back from Walcheren. When Castlereagh learned from Percival that the slur cast on him had its origin in a secret attack on him many months before, he was cruelly hurt. The main charge against him was, he says, that he would not throw over officers on whom unpopularity fell, at the first shadow of ill-fortune. His refusal to rush into censure of Moore, following Canning's sudden change from eulogy to denunciation, requires no defence. According to the ideas then prevailing Castlereagh held himself justified in sending a challenge to the original author, as he held, of a disloyal intrigue against a colleague. In the subsequent duel Canning was wounded and the rivals simultaneously resigned. In private letters to his father and brother, Castlereagh urged that he was bound to show that he "was not privy to his own disgrace." When Canning published a lengthy explanation of his conduct, many who had sided with him were convinced that Castlereagh had been much wronged. The excuse that the protest upon which the cabinet decided against Castlereagh did not mention the minister's name was regarded as a quibble. Men widely differing in character and opinions—Walter Scott, Sidney Smith, Brougham and Cobbett—took this view. Castlereagh loyally supported the government in parliament, after Lord Wellesley's appointment to the Foreign Office. Though Wellington's retreat after Talavera had been included, with the disasters of the Corunna and Walcheren campaigns, in the censures on Castlereagh, and though ministers were often depressed and doubtful, Castlereagh never lost faith in Wellington's genius. Lord Wellesley's resignation in 1812, when the Whigs failed to come to terms with the regent, led to Castlereagh's return to office as foreign secretary (March 1812). The assassination of Percival soon threw upon him the leadership of the House of Commons, and this double burden he continued to bear during the rest of his life.

From March 1812 to July 1822 Castlereagh's biography is, in truth, the history of England. Though never technically prime minister, during these years he wielded a power such as few ministers have exercised. Political opponents and personal ill-wishers admitted that he was the ablest leader who ever controlled the House of Commons for so long a period. As a diplomatist, nobody save Marlborough had the same influence over men or was given equal freedom by his colleagues at home. Foreigners saw in him the living presence of England in the camp of the Allies. At the War Office he had been hampered by the lack of technical knowledge, while nature had not granted him, as an organizer, the powers of a Carnot or Roon. But in diplomacy his peculiar combination of strength and charm, of patience and conciliatory adroitness, was acknowledged by all. At the Foreign Office he set himself at once to meet Napoleon's designs in northern Europe, where Russia was preparing for her life-and-death struggle. Lord Wellesley paid a high tribute to Castlereagh's conduct in this situation, and Wellington declared that he had then "rendered to the world the most important service that ever fell to the lot of any individual to perform." Castlereagh wisely rejected Napoleon's insincere overtures for peace. After the Moscow *débâcle* Napoleon's fate was affected not only by Wellington's progress in Spain, but by the attitude of the northern powers and by the action of Turkey, due to Castlereagh's opportune disclosure to the Porte of the scheme of partition at Tilsit. At home, the repeal of the Orders in Council was carried, the damage to British trade plainly outweighing the injury inflicted on France by the restrictive system. The British subsidies to the Allies were largely increased as the operations of 1813 developed, but all Castlereagh's skill was needed to keep the Coalition together. The Allied powers were willing, even after Leipzig, to treat with France on the basis of restoring her "natural frontiers"—the Rhine, the Alps and the Pyrenees; but Castlereagh protested. He would not allow the enemy to take ground for another tiger-spring. Before the Conference of Châtillon, where Napoleon sent Caulaincourt to negotiate for peace—with the message scribbled on the margin of his instructions, "Ne signez rien"—Aberdeen wrote to hasten Castlereagh's coming: "Everything which has been so long smothered is now bursting forth"; and again, "Your presence has done much and would, I have no doubt, continue to sustain them (the Allies) in misfortune." The Liverpool cabinet then and later were as urgent in pressing him to return to lead the House of Commons. He had lost his seat for Down in 1805, and afterwards sat for British boroughs; but in 1812 he was re-elected by his old constituents; and again in 1818 and 1820, sitting, after he became marquess of Londonderry in 1821, for Orford. Early in 1814 his colleagues reluctantly consented to his visit to the allied headquarters. The Great Alliance showed signs of weakness and division. Austria was holding back; Prussia had almost broken away; above all, the ambiguous conduct of Alexander bred alarm and doubt. This situation became increasingly serious while Napoleon was giving daily proofs that his military genius, confronting a hesitant and divided enemy, was at its best. Castlereagh strove to keep the Allies together, to give no excuse for those separate arrangements upon which Napoleon was reckoning, to assert no selfish policy for England, to be tied by no theoretical consistency. At the Châtillon conferences England was represented by others, but Castlereagh was present with supreme authority over all, and it was he who determined the result. He declined to commit his country either to a blank refusal to negotiate with Napoleon or to the advocacy of a Bourbon restoration. He was ready to give up almost the whole of England's conquests, but he insisted on the return of France within her ancient limits as the basis of a settlement. Caulaincourt's advice was to take advantage of these overtures; but his master was not to be advised. The counter-projects that he urged Caulaincourt to submit to were advanced after his victory at Montereau, when he boasted that he was nearer to Munich than the Allies were to Paris. Even before the Châtillon conference was dissolved (March 18th), Castlereagh saw that Caulaincourt's efforts would never bend Napoleon's will. The Allies adopted his view and signed the treaty of Chaumont (March 1st), "my treaty," as Castlereagh called it, with an unusual touch of personal pride; adding "Upon the face of the treaty this year our engagement is equivalent to theirs united." The power of England when she threw her purse into the scale had been just exhibited at Bar-sur-Aube, when at a council of all the representatives of the powers the retreat of the allied armies was discussed. Bernadotte, playing a waiting game in Holland, was unwilling to reinforce Blücher, then in a dangerous position, by the Russian and Prussian divisions of Winzingerode and Bülow, temporarily placed under his orders. Having asked for and received the assurance that the military leaders were agreed in holding the transfer necessary, Castlereagh declared that he took upon himself the responsibility of bringing the Swedish prince to reason. The withholding of the British subsidies was a vital matter, not only with Bernadotte but with all the powers. Castlereagh's avowed intention to take this step without waiting for sanction from his cabinet put an end to evasion and delay. Blücher was reinforced by the two divisions; the battle of Laon was fought and won, and the allies occupied the French capital. In April 1814 Castlereagh arrived in Paris. He did not disguise his discontent with Napoleon's position at Elba, close to the French coast, though he advised England not to separate herself at this crisis from her allies. His uneasiness led him to summon Wellington from the south to the Embassy in Paris. He hastened himself to

London during the visit of the allied sovereigns, and met with a splendid reception. He was honoured with the Garter, being one of the few commoners ever admitted to that order. When the House of Commons offered to the Crown its congratulations upon the treaty of peace, Castlereagh's triumph was signalized by a brilliantly eloquent panegyric from Canning, and by a recantation of his former doubts and denunciations from Whitbread. His own dignified language vindicated his country from the charge of selfish ambition.

His appointment as British representative at Vienna, where the congress was to meet in September, was foreseen; but meanwhile he was not idle. The war with the United States, originating in the non-intercourse dispute and the Orders in Council, did not cease with the repeal of the latter. It lasted through 1814 till the signing of the treaty of Ghent, soon before the flight from Elba. In parliament the ministry, during Castlereagh's absence, had been poorly championed. Canning had thrown away his chance by his unwise refusal of the Foreign Office. None of the ministers had any pretension to lead when Castlereagh was busy abroad and Canning was sulking at home, and Castlereagh's letters to Vansittart, the chancellor of the exchequer, show how these difficulties weighed upon him in facing the position at Vienna, where it was imperative for him to appear. At Vienna he realized at once that the ambition of Russia might be as formidable to Europe and to Great Britain as that of the fallen tyrant. His aim throughout had been to rescue Europe from military domination; and when he found that Russia and Prussia were pursuing ends incompatible with the general interest, he did not hesitate to take a new line. He brought about the secret treaty (Jan. 3, 1815) between Great Britain, Austria and France, directed against the plans of Russia in Poland and of Prussia in Saxony. Through Castlereagh's efforts, the Polish and Saxon questions were settled on the basis of compromise. The threat of Russian interference in the Low Countries was dropped.

While the Congress was still unfinished, Napoleon's escape from Elba came like a thunderclap. Castlereagh had come home for a short visit (Feb. 1815), at the urgent request of the cabinet, just before the flight was known. The shock revived the Great Alliance under the compact of Chaumont. All energies were directed to preparing for the campaign of Waterloo. Castlereagh's words in parliament were, "Whatever measures you adopt or decision you arrive at must rest on your own power and not on reliance on this man." Napoleon promptly published the secret treaty which Castlereagh had concluded with Metternich and Talleyrand, and the last left in the French archives. But Russia and Prussia, though much displeased, saw that, in the face of Bonaparte's return, they dared not weaken the Alliance. British subsidies were again poured out like water. After Napoleon's overthrow, Castlereagh successfully urged his removal to St Helena, where his custodians were charged to treat him "with all the respect due to his rank, but under such precautions as should render his escape a matter of impossibility." Some of the continental powers demanded, after Waterloo, fines and cessions that would have crushed France; but in November a peace was finally concluded, mainly by Castlereagh's endeavours, minimising the penalties exacted, and abandoning on England's part the whole of her share of the indemnity. The war created an economic situation at home which strengthened the Whigs and Radicals, previously discredited by their hostility to a patriotic struggle. In 1816 the Income Tax was remitted, despite Castlereagh's contention that something should first be done to reduce the Debt Charge. His policy, impressed upon British representatives abroad, was "to turn the confidence Great Britain inspired to the account of peace, by exercising a conciliatory influence in Europe." Brougham's action, at the end of 1815, denouncing the Holy Alliance, even in its early form, was calculated to embarrass England, though she was no party to what Castlereagh described as a "piece of sublime mysticism and nonsense."

While he saw no reason in this for breaking up the Grand Alliance, which he looked upon as a convenient organ of diplomatic intercourse and as essential for the maintenance of peace, he regarded with alarm "the little spirit of German intrigue," and agreed with Wellington that to attempt to crush France, as the Prussians desired, or to keep her in a perpetual condition of tutelage under a European concert from which she herself should be excluded, would be to invite the very disaster which it was the object of the Alliance to avoid. It was not till Metternich's idea of extending the scope of the Alliance, by using it to crush "the revolution" wherever it should raise its head, began to take shape, from the conference of Aix-la-Chapelle (1818) onward, that Great Britain's separation from her continental allies became inevitable. Against this policy of the reactionary powers Castlereagh from the first vigorously protested. As little was he prepared to accept the visionary schemes of the emperor Alexander for founding an effective "confederation of Europe" upon the inclusive basis of the Holy Alliance (see Alexander I. of Russia).

Meanwhile financial troubles at home, complicated by the resumption of cash payments in 1819, led to acute social tension. "Peterloo" and the "Six Acts" were furiously denounced, though the bills introduced by Sidmouth and Castlereagh were carried in both Houses by overwhelming majorities. The danger that justified them was proved beyond contest by the Cato Street Conspiracy in 1820. It is now admitted by Liberal writers that the "Six Acts," in the circumstances, were reasonable and necessary. Throughout, Castlereagh maintained his tranquil ascendancy in the House of Commons, though he had few colleagues who were capable of standing up against Brougham. Canning, indeed, had returned to office and had defended the "Six Acts," but Castlereagh bore the whole burden of parliamentary leadership, as well as the enormous responsibilities of the Foreign Office. His appetite for work caused him to engage in debates and enquiries on financial and legal questions when he might have delegated the task to others. Althorp was struck with his unsleeping energy on the Agricultural Distress Committee; "His exertions, coupled with his other duties—and unfortunately he was always obstinate in refusing assistance—strained his constitution fearfully, as was shown by his careworn brow and increasing paleness." In 1821, on Sidmouth's retirement, he took upon himself the laborious functions of the Home Office. The diplomatic situation had become serious. The policy of "intervention," with which Great Britain had consistently refused to identify herself, had been proclaimed to the world by the famous Troppau Protocol, signed by Russia, Austria and Prussia (see Troppau, Congress of). The immediate occasion was the revolution at Naples, where the egregious Spanish constitution of 1812 had been forced on the king by a military rising. With military revolts, as with paper constitutions of an unworkable type, Castlereagh had no sympathy; and in this particular case the revolution, in his opinion, was wholly without excuse or palliation. He was prepared to allow the intervention of Austria, if she considered her rights under the treaty of 1813 violated, or her position as an Italian Power imperilled. But he protested against the general claim, embodied in the Protocol, of the European powers to interfere, uninvited, in the internal concerns of sovereign states; he refused to make Great Britain, even tacitly, a party to such interference, and again insisted that her part in the Alliance was defined by the letter of the treaties, beyond which she was not prepared to go. In no case, he affirmed, would Great Britain "undertake the moral responsibility for administering a general European police," which she would never tolerate as applied to herself.

To Troppau, accordingly, no British plenipotentiary was sent, since the outcome of the conferences was a foregone conclusion; though Lord Stewart came from Vienna to watch the course of events. At Laibach an attempt to revive the Troppau proposals was defeated by the firm opposition of Stewart; but a renewal of the struggle at Verona in the autumn of 1822 was certain. Castlereagh, now marquess of Londonderry, was again to be the British representative, and he drew up for himself instructions that were handed over unaltered by Canning, his successor at the Foreign Office, to the new plenipotentiary, Wellington. In the threatened intervention of the continental powers in Spain, as in their earlier action towards Naples and Sardinia, England refused to take part. The Spanish revolutionary movement,

Castlereagh wrote, “was a matter with which, in the opinion of the English cabinet, no foreign power had the smallest right to interfere.” Before, however, the question of intervention in Spain had reached its most critical stage the development of the Greek insurrection against the Ottoman government brought up the Eastern Question in an acute form, which profoundly modified the relations of the powers within the Alliance, and again drew Metternich and Castlereagh together in common dread of an isolated attack by Russia upon Turkey. A visit of King George IV. to Hanover, in October 1821, was made the occasion of a meeting between Lord Londonderry and the Austrian chancellor. A meeting so liable to misinterpretation was in Castlereagh’s opinion justified by the urgency of the crisis in the East, “a practical consideration of the greatest moment,” which had nothing in common with the objectionable “theoretical” question with which the British government had refused to concern itself. Yet Castlereagh, on this occasion, showed that he could use the theories of others for his own practical ends; and he joined cordially with Metternich in taking advantage of the emperor Alexander’s devotion to the principles of the Alliance to prevent his taking an independent line in the Eastern Question. It was, indeed, the belief that this question would be made the matter of common discussion at the congress that led Castlereagh to agree to be present at Verona; and in his *Instructions* he foreshadowed the policy afterwards carried out by Canning, pointing out that the development of the war had made the recognition of the belligerent rights of the Greeks inevitable, and quoting the precedent of the Spanish American colonies as exactly applicable. With regard to the Spanish colonies, moreover, though he was not as yet prepared to recognize their independence *de jure*, he was strongly of opinion that the Spanish government should do so since “other states would acknowledge them sooner or later, and it is to the interest of Spain herself to find the means of restoring an intercourse when she cannot succeed in restoring a dominion.”

But the tragic ending of Castlereagh’s strenuous life was near; and the credit of carrying out the policy foreshadowed in the *Instructions* was to fall to his rival Canning. Lord Londonderry’s exhaustion became evident during the toilsome session of 1822. Both the king and Wellington were struck by his overwrought condition, which his family attributed to an attack of the gout and the lowering remedies employed. Wellington warned Dr Bankhead that Castlereagh was unwell, and, perhaps, mentally disordered. Bankhead went down to North Cray and took due precautions. Castlereagh’s razors were taken away, but a penknife was forgotten in a drawer, and with this he cut his throat (August 12, 1822). He had just before said, “My mind, my mind, is, as it were, gone”; and, when he saw his wife and Bankhead talking together, he moaned “there is a conspiracy laid against me.” It was as clear a case of brain disease as any on record. But this did not prevent his enemies of the baser sort from asserting, without a shadow of proof, that the suicide was caused by terror at some hideous and undefined charge. The testimony of statesmen of the highest character and of all parties to Castlereagh’s gifts and charm is in strong contrast with the flood of vituperation and calumny poured out upon his memory by those who knew him not.

BIBLIOGRAPHY.—Castlereagh’s correspondence and papers were published by his brother and successor (1850-1853) in twelve volumes. Sir Archibald Alison’s *Biography* in three volumes came out in 1861, with copious extracts from the manuscripts preserved at Wynyard. It was made the subject of an interesting essay in the *Quarterly Review* for January 1862, reprinted in *Essays by the late Marquis of Salisbury* (London, 1905). A graceful sketch by Theresa, Marchioness of Londonderry (London, 1904), originally brought out in the *Anglo-Saxon Review*, contains some extracts from Castlereagh’s unpublished correspondence with his wife, the record of an enduring and passionate attachment which throws a new light on the man.

(E. D. J. W.)

LONDONDERRY,

a northern county of Ireland in the province of Ulster, bounded N. by the Atlantic, W. by Lough Foyle and Donegal, E. by Antrim and Lough Neagh, and S. by Tyrone. The area is 522,315 acres, or about 816 sq. m. The county consists chiefly of river valleys surrounded by elevated table-lands rising occasionally into mountains, while on the borders of the sea-coast the surface is generally level. The principal river is the Roe, which flows northward from the borders of Tyrone into Lough Foyle below Newton-Limavady, and divides the county into two unequal parts. Farther west the Faughan also falls into Lough Foyle, and the river Foyle passes through a small portion of the county near its north-western boundary. In the south-east the Moyola falls into Lough Neagh, and the Lower Bann from Lough Neagh forms for some distance its eastern boundary with Antrim. The only lake in the county is Lough Finn on the borders of Tyrone, but Lough Neagh forms about 6 m. of its south-eastern boundary. The scenery of the shores of Lough Foyle and the neighbouring coast is attractive, and Castlerock, Downhill, Magilligan and Portstewart are favourite seaside resorts. On the flat Magilligan peninsula, which forms the eastern horn of Lough Foyle, the base-line of the trigonometrical survey of Ireland was measured in 1826. The scenery of the Roe valley, with the picturesque towns of Limavady and Dungiven, is also attractive, and the roads from the latter place to Draperstown and to Maghera, traversing the passes of Evishgore and Glenshane respectively, afford fine views of the Sperrin and Slieve Gallion mountains.

The west of this county consists of Dalradian mica-schist, with some quartzite, and is a continuation of the northern region of Tyrone. An inlier of these rocks appears in the rising ground east of Dungiven, including dark grey crystalline limestone. Old Red Sandstone and Lower Carboniferous Sandstone overlie these old rocks in the south and east, meeting the igneous “green rocks” of Tyrone, and the granite intrusive in them, at the north end of Slieve Gallion. Triassic sandstone covers the lower slope of Slieve Gallion on the south-east towards Moneymore, and rises above the Carboniferous Sandstone from Dungiven northward. At Moneymore we reach the western scarp of the white Limestone (Chalk) and the overlying basalt of the great plateaus, which dip down eastward under Lough Neagh. The basalt scarp, protecting chalk and patches of Liassic and Rhaetic strata, rises to 1260 ft. in Benevenagh north of Limavady, and repeats the finest features of the Antrim coast. A raised shelf with post-glacial marine clays forms the flat land west of Limavady. Haematite has been mined on the south flank of Slieve Gallion.

The excessive rainfall and the cold and uncertain climate are unfavourable for agriculture. Along the sea-coast there is a district of red clay formed by the decomposition of sandstone, and near the mouth of the Roe there is a tract of marl. Along the valleys the soil is often fertile, and the elevated districts of the clay-slate region afford pasture for sheep. The acreage of pasture-land does not greatly exceed that of tillage. Oats, potatoes and turnips are chiefly grown, with some flax; and cattle, sheep, pigs and poultry are kept in considerable numbers. The staple manufacture of the county is linen. The manufacture of coarse earthenware is also carried on, and there are large distilleries and breweries and some salt-works. There are fisheries for salmon and eels on the Bann, for which Coleraine is the headquarters. The deep-sea and coast fisheries are valuable, and are centred at Moville in Co. Donegal. The city of Londonderry is an important railway centre. The Northern Counties (Midland) main line reaches it by way of Coleraine and the north coast of the county, and the same railway serves the eastern part of the county, with branches from Antrim to Magherafelt, and Magherafelt to Cookstown (Co. Tyrone), to Draperstown and to Coleraine, and from

Limavady to Dungiven. The Great Northern railway reaches Londonderry from the south, and the city is also the starting-point of the County Donegal, and the Londonderry and Lough Swilly railways.

The population decreases (152,009 in 1891; 144,404 in 1901) and emigration is extensive, though both decrease and emigration are well below the average of the Irish counties. Of the total, about 43% are Roman Catholics, and nearly 50% Presbyterians or Protestant Episcopalians. Londonderry (pop. 38,892), Coleraine (6958) and Limavady (2692) are the principal towns, while Magherafelt and Moneymore are lesser market towns. The county comprises six baronies. Assizes are held at Londonderry, and quarter sessions at Coleraine, Londonderry and Magherafelt. The county is represented in parliament by two members, for the north and south divisions respectively. The Protestant and Roman Catholic dioceses of Armagh, Derry and Down each include parts of the county.

At an early period the county was inhabited by the O'Cathans or O'Catrans, who were tributary to the O'Neills. Towards the close of the reign of Elizabeth the county was seized, with the purpose of checking the power of the O'Neills, when it received the name of Coleraine, having that town for its capital. In 1609, after the confiscation of the estates of the O'Neills, the citizens of London obtained possession of the towns of Londonderry and Coleraine and adjoining lands, 60 acres out of every 1000 being assigned for church lands. The common council of London undertook to expend £20,000 on the reclamation of the property, and elected a body of twenty-six for its management, who in 1613 were incorporated as the Irish Society, and retained possession of the towns of Londonderry and Coleraine, the remainder of the property being divided among twelve of the great livery companies. Their estates were sequestrated by James I., and in 1637 the charter of the Irish Society was cancelled. Cromwell restored the society to its former position, and Charles II. at the Restoration granted it a new charter, and confirmed the companies in their estates. In the insurrection of 1641 Moneymore was seized by the Irish, and Magherafelt and Bellaghy, then called Vintner's Town, burned, as well as other towns and villages. There are several stone circles, and a large number of artificial caves. The most ancient castle of Irish origin is that of Carrickreagh; and of the castles erected by the English those of Dungiven and Muff are in good preservation. The abbey of Dungiven, founded in 1109, and standing on a rock about 200 ft. above the river Roe, is a picturesque ruin.

LONDONDERRY, or Derry, a city, county of a city, parliamentary borough (returning one member) and the chief town of Co. Londonderry, Ireland, 4 m. from the junction of the river Foyle with Lough Foyle, and 95 m. N.N.W. of Belfast. Pop. (1901) 38,892. The city is situated on an eminence rising abruptly from the west side of the river to a height of about 120 ft. The eminence is surrounded by hills which reach, a few miles to the north, an elevation of upwards of 1500 ft., and the river and lough complete an admirable picture. The city is surrounded by an ancient rampart about a mile in circumference, having seven gates and several bastions, but buildings now extend beyond this boundary. The summit of the hill, at the centre of the town, is occupied by a quadrangular area from which the main streets diverge. Some old houses with high pyramidal gables remain but are much modernized. The Protestant cathedral of St Columba, in Perpendicular style, was completed from the design of Sir John Vanbrugh in 1633, at a cost of £4000 contributed by the city of London, and was enlarged and restored in 1887. The spire was added in 1778 and rebuilt in 1802. The bishop's palace, erected in 1716, occupies the site of the abbey founded by Columba. The abbot of this monastery, on being made bishop, erected in 1164 Temple More or the "Great Church," one of the finest buildings in Ireland previous to the Anglo-Norman invasion. The original abbey church was called the "Black Church," but both it and the "Great Church" were demolished in 1600 and their materials used in fortifying the city. There is a large Roman Catholic cathedral, erected c. 1870 and dedicated to St Eugenius. For Foyle College, founded in 1617, a new building was erected in 1814. This and the Academical Institution, a foundation of 1868, were amalgamated in 1896. Magee College, taking its name from its foundress, Mrs Magee of Dublin, was instituted in 1857 as a training-school for the Presbyterian ministry.

The staple manufacture of the town is linen (especially shirt-making), and there are also shipbuilding yards, iron-foundries, saw-mills, manure-works, distilleries, breweries and flour-mills. The salmon fishery on the Foyle is valuable. The river affords a commodious harbour, its greatest depth being 33 ft. at high tide, and 12 ft. at low tide. It is under the jurisdiction of the Irish Society. The port has a considerable shipping trade with Great Britain, exporting agricultural produce and provisions. Regular services of passenger steamers serve Londonderry from Glasgow, Liverpool, Morecambe, Belfast and local coast stations. In 1898 Londonderry was constituted one of the six county boroughs which have separate county councils.

About 5 m. W. of the city, on a hill 803 ft. high, is a remarkable fort, consisting of three concentric ramparts, and an interior fortification of stone. It is named the Grianan of Aileach, and was a residence of the O'Neills, kings of Ulster. It was restored in 1878.

Derry, the original name of Londonderry, is derived from *Doire*, the "place of oaks." It owes its origin to the monastery founded by Columba about 546. With the bishopric which arose in connexion with this foundation, that of Raphoe was amalgamated in 1834. From the 9th to the 11th century the town was frequently in the possession of the Danes, and was often devastated, but they were finally driven from it by Murtagh O'Brien about the beginning of the 12th century. In 1311 it was granted by Edward II. to Richard de Burgh. After the Irish Society of London obtained possession of it, it was incorporated in 1613 under the name of Londonderry. From this year until the Union in 1800 two members were returned to the Irish parliament. The fortifications, which were begun in 1600, were completed in 1618. In 1688 Derry had become the chief stronghold of the Protestants of the north. On the 7th of December certain of the apprentices in the city practically put themselves and it in a stage of siege by closing the gates, and on the 19th of April 1689 the forces of James II. began in earnest the famous siege of Derry. The rector of Donaghmore, George Walker, who, with Major Baker, was chosen to govern Derry, established fame for himself for his bravery and hopefulness during this period of privation, and the historic answer of "No surrender," which became the watchword of the men of Derry, was given to the proposals of the besiegers. The garrison was at the last extremity when, on the 30th of July, ships broke through the obstruction across the harbour and brought relief. Walker and the siege are commemorated by a lofty column (1828), bearing a statue of the governor, on the Royal Bastion, from which the town standards defied the enemy; and the anniversary of the relief is still observed.

LONG, GEORGE (1800-1879), English classical scholar, was born at Poulton, Lancashire, on the 4th of November 1800, and educated at Macclesfield grammar-school and Trinity College, Cambridge. He was Craven university scholar in 1821 (bracketed with Lord Macaulay and Henry Malden), wrangler and senior chancellor's medallist in 1822 and became a fellow of Trinity in 1823. In 1824 he was elected professor of ancient languages in the new university of Virginia at Charlottesville, U.S.A., but after four years returned to England as the first Greek professor at the newly founded university of London. In 1842 he succeeded T. H. Key as professor of Latin at University College; in 1846-1849 he was reader in jurisprudence and civil law in the Middle Temple, and finally (1849-1871) classical lecturer at Brighton College. Subsequently he lived in retirement at Portfield, Chichester, in receipt (from 1873) of a Civil List pension of £100 a year obtained for him by Gladstone. He was one of the founders (1830), and for twenty years an officer, of the Royal Geographical Society; an active member of the Society for the Diffusion of Useful Knowledge, for which he edited the quarterly *Journal of Education* (1831-1835) as well as many of its text-books; the editor (at first with Charles Knight, afterwards alone) of the *Penny Cyclopaedia* and of Knight's *Political Dictionary*; and a member of the Society for Central Education instituted in London in 1837. He contributed the Roman law articles to Smith's *Dictionary of Greek and Roman Antiquities*, and wrote also for the companion dictionaries of *Biography and Geography*. He is remembered, however, mainly as the editor of the *Bibliotheca Classica* series—the first serious attempt to produce scholarly editions of classical texts with English commentaries—to which he contributed the edition of Cicero's *Orations* (1851-1862). He died on the 10th of August 1879.

Among his other works are: *Summary of Herodotus* (1829); editions of Herodotus (1830-1833) and Xenophon's *Anabasis* (1831); revised editions of J. A. Macleane's Juvenal and Persius (1867) and Horace (1869); the *Civil Wars of Rome*; a translation with notes of thirteen of Plutarch's *Lives* (1844-1848); translations of the *Thoughts of Marcus Aurelius* (1862) and the *Discourses of Epictetus* (1877); *Decline of the Roman Republic* (1864-1874), 5 vols. See H. J. Matthews, "In Memoriam," reprinted from the *Brighton College Magazine*, 1879.

LONG, JOHN DAVIS (1838-), American lawyer and political leader, was born in Buckfield, Oxford county, Maine, on the 27th of October 1838. He graduated at Harvard in 1857, studied law at the Harvard Law School and in 1861 was admitted to the bar. He practised in Boston, became active in politics as a Republican, was a member of the Massachusetts House of Representatives in 1875-1878 and its speaker in 1876-1878, lieutenant-governor of the state in 1879, and governor in 1880-1882. In 1883-1889 he was a member of the National House of Representatives, and from March 1897 to May 1902 was secretary of the navy, in the cabinet, first of President McKinley and then of President Roosevelt. In 1902 he became president of the Board of Overseers of Harvard College. His publications include a version of the *Aeneid* (1879), *After-Dinner and Other Speeches* (1895) and *The New American Navy* (1903).

LONG BRANCH, a city of Monmouth county, New Jersey, U.S.A., on the easternmost or "long" branch of the Shrewsbury river and on the Atlantic coast, about 30 m. S. of New York City. Pop. (1890) 7231; (1900) 8872, of whom 1431 were foreign-born and 987 were negroes; (1910 census) 13,298. It is served by the Pennsylvania, the Central of New Jersey, the New York & Long Branch, and electric railways, and by steamboats to New York. The carriage roads in the vicinity are unusually good. Long Branch is one of the oldest American watering-places. It is situated on a bluff which rises abruptly 20-35 ft. above the beach, and along the front of which bulkheads and jetties have been erected as a protection from the waves; along or near the edge of the bluff, Ocean Avenue, 60 ft. wide and about 5 m. long (from Seabright to Deal), commands delightful views of the ocean. A "bluff walk" runs above the water for 2 m. The city has one public park, Ocean Park (about 10 acres), and two privately owned parks, one of which is Pleasure Bay Park (25 acres), on the Shrewsbury river, where operas are given in the open air. The principal public institutions are the Monmouth Memorial Hospital and the Long Branch Circulating Library. In Long Branch the Monmouth County Horse Show is held annually in July. The southern part of Long Branch, known as Elberon, contains some beautiful summer residences—in one of its cottages General U. S. Grant spent his summers for many years, and in another, the Francklyn, President J. A. Garfield died in 1881. In 1909 a monument to Garfield was erected in Ocean Park. Adjoining Long Branch on the N. is the borough of Monmouth Beach (incorporated in 1906; population, 1910, 485). Before the War of Independence the site of Long Branch was owned by Colonel White, a British officer. It was confiscated as a result of the war, and late in the century its development as a watering-place began. Long Branch was chartered as a city in 1904.

LONGCHAMP, WILLIAM (d. 1197), chancellor of England and bishop of Ely, entered public life at the close of Henry II.'s reign as official to the king's son Geoffrey, for the archdeaconry of Rouen. Henry II., who disliked him, called him the "son of two traitors." He soon deserted Geoffrey for Richard, who made him chancellor of the duchy of Aquitaine. He always showed himself an able diplomatist. He first distinguished himself at Paris, as Richard's envoy, when he defeated Henry II.'s attempt to make peace with Philip Augustus (1189). On Richard's accession William became chancellor of the kingdom and bishop of Ely. When Richard left England (Dec. 1189), he put the tower of London in his hands and chose him to share with Hugh de Puiset, the great bishop of Durham, the office of chief justiciar. William immediately quarrelled with Hugh, and by April 1190 had managed to oust him completely from office. In June 1190 he received a commission as legate from Pope Celestine. He was then master in church as well as state. But his disagreeable appearance and manners, his pride, his contempt for everything English made him detested. His progresses through the country with a train of a thousand knights were ruinous to those on whom devolved the burden of entertaining him. Even John seemed preferable to him. John returned to England in 1191; he and his adherents were immediately involved in disputes with William, who was always worsted. At last (June 1191) Geoffrey, archbishop of York and William's earliest benefactor, was violently arrested by William's subordinates on landing at Dover. They exceeded their orders, which were to prevent the archbishop from entering England until he had sworn fealty to

Richard. But this outrage was made a pretext for a general rising against William, whose legatine commission had now expired, and whose power was balanced by the presence of the archbishop of Rouen, Walter Coutances, with a commission from the king, William shut himself up in the Tower, but he was forced to surrender his castles and expelled from the kingdom. In 1193 he joined Richard in Germany, and Richard seems to have attributed the settlement soon after concluded between himself and the emperor, to his "dearest chancellor." For the rest of the reign Longchamp was employed in confidential and diplomatic missions by Richard all over the continent, in Germany, in France and at Rome. He died in January 1197. His loyalty to Richard was unswerving, and it was no doubt through his unscrupulous devotion to the royal interest that he incurred the hatred of Richard's English subjects.

AUTHORITIES.—Benedictus, *Gesta Henrici*, vol. ii.; Giraldus Cambrensis, *De Vita Galfridi*; Stubbs' Preface to Roger of Hoveden, vol. iii.; L. Bovine-Champeaux, *Notice sur Guillaume de Longchamp* (Évreux, 1885).

LONGCLOTH, a plain cotton cloth originally made in comparatively long pieces. The name was applied particularly to cloth made in India. Longcloth, which is now commonly bleached, comprehends a number of various qualities. It is heavier than cambric, and finer than medium or Mexican. As it is used principally for underclothing and shirts, most of the longcloth sold in Great Britain passes through the hands of the shirt and underclothing manufacturers, who sell to the shopkeepers, though there is still a considerable if decreasing retail trade in piece-goods. The lower kinds of longcloth, which are made from American cotton, correspond in quality to the better kinds of "shirting" made for the East, but the best longcloths are made from Egyptian cotton, and are fine and fairly costly goods.

LONG EATON, an urban district in the Ilkeston parliamentary division of Derbyshire, England, 10 m. E.S.E. of Derby, on the Midland railway. Pop. (1891) 9636; (1901) 13,045. It lies in the open valley of the Trent, at a short distance from the river, and near the important Trent Junction on the Midland railway system. The church of St Lawrence has Norman portions, and an arch and window apparently of pre-Conquest date. The large industrial population of the town is occupied in the manufacture of lace, which extended hither from Nottingham; there are also railway carriage works. To the north is the township of SANDIACRE (pop. 2954), where the church has a fine Decorated chancel.

LONGEVITY, a term applied to express either the length or the duration of life in any organism, but, as cases of long duration excite most interest, frequently used to denote a relatively unusual prolongation of life. There is no reason to suppose that protoplasm, the living material of organisms, has a necessarily limited duration of life, provided that the conditions proper to it are maintained, and it has been argued that since every living organism comes into existence as a piece of the protoplasm of a pre-existing living organism, protoplasm is potentially immortal. Living organisms exist, however, as particles or communities of particles of protoplasm (see LIFE), and as such have a limited duration of life. Longevity, as E. Ray Lankester pointed out in 1869, for practical purposes must be understood to mean the "length of time during which life is exhibited in an individual." The word "individual" must be taken in its ordinary sense as a wholly or partially independent, organized mass produced from a pre-existing organized mass, as otherwise the problem will be confused by arguments as to the meaning of biological individuality.

Empirical Data.—A multitude of observations show that only a very brief life, ranging from a few hours to a few days, is the normal fate of the vast majority of single-celled organisms, whether these be animal or vegetable or on the border-line between the two kingdoms. Death comes to them rapidly from internal or external causes, or the individual life ends in conjugation or division or spore-formation. Under special conditions, natural or artificial, the individual life may be prolonged by desiccation, or freezing, or by some similar arrest of functional activity.

The duration of life among plants is varied. The popular division into annuals, biennials and perennials is not absolute, for natural and artificial conditions readily prolong the lives of annuals and biennials for several seasons, whereas the case of perennials is much complicated by the mode of growth, and the problem of individuality, however we desire to exclude it, obtrudes itself. In the vast majority of cases where a plant is obviously a simple individual, its life is short, ranging from a few days in the case of fungi, to two seasons in the case of biennial herbs. Most of the simple algae are annual, their life enduring only for part of the year; the branching algae are more often perennial, but in their cases not only are observations as to duration lacking, but however simply we may use the term individual, its application is difficult. The larger terrestrial plants with woody tissues which we denote roughly as shrubs and trees have an individuality which, although different from that of a hyacinth or carrot, is usually obvious. Shrubs live from four to ten or more years, and it apparently is the case that odoriferous shrubs such as sage and lavender display the longer duration. Trees with soft wood, such as poplars and willows, last for about fifty years, fruit-trees rather longer. Estimates of the age which large trees can attain, based partly on attempts to count the annual rings, have been given by many writers, and range from about three hundred years in the case of the elm to three to five thousand years in the case of *Sequoia gigantea* of California, and over five thousand years in that of the baobab (*Adansonia digitata*) of Cape Verde. It is impossible to place exact reliance on these estimates, but it is at least certain that very many trees have a duration of life exceedingly great in comparison with the longest-lived animals.

The duration of life amongst multicellular invertebrate animals is little known, except in the frequent instances

where it is normally brief. Many sponges and polyps die at the end of the season, leaving winter eggs or buds. The much-branched masses of the larger sponges and compound hydrozoa certainly may be perennial. A sea-anemone (*Actinia mesembryanthemum*), captured in 1828 by Sir John Dalyell, a Scottish naturalist, and then guessed to be about seven years old, lived in captivity in Edinburgh until 1887, the cause of death being unknown. As other instances of great ages attained by sea-anemones are on record, it is plain that these animals, although simple polyps, are long-lived. Echinoderms are inferred to live to considerable ages, as they grow slowly and as there is great difference in size amongst fully adult specimens. On similar reasoning, considerable age is attributed to the larger annulates and crustacea, but the smaller forms in many cases are known to have very short lives. The variation in the length of life of molluscs appears to be great. Many species of gastropods live only a few years; others, such as *Natica heros*, have reached thirty years, whilst the large *Tridacna gigas* is stated to live from sixty to a hundred years. Among insects, the adult stage has usually only a very short duration of life, extending from a few hours to a few months, but the larval stages may last much longer. Including these latter, the range of duration among insects, taking the whole life from hatching to death, appears to lie between the limits of a few weeks in the case of plant-lice to seventeen years in the case of the American *Cicada septemdecim*, the larva of which lives seventeen years, the adult only a month. Most butterflies are annuals, but those which fail to copulate may hibernate and live through a second season, whilst the lives of some have been preserved artificially for seven years. Worker bees and drones do not survive the season, but queens may live from two to five years. In the case of vertebrates, the duration of life appears to be greater among fish and reptiles than among birds and mammals. The ancient Romans have noted that eels, kept in aquaria, could reach the age of sixty years. Estimates based on size and rate of growth have led to the inference that salmon may live to the age of a hundred years, whilst G. L. L. Buffon set down the period of life of carp in ponds as one hundred and fifty years, and there is evidence for a pike having reached the age of over two centuries. More recently it has been claimed that the age of fish can be ascertained exactly by counting the annual rings of the otoliths. No great ages have as yet been recorded by this method, whilst, on the other hand, by revealing great variations of weight and size in fishes with the same number of annual rings, it has thrown doubt on the validity of estimates of age based on size and rate of growth. The evidence as a whole is unsatisfactory, but it is highly probable that in the absence of accidents most fish can attain very great ages. The duration of life among batrachia is little known, but small frogs have been recorded as living over twelve years, and toads up to thirty-six years.

Almost nothing is known as to the longevity of snakes and lizards, but it is probable that no great ages are reached. Crocodiles, alligators and caymans grow slowly and are believed to live very long. There is exact evidence as to alligators in captivity in Europe reaching forty years without signs of senescence, and some of the sacred crocodiles of India are believed to be more than a hundred years old. Chelonians live still longer. A tortoise has lived for eighty years in the garden of the governor of Cape Town, and is believed to be at least two hundred years old. There are records of small land-tortoises that have been kept in captivity for over a century, whilst the very large tortoises of the Galapagos Islands certainly attain ages of at least two centuries and possibly much more. A considerable body of information exists regarding the longevity of birds, and much of this has been brought together by J. H. Gurney. From his lists, which include more than fifty species, it appears that the duration is least in the case of small passerine and picarian birds, where it ranges from eight or nine years (goat-suckers and swifts) to a maximum of twenty-five years, the latter age having been approached by larks, canaries and goldfinch. Gulls have been recorded as living over forty years, ducks and geese over fifty years (the duchess of Bedford has recorded the case of a Chinese goose having been in possession of the same family for fifty-seven years). Parrots frequently live over eighty years, swans nearly as long, ravens and owls rather less, whilst there is excellent evidence of eagles and falcons considerably exceeding a hundred years. Notwithstanding their relatively large size, struthious birds do not reach great ages. The records for cassowaries and rheas do not exceed thirty years, and the maximum for ostriches is fifty years, and that on doubtful evidence.

Exact records regarding the longevity of mammals are surprisingly few. There is no evidence as to Monotremes. The life of Marsupials in captivity is seldom long; a phalanger has lived in the London Zoological Gardens and showed no signs of age at more than ten years old; it may be inferred that the larger forms are capable of living longer. Reliable records as to Edentates do not exist; those in captivity have short lives, but the size and structure of some of the extinct forms suggests that they may have reached a great age. Nothing is known regarding the longevity of Sirenians, except that they do not live long in captivity. In the case of Cetaceans, estimates based on the growth of whale-bone assign an age of several centuries to whale-bone whales; exact records do not exist. More is known regarding Ungulates, as many of these are domesticated, semi-domesticated or are frequently kept in captivity. Great length of life has been assigned to the rhinoceros, but the longest actual record is that of an Indian rhinoceros which lived for thirty-seven years in the London Zoological Gardens. The usual duration of life in the case of horses, asses and zebras is from fifteen to thirty years, but instances of individuals reaching fifty years are fairly well authenticated. Domestic cattle may live from twenty-five to thirty years, sheep and goats from twelve to fourteen years, antelopes rather longer, especially in the case of the larger forms. A giraffe has lived for nineteen years in the London Zoological Gardens. Deer are reputed to live longer than sheep, and records of individuals at the London Gardens confirm this, but it is doubtful if they live as long as cattle. Camels are long-lived, according to repute, but actual records show no great age; a llama which died in the London Gardens at the age of seventeen years showed unmistakable signs of senility. The hippopotamus is another large ungulate to which great longevity has been assigned, but the longest actual record is the case of a female born in the London Gardens which died in its thirty-fifth year. The duration of life assigned to domestic swine is about twenty years; an Indian wild boar, alive in the London Zoological Gardens in 1910, and apparently in full vigour, was fifteen years old. Elephants are usually supposed capable of reaching great ages, but the actual records of menagerie and military animals show that thirty to forty years is a normal limit. Facts as to rodents are not numerous; the larger forms such as hares and rabbits may live for ten years, smaller forms such as rats and mice, for five or six years. Bats have a reputation for long duration of life, and tropical fruit-bats are known to have lived for seventeen years. No great ages have been recorded for Carnivora, but the average is fairly high. Twenty-five years appears to be a limit very rarely exceeded by lions, tigers or bears; domestic cats may live for from twelve to twenty-three years, and dogs from sixteen to eighteen years, though cases of as many as thirty-four years have been noted. Less is known of the smaller forms, but menagerie records show that ages between twelve and twenty are frequently reached. There were in 1910 in the London Zoological Gardens, apparently in good health, a meerkat at least twelve years old, a sand-badger fourteen years and a ratel nineteen years of age. Records regarding monkeys are unsatisfactory, for these creatures are notoriously delicate in captivity, and it is practically certain that under such circumstances they rarely die of old age. A grey lemur eleven years old and a chimpanzee eleven and a half, both in good health in the London Zoological Gardens, appear to be the oldest primates definitely recorded. Estimates based on size, condition of the skull and so forth obtained by examination of wild specimens that have been killed would seem to establish a rough correspondence between the size of monkeys and their duration of life, and to set the limits as between seven or eight and thirty years.

With regard to the human race, there seems to be almost no doubt but that the average duration of life has increased with civilization; the generally improved conditions of life, the greater care of the young and of the aged and the

advance in medical and surgical science far more than outweigh any depressing effect caused by the more strenuous and nervous activity required by modern social organization. The expectation of life of those who attain the age of sixty varies with race, sex and occupation, but is certainly increasing, and an increasing number of persons have a chance of reaching and do reach ages between ninety and one hundred. Careful investigation has thrown doubt almost amounting to disproof on the much-quoted cases of great longevity, such as that of Thomas Parr, the Shropshire peasant, who was supposed to have reached his hundred and fifty-third year, and, although the existence of centenarians is thoroughly established, any ages exceeding a hundred by more than two or three years are, at the most, dubious.

A survey of the facts of longevity, so far as these are established on reasonable evidence, discloses that the recorded ages both of men and animals are much shorter than those assigned in popular belief. The duration of life is usually brief in the animal kingdom, and except for some fish and reptiles, and possibly whales, it is certain that a man enjoys the longest average duration of life and that centenarians occur more frequently amongst men than amongst most of the lower animals.

Theories of Longevity.—Ray Lankester has pointed out that several meanings are attached to the word longevity. It may be used of an individual, and in this sense has little importance, partly because of the inevitable variability of the individual, and partly because there may be individuals that are abnormal in duration of life, just as there are abnormalities in weight or height. It may be used for the average duration of life of all the individuals of a species and so be another way of expressing the average mortality that affects the species, and that varies not only with structure and constitution but with the kind of enemies, accidents and conditions to which the members of the species are subject. If we reflect on the large incidence of mortality from external causes affecting a species and particularly the young of a species, we shall see that we must conclude that intrinsic, physiological causes can have relatively little weight in determining the average mortality rate. Finally, longevity may be used, and is most conveniently used, to denote the specific potential longevity, that is to say the duration of life that would be attained by normal individuals of a species if the conditions were most favourable. It is necessary to keep in mind these various applications of the term when considering the theoretical explanations that have been associated with the empirical facts.

There is a certain relation between size and longevity. As a general rule small animals do not live so long as larger creatures. Whales survive elephants, elephants live longer than camels, horses and deer, and these again than rabbits and mice. But the relation is not absolute; parrots, ravens and geese live longer than most mammals and than many larger birds. G. L. L. Buffon tried to find a more definite measure of longevity, and believed that it was given by the ratio between the whole period of life and the period of growth. He believed that the possible duration of life was six or seven times that of the period of growth. Man, he said, takes fourteen years to grow, and his duration of life is ninety to one hundred years; the horse has reached its full size at four years of age and may live for a total period of twenty-five to thirty years. M. J. P. Flourens attempted to make Buffon’s suggestion more exact; he took the end of the period of growth as the time at which the epiphyses of the long bones united with the bones themselves, and on this basis held that the duration of life was five times the length of the period of growth. The theories of Buffon and Flourens, however, do not apply to all vertebrates and have no meaning in the case of invertebrates. Y. Bunge has suggested that in the case of mammals the period taken by the new-born young to double in weight is an index of the rapidity of growth and is in a definite relation to the possible duration of life. M. Oustalet has discussed the existence of definite relations between duration of life and size, rate of growth, period of gestation and so forth, and found so many exceptions that no general conclusion could be drawn. He finally suggested that diet was the chief factor in determining the span of life. E. Metchnikoff has provided the most recent and fullest criticism and theory of the physiological causes of longevity. He admits that many factors must be involved, as the results vary so much in different kinds of animals. He thinks that too little is known of the physiological processes of invertebrates to draw any valid conclusions in their case. With regard to vertebrates, he calls attention to the gradual reduction of longevity as the scale of life is ascended. On the whole, reptiles live much longer than birds, and birds than mammals, the contrast being specially notable when birds and mammals are compared. He dismisses the effect of the reproductive tax from possible causes of short duration of life, for the obvious reason that longevity is nearly equal in the two sexes, although females have a much greater reproductive drain. He points out that the hind-gut or large intestine is least developed in fishes, relatively small in reptiles, still small but relatively larger in birds and largest in mammals, relatively and absolutely, the caecum or caeca being reckoned as part of the hind-gut. The area of the intestinal tract in question is of relatively little importance in digestion, although a considerable amount of absorption may take place from it. It serves 977
chiefly as a reservoir of waste matter and is usually the seat of extensive putrefactive change. The products of putrefaction are absorbed by the blood and there results a constant auto-intoxication of the body which Metchnikoff believes to be the principal agent in senile degeneration. Mammals, if they escape from enemies, diseases and accidents, fall victims to premature senility as the result of the putrefactive changes in their intestines, and the average mortality of the species is much too high, the normal specific longevity being rarely if ever attained. Metchnikoff urges, and so far probably is followed by all competent authorities, that improvements in the conditions of life, greater knowledge of disease and of hygiene and simplification of habits are tending to reduce the average mortality of man and the domestic animals, and to bring the average longevity nearer the specific longevity. He adds to this, however, a more special theory, which, although it appears rapidly to be gaining ground, is yet far from being accepted. The theory is that duration of life may be prolonged by measures directed against intestinal putrefaction.

The process of putrefaction takes place in masses of badly-digested food, and may be combated by careful dieting, avoidance of rich foods of all kinds and particularly of flesh and alcohol. Putrefaction, however, cannot take place except in the presence of a particular group of bacteria, the entrance of which to the body can be prevented to a certain extent. But it would be impossible or impracticable to secure a sterilized diet, and Metchnikoff urges that the bacteria of putrefaction can be replaced or suppressed by another set of microbes. He found that there was a widely spread popular belief in the advantage of diet consisting largely of products of soured milk and that there was a fair parallel between unusual longevity and such a diet. Experimentally he showed that the presence of the bacilli which produce lactic acid inhibited the process of putrefaction. Accordingly he recommends that the diet of human beings should include preparations of milk soured by cultures of selected lactic acid bacilli, or that the spores of such bacilli should be taken along with food favourable to their development. In a short time the bacilli establish themselves in the large intestine and rapidly stop putrefactive change. The treatment has not yet been persisted in sufficiently long by a sufficient number of different persons to be accepted as universally satisfactory, and there is even more difference of opinion as to Metchnikoff’s theory that the chief agent in senile degeneration is the stimulation of phagocytes by the products of putrefaction with the resulting destruction of the specific cells of the tissues. Metchnikoff, however, gave it to the world, not as a proved and completed doctrine, but as the line of inquiry that he himself had found most promising. He has suggested further that if the normal specific longevity were attained by human beings, old and not degenerate individuals would lose the instinct for life and acquire an instinct for death, and that as they had fulfilled the normal cycle of life, they would accept death with the same relieved acquiescence that they now accept sleep.

The various writers whose opinions have been briefly discussed agree in supposing that there is a normal specific

longevity, although Metchnikoff alone has urged that this differs markedly from the average longevity, and has propounded a theory of the causes of the divergence. It is common ground that they believe the organism to be wound up, so to say, for a definite period, but have no very definite theory as to how this period is determined. A. Weismann, on the other hand, in a well-known essay on the duration of life, has developed a theory to explain the various fashions in which the gift of life is measured out to different kinds of creatures. He accepts the position that purely physiological conditions set a limit to the number of years that can be attained by each kind of multicellular organism, but holds that these conditions leave room for a considerable amount of variation. Duration of life, in fact, according to Weismann, is a character that can be influenced by the environment and that by a process of natural selection can be adapted to the conditions of existence of different species.

If a species is to maintain its existence or to increase, it is obvious that its members must be able to replace the losses caused by death. It is necessary, moreover, for the success of the species, that an average population of full vigour should be maintained. Weismann argues that death itself is an adaptation to secure the removal of useless and worn-out individuals and that it comes as soon as may be after the period of reproductive activity. It is understood that the term reproductive activity covers not merely the production of new individuals but the care of these by the parents until they are self-sufficient. The average longevity, according to Weismann, is adapted to the needs of the species; it is sufficiently long to secure that the requisite number of new individuals is produced and protected. He has brought together a large number of instances which show that there is a relation between duration of life and fertility. Birds of prey, which breed slowly, usually producing an annual brood of no more than one or two, live to great ages, whilst rabbits which produce large litters at frequent intervals have relatively short lives. Allowance has to be made in cases where the young are largely preyed upon by enemies, for this counteracts the effect of high fecundity. In short, the duration of life is so adapted that a pair of individuals on the average succeed in rearing a pair of offspring. Metchnikoff, however, has pointed out that the longevity of such fecund creatures must have arisen independently, as otherwise species subject to high risks of this nature would have ceased to exist and would have disappeared, as many species have vanished in the past of the world's history.

The normal specific longevity, the age to which all normal individuals of a species would survive under the most favourable conditions, must depend on constitution and structure. No doubt selection is involved, as it is obvious that creatures would perish if their constitution and structure were not such that they could live long enough to reproduce their kind. The direct explanation, however, must be sought for in size, complexity of structure, length of period of growth, capacity to withstand the wear and tear of life and such other intrinsic qualities. The average specific longevity, on the other hand, depends on a multitude of extrinsic conditions operating on the intrinsic constitution; these extrinsic conditions are given by the environment of the species as it affects the young and the adults, enemies, diseases, abundance of food, climatic conditions and so forth. It would seem most natural to suppose that in all cases, except perhaps those of intelligent man and the domestic animals or plants he harbours, the average longevity must vary enormously with changing conditions, and must be a factor of greater importance in the survival of the species than the ideal normal specific longevity. It also seems more probable that the reproductive capacity, which is extremely variable, has been adapted to the average longevity of the species, than that, as Weismann supposed, it should itself be the determining cause of the duration of life.

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(P. C. M.)

LONGFELLOW, HENRY WADSWORTH

(1807-1882), American poet, was born on the 27th of February 1807, at Portland, Maine. His ancestor, William Longfellow, had immigrated to Newbury, Massachusetts, in 1676, from Yorkshire, England. His father was Stephen Longfellow, a lawyer and United States congressman, and his mother, Zilpha Wadsworth, a descendant of John Alden and of "Priscilla, the Puritan maiden."

Longfellow's external life presents little that is of stirring interest. It is the life of a modest, deep-hearted gentleman, whose highest ambition was to be a perfect man, and, through sympathy and love, to help others to be the same. His boyhood was spent mostly in his native town, which he never ceased to love, and whose beautiful surroundings and quiet, pure life he has described in his poem "My Lost Youth." Here he grew up in the midst of majestic peace, which was but once broken, and that by an event which made a deep impression on him—the war of 1812. He never forgot

"the sea-fight far away.
How it thundered o'er the tide.
And the dead captains as they lay
In their graves o'erlooking the tranquil bay.
Where they in battle died."

The "tranquil bay" is Casco Bay, one of the most beautiful in the world, studded with bold, green islands, well fitted to be the Hesperides of a poet's boyish dreams. At the age of fifteen Longfellow entered Bowdoin College at Brunswick, a town situated near the romantic falls of the Androscoggin river, about 25 m. from Portland, and in a region full of Indian scenery and legend. Here he had among his classfellows Nathaniel Hawthorne, George B. Cheever and J. S. C. Abbott. During the latter years of his college life he contributed to the *United States Literary Gazette* some half-dozen poems, which are interesting for two reasons—(1) as showing the poet's early, book-mediated sympathy with nature and legendary heroisms, and (2) as being almost entirely free from that supernatural view of nature which his subsequent residence in Europe imparted to him. He graduated in 1825, at the age of eighteen, with honours, among others that of writing the "class poem"—taking the fourth place in a class of thirty-eight. He then entered his father's law office, without intending, however, it would appear, to devote himself to the study of the law. For this profession he was, both by capacity and tastes, utterly unfitted, and it was fortunate that, shortly after his graduation, he received an offer of a professorship of modern languages at Bowdoin College. In order the better to qualify himself for this appointment, he went to Europe (May 15th, 1826) and spent three years and a half travelling in France, Italy, Spain, Germany, Holland and England, learning languages, for which he had unusual talent, and drinking in the spirit of the history and life of these countries. The effect of Longfellow's visit was twofold. On the one hand, it widened his

sympathies, gave him confidence in himself and supplied him with many poetical themes; on the other, it traditionalized his mind, coloured for him the pure light of nature and rendered him in some measure unfit to feel or express the spirit of American nature and life. His sojourn in Europe fell exactly in the time when, in England, the reaction against the sentimental atheism of Shelley, the pagan sensitivity of Keats, and the sublime, Satanic outcastness of Byron was at its height; when, in the Catholic countries, the negative exaggerations of the French Revolution were inducing a counter current of positive faith, which threw men into the arms of a half-sentimental, half-aesthetic medievalism; and when, in Germany, the aristocratic paganism of Goethe was being swept aside by that tide of dutiful, romantic patriotism which flooded the country, as soon as it began to feel that it still existed after being run over by Napoleon's war-chariot. He returned to America in 1829, and remained six years at Bowdoin College (1829-1835), during which he published various text-books for the study of modern languages. In his twenty-fourth year (1831) he married Miss Mary Story Potter, one of his "early loves." In 1833 he made a series of translations from the Spanish, with an essay on the moral and devotional poetry of Spain, and these were incorporated in 1835 in *Outre-mer: a Pilgrimage beyond the Sea*.

In 1835 Longfellow was chosen to succeed George Ticknor as professor of modern languages and belles-lettres in Harvard. On receiving this appointment, he paid a second visit of some fifteen months to Europe, this time devoting special attention to the Scandinavian countries and Switzerland. During this visit he lost his wife, who died at Rotterdam, on the 29th of November 1835.

On his return to America in December 1836, Longfellow took up his residence in Cambridge, and began to lecture at Harvard and to write. In his new home he found himself amid surroundings entirely congenial to him. Its spaciousness and free rural aspect, its old graveyards and towering elms, its great university, its cultivated society and its vicinity to humane, substantial, busy Boston, were all attractions for such a man. In 1837-1838 several essays of Longfellow's appeared in the *North American Review*, and in 1839 he published *Hyperion: a Romance*, and his first volume of original poetry, entitled *Voices of the Night*. *Hyperion*, a poetical account of his travels, had, at the time of its publication, an immense popularity, due mainly to its sentimental romanticism. At present few persons beyond their teens would care to read it through, so unnatural and stilted is its language, so thin its material and so consciously mediated its sentiment. Nevertheless it has a certain historical importance, for two reasons—(1) because it marks that period in Longfellow's career when, though he had left nature, he had not yet found art, and (2) because it opened the sluices through which the flood of German sentimental poetry flowed into the United States. The *Voices of the Night* contains some of his best minor poems, *e.g.* "The Psalm of Life" and "Footsteps of Angels." In 1842 Longfellow published a small volume of *Ballads and other Poems*, containing some of his most popular pieces, *e.g.* "The Skeleton in Armour," "The Wreck of the Hesperus," "The Village Blacksmith," "To a Child," "The Bridge," "Excelsior." In the same year he paid a third brief visit to Europe, spending the summer on the Rhine. During his return-passage across the Atlantic he wrote his *Poems on Slavery* (1842), with a dedication to Channing. These poems went far to wake in the youth of New England a sense of the great national wrong, and to prepare them for that bitter struggle in which it was wiped out at the expense of the lives of so many of them. In 1843 he married again, his wife being Miss Frances Elizabeth Appleton of Boston, a daughter of Hon. Nathan Appleton, one of the founders of Lowell, and a sister of Thomas G. Appleton, himself no mean poet.

About the same time he bought, and fixed his residence in, the Craigie House, where he had formerly only been a lodger, an old "revolutionary house," built about the beginning of the 18th century, and occupied by General Washington in 1776. This quaint old wooden house, in the midst of a large garden full of splendid elms, continued to be his chief residence till the day of his death. Of the lectures on Dante which he delivered about this time, James Russell Lowell says: "These lectures, illustrated by admirable translations, are remembered with grateful pleasure by many who were thus led to learn the full significance of the great Christian poet." Indeed, as a professor, Longfellow was eminently successful. Shortly after the *Poems on Slavery*, there appeared in 1843 a more ambitious work, *The Spanish Student, a Play in Three Acts*, a kind of sentimental "Morality," without any special merit but good intention. If published nowadays it would hardly attract notice; but in those gushing, emotion-craving times it had considerable popularity, and helped to increase the poet's now rapidly widening fame. A huge collection of translations of foreign poetry edited by him, and entitled *The Poets and Poetry of Europe*, appeared in 1845, and, in 1846, a few minor poems —songs and sonnets—under the title *The Belfry of Bruges*. In 1847 he published at Boston the greatest of all his works, *Evangeline, a Tale of Acadie*. It was, in some degree, an imitation of Goethe's *Hermann and Dorothea*, and its plot, which was derived from Hawthorne's *American Note-Books*, is even simpler than that of the German poem, not to say much more touching. At the violent removal by the British government of a colony of French settlers from Acadie (Nova Scotia) in 1755, a young couple, on the very day of their wedding, were separated and carried in different directions, so that they lost all trace of each other. The poem describes the wanderings of the bride in search of her lover, and her final discovery of him as an old man on his death-bed, in a public hospital which she had entered as a nurse. Slight as the story is, it is worked out into one of the most affecting poems in the language, and gives to literature one of its most perfect types of womanhood and of "affection that hopes and endures and is patient." Though written in a metre deemed foreign to English ears, the poem immediately attained a wide popularity, which it has never lost, and secured to the dactylic hexameter a recognized place among English metres.

In 1849 Longfellow published a novel of no great merit, *Kavanagh*, and also a volume of poems entitled *The Seaside and the Fireside*, a title which has reference to his two homes, the seaside one on the charming peninsula of Nahant, the fireside one in Cambridge. One of the poems in this collection, "Resignation," has taken a permanent place in literature; another, "Hymn for my Brother's Ordination," shows plainly the nature of the poet's Christianity. His brother, the Rev. Samuel Longfellow, was a minister of the Unitarian Church.

Longfellow's genius, in its choice of subjects, always oscillated between America and Europe, between the colonial period of American history and the Middle and Romantic Ages of European feeling. When tired of the broad daylight of American activity, he sought refuge and rest in the dim twilight of medieval legend and German sentiment. In 1851 appeared *The Golden Legend*, a long lyric drama based upon Hartmann von Aue's beautiful story of self-sacrifice, *Der arme Heinrich*. Next to *Evangeline*, this is at once the best and the most popular of the poet's longer works, and contains many passages of great beauty. Bringing his imagination back to America, he next applied himself to the elaboration of an Indian legend. In 1854 he resigned his professorship. In the following year he gave to the world the Indian Edda, *The Song of Hiawatha*, a conscious imitation, both in subject and metre, of the Finnish epic, the *Kalevala*, with which he had become acquainted during his second visit to Europe. The metre is monotonous and easily ridiculed, but it suits the subject, and the poem is very popular. In 1858 appeared *The Courtship of Miles Standish*, based on a charming incident in the early history of the Plymouth colony, and, along with it, a number of minor poems, included under the modest title, *Birds of Passage*. One of these is "My Lost Youth."

Two events now occurred which served to cast a gloom over the poet's life and to interrupt his activity,—the outbreak of the Civil war, and the tragic fate of his wife, who, having accidentally allowed her dress to catch fire, was burnt to death in her own house in 1861. It was long before he recovered from the shock caused by this terrible event, and in his subsequent published poems he never ventured even to allude to it. When he did in some measure find

himself again, he gave to the world his charming *Tales of a Wayside Inn* (1863), and in 1865 his *Household Poems*. Among the latter is a poem entitled "The Children's Hour," which affords a glance into the home life of the widowed poet, who had been left with five children—two sons, Ernest and Charles, and three daughters,

"Grave Alice, and laughing Allegra,
And Edith with golden hair."

A small volume entitled *Flower de Luce* (1867) contains, among other fine things, the beautiful "threnos" on the burial of Hawthorne, and "The Bells of Lynn." Once more the poet sought refuge in medieval life by completing his translation of the *Divina Commedia*, parts of which he had rendered into English as much as thirty years before. This work appeared in 1867, and gave a great impulse to the study of Dante in America. It is a masterpiece of literal translation. Next came the *New England Tragedies* (1868) and *The Divine Tragedy* (1871), which found no large public. In 1868-1869 the poet visited Europe, and was everywhere received with the greatest honour. In 1872 appeared *Three Books of Song*, containing translated as well as original pieces, in 1873 *Aftermath* and in 1875 *The Mask of Pandora, and other Poems*. Among these "other poems" were "The Hanging of the Crane," "Morituri Salutamus" and "A Book of Sonnets." *The Mask of Pandora* is a proof of that growing appreciation of pagan naturalism which marked the poet's later years. Though not a great poem, it is full of beautiful passages, many of which point to the riddle of life as yet unsolved, a conviction which grew ever more and more upon the poet, as the ebulliency of romanticism gave way to the calm of classic feeling. In the "Book of Sonnets" are some of the finest things he ever wrote, especially the five sonnets entitled "Three Friends of Mine." These "three friends" were Cornelius Felton, Louis Agassiz and Charles Sumner, whom he calls

"The noble three,
Who half my life were more than friends to me."

The loss of Agassiz was a blow from which he never entirely recovered; and, when Sumner also left him, he wrote:—

"Thou hast but taken thy lamp and gone to bed;
I stay a little longer, as one stays
To cover up the embers that still burn."

He did stay a little longer; but the embers that still burnt in him refused to be covered up. He would fain have ceased writing, and used to say, "It's a great thing to know when to stop"; but he could not stop, and did not stop, till the last. He continued to publish from time to time, in the magazines, poems which showed a clearness of vision and a perfection of workmanship such as he never had equalled at any period of his life. Indeed it may be said that his finest poems were his last. Of these a small collection appeared under the title of *Keramos, and other Poems* (1878). Besides these, in the years 1875-1878 he edited a collection of *Poems of Places* in thirty-one small volumes. In 1880 appeared *Ultima Thule*, meant to be his last work, and it was nearly so. In October 1881 he wrote a touching sonnet on the death of President Garfield, and in January 1882, when the hand of death was already upon him, his poem, *Hermes Trismegistus*, in which he gives utterance, in language as rich as that of the early gods, to that strange feeling of awe without fear, and hope without form, with which every man of spotless life and upright intellect withdraws from the phenomena of time to the realities of eternity.

In the last years of his life he suffered a great deal from rheumatism, and was, as he sometimes cheerfully said, "never free from pain." Still he remained as sunny and genial as ever, looking from his Cambridge study windows across the Brighton meadows to the Brookline hills, or enjoying the "free wild winds of the Atlantic," and listening to "The Bells of Lynn" in his Nahant home. He still continued to receive all visitors, and to take occasional runs up to Castine and Portland, the homes of his family. About the beginning of 1882, however, a serious change took place in his condition. Dizziness and want of strength confined him to his room for some time, and, although after some weeks he partially recovered, his elasticity and powers were gone. On the 19th of March he was seized with what proved to be peritonitis, and he died on the 24th. The poet was buried two days afterwards near his "three friends" in Mount Auburn cemetery. The regret for his loss was universal; for no modern man was ever better loved or better deserved to be loved.

Longfellow was made an LL.D. of Bowdoin College in 1828, at the age of twenty-one, of Harvard in 1859 and of Cambridge (England) in 1868, and D.C.L. of Oxford in 1869. In 1873 he was elected a member of the Russian Academy of Science, and in 1877 of the Spanish Academy.

In person, Longfellow was rather below middle height, broad shouldered and well built. His head and face were extremely handsome, his forehead broad and high, his eyes full of clear, warming fire, his nose straight and graceful, his chin and lips rich and full of feeling as those of the Praxitelean Hermes, and his voice low, melodious and full of tender cadences. His hair, originally dark, became, in his later years, silvery white, and its wavy locks combined with those of his flowing beard to give him that leonine appearance so familiar through his later portraits. Charles Kingsley said of Longfellow's face that it was the most beautiful human face he had ever seen. A bust to his memory was erected in the Poet's Corner in Westminster Abbey in 1884.

> In Longfellow, the poet was the flower and fruit of the man. His nature was essentially poetic, and his life the greatest of his poems. Those who knew only the poems he wrote could form but a faint notion of the harmony, the sweetness, the manliness and the tenderness of that which he lived. What he would have been as a poet, if, instead of visiting Europe in early life and drinking in the spirit of the middle ages under the shadows of cathedral towers, he had, like Whittier, grown old amid American scenery and life, we can only guess from his earlier poems, which are as naturalistic, fresh and unmystical as could be desired; but certain it is that, from his long familiarity with the medieval view of nature, and its semi-pagan offspring, the romantic view, he was brought, for the greater part of his life, to look upon the world of men and things either as the middle scene of a miracle play, with a heaven of rewarding happiness above and a purgatory of purifying pain below, or else as a garment concealing, while it revealed, spiritual forms of unfathomed mystery. During this time he could hear "the trailing garments of the night sweep through her marble halls," and see "the stars come out to listen to the music of the seas." Later on, as he approached his second youth (he was spared a second childhood), he tended to a more pagan view. About the time when he was writing *The Mask of Pandora*, he could see "in the sunset Jason's fleece of gold," and hear "the waves of the distracted sea piteously calling and lamenting" his lost friend. But through all the periods of his life his view of the world was essentially religious and subjective, and, consequently, his manner of dealing with it hymnal or lyric. This fact, even more than his merits as an artist, serves to account for his immense popularity. Too well-informed, too appreciative and too modest to deem himself the peer of the "grand old masters," or one of "those far stars that come in sight once in a century," he made it his aim to write something that should "make a purer faith and manhood shine in the untutored heart," and to do this in the way that should best reach that heart. This aim determined at once his choice of subjects and his mode of treating them.

The subjects of Longfellow's poetry are, for the most part, aspects of nature as influencing human feeling, either directly or through historical association, the tender or pathetic sides and incidents of life, or heroic deeds preserved in legend or history. He had a special fondness for records of human devotion and self-sacrifice, whether they were monkish legends, Indian tales, Norse *drápas* or bits of American history. His mode of treatment is subjective and lyric. No matter what form his works assume, whether the epic, as in Evangeline, *The Courtship of Miles Standish* and *Hiawatha*, the dramatic, as in *The Spanish Student*, *The Golden Legend* and *The Mask of Pandora*, or the didactic, as in *The Psalm of Life* and many of the minor poems; they are all subjective. This is not the highest praise that can be given to works of art; but it implies less dispraise in Longfellow's case than in almost any other, by reason of his noble subjectivity.

If we look in Longfellow's poetry for originality of thought, profound psychological analysis or new insights into nature, we shall be disappointed. Though very far from being hampered by any dogmatic philosophical or religious system of the past, his mind, until near the end, found sufficient satisfaction in the Christian view of life to make it indifferent to the restless, inquiring spirit of the present, and disinclined to play with any more recent solution of life's problems. He had no sympathy with either scepticism or formal dogmatism, and no need to hazard rash guesses respecting man's destiny. He disliked the psychological school of art, believing it to be essentially morbid and unhealthy. He had no sympathy with the tendency represented by George Eliot, or with any attempt to be analytic in art. He held art to be essentially synthetic, creative and manifesting, not analytic, destructive or questioning. Hence he never strove to draw from nature some new secret, or to show in her relations never discovered before. His aim was to impress upon her familiar facts and aspects the seal of his own gracious nature. A man in intellect and courage, yet without conceit or bravado; a woman in sensibility and tenderness, yet without shrinking or weakness; a saint in purity of life and devotion of heart, yet without asceticism or religiosity; a knight-errant in hatred of wrong and contempt of baseness, yet without self-righteousness or cynicism; a prince in dignity and courtesy, yet without formality or condescension; a poet in thought and feeling, yet without jealousy or affectation; a scholar in tastes and habits, yet without aloofness or bookishness; a dutiful son, a loving husband, a judicious father, a trusty friend, a useful citizen and an enthusiastic patriot,—he united in his strong, transparent humanity almost every virtue under heaven. A thoroughly healthy, well-balanced, harmonious nature, accepting life as it came, with all its joys and sorrows, and living it beautifully and hopefully, without canker and without uncharity. No man ever lived more completely in the light than Henry Wadsworth Longfellow.

Perhaps the most remarkable traits in Longfellow's character were his accessibility and his charity. Though a great worker, he seemed always to have time for anything he was asked to do. He was never too busy to see a caller, to answer a letter, or to assist, by word or deed, any one that needed assistance. His courtesy to all visitors, even to strangers and children who called to look at him, or who, not venturing to call, hung about his garden-gate in order to catch a glimpse of him, was almost a marvel. He always took it for granted that they had come to see Washington's study, and, accordingly, took the greatest interest in showing them that. He never, as long as he could write, was known to refuse his autograph, and so far was he from trying to protect himself from intruders that he rarely drew the blinds of his study windows at night, though that study was on the ground floor and faced the street. His acts of charity, though performed in secret, were neither few nor small. Of him it may be said with perfect truth, "He went about doing good"; and not with his money merely, but also with his presence and his encouragement. To how many sad hearts did he come like an angel, with the rich tones of his voice waking harmonics of hope, where before there had been despair and silence? How many young literary people, disappointed at the unsuccess of their first attempts, did he comfort and spur on to renewed and higher efforts! How careful he was to quench no smoking flax! How utterly free he was from jealousy or revengefulness! While poor, morbid Edgar Allan Poe was writing violent and scurrilous articles upon him, accusing him of plagiarism and other literary misdemeanours, he was delivering enthusiastic lectures to his classes on Poe's poetry. His charity was unbounded. Once, when the present writer proposed to the president of the Harvard University Visiting Committee that Longfellow should be placed on that committee, the president replied: "What would be the use? Longfellow could never be brought to find fault with anybody or anything." And it was true. His whole life was bathed in that sympathy, that love which suffers long and envies not, which forgives unto seventy times seven times, and as many more if need be. Even in his last years, when loss of friends and continual physical pain made life somewhat "cold, and dark and dreary" for him, he never complained, lamented or blamed the arrangements of nature, and the only way in which it was possible to know that he suffered was through his ever-increasing delight in the health and strength of younger men. His whole nature was summed up in the lines of his favourite poet:—

"Luce intellettual, piena d'amore.
Amor di vero ben, pien di letizia.
Letizia che trascende ogni dolzore."

See his *Life ... with Extracts from his Journals and Correspondence*, by Samuel Longfellow, and the "Riverside" edition of the prose and poems (Boston, 11 vols., 1886-1890). An enlarged edition of the *Life* (3 vols., 1891) included the journals and correspondence, 1866-1882, published in 1887 as *Final Memorials* (Boston and New York). Also the volume by T. W. Higginson in the "American Men of Letters" series (1902); E. C. Stedman's criticism in *Poets of America*; and an article in W. D. Howells' *My Literary Friends and Acquaintance* (New York, 1900) which contains a valuable account of Longfellow's later life.

(T. Da.)

LONG FIVES. This game, though played in a tennis-court, bears but a slight resemblance to tennis, but is nevertheless a valuable form of preparatory practice. The game is 8 or 11 points, each stroke won counting one point to the winner. The server gives 3 points in 8, or 4 points in 11 to the striker-out. There are no chases. The winning openings count as at tennis. If a ball be struck into any other gallery or opening, it may be counted, by arrangement, either as a "let" (the rest being annulled) or against the striker; a similar arrangement is made for balls that make any chase on the hazard-side, or a chase of the last gallery on the service-side.

LONGFORD, a county of Ireland in the province of Leinster, bounded N.W. by Leitrim, N.E. by Cavan, E. and S. by Westmeath and W. by Lough Ree and Roscommon. With the exception of Carlow, Louth and Dublin, it is the smallest county in Ireland, the area being 269,408 acres, or about 421 sq. m. The general level surface is broken occasionally by low hills, which cover a considerable area at its northern angle. The principal rivers are the Camlin, which rises near Granard and flows past Longford to the Shannon, and the Inny, which entering the county from Westmeath crosses its southern corner and falls into Lough Ree. Lough Ree is partly included in Longford, and the other principal lakes are Lough Gowna, Derrylough, Lough Drum and Lough Bannow.

The Silurian axis of Newry reaches the north of this county, where Lough Gowna lies upon it. The rest of the county, but for anticlinals which bring up Old Red Sandstone at Longford town and Ardagh, belongs to the Carboniferous Limestone plain, in which Lough Ree forms a very characteristic lake, with signs of extension by solution along its shores. Marble of fine quality has been raised. In the north indications of iron are abundant, and there are also some traces of lead.

The climate is somewhat moist and cold, and there is a large extent of marsh and bog. The soil in the southern districts resting on the limestone is a deep loam well adapted for pasture, but in the north it is often poor. The proportion of tillage to pasture is roughly as 1 to 2. Oats and potatoes, in decreasing quantities, are the principal crops. The numbers of cattle, sheep, pigs and poultry are well maintained. The population is almost wholly rural, but the principal industry of agriculture is supplemented by a slight manufacture of coarse woollens and linen. The Midland Great Western line from Mullingar to Sligo crosses the centre of the county by way of the county town of Longford; and the Cavan branch touches the extreme east. The Royal Canal enters the county in the south at Abbeyshrule, and joins the Shannon near Cloondara.

The population (52,647 in 1891; 46,672 in 1901) decreases seriously, owing to emigration. About 90% of the total are Roman Catholics. The only towns of any importance are Longford (the county town, pop. 3747) and Granard (1622). The county includes six baronies. Assizes are held at Longford, and quarter sessions at Ballymahon, Granard and Longford. The county is in the Protestant diocese of Ardagh, and the Roman Catholic dioceses of Ardagh and Meath. It is divided into two parliamentary divisions, north and south, each returning one member.

The early name of Longford was Annaly or Analé, and it was a principality of the O'Farrels. Along with the province of Meath, in which it was then included, it was granted by Henry II. to Hugh de Lacy, who planted an English colony. On the division of Meath into two counties in 1543, Annaly was included in Westmeath, but under a statute of 1569, for the shiring of countries not already shired, it was made shire ground under the name of Longford.

Among antiquarian remains the chief ruin is the rath called the Moat of Granard, at the end of the main street of that town. There are monastic remains at Ardagh, a former bishopric, Longford, Moydow and on several of the islands of Lough Ree. The principal old castles are those of Rathcline near Lanesborough, and Ballymahon on the Inny. The principal modern seats are those of Carrickglass on the Camlin, and Castle Forbes, the seat of the earls of Granard. Oliver Goldsmith was born at Pallas, a village near Ballymahon, in this county; and at Edgeworthstown the family of Edgeworth, of which the famous novelist Maria Edgeworth was a member, established themselves in the 16th century.

LONGFORD, the county town of Co. Longford, Ireland, on the river Camlin, and on a branch of the Midland Great Western railway, 75 m. W.N.W. of Dublin. Pop. (1901) 3747. The principal building is St Mel's Roman Catholic cathedral for the diocese of Ardagh, one of the finest Roman Catholic churches in Ireland. The town has a considerable trade in grain, butter and bacon. There are corn-mills, a spool factory and tanneries. Longford is governed by an urban district council. The ancient name of the town was Athfada, and here a monastery is said to have been founded by St Idus, a disciple of St Patrick. The town obtained a fair and market from James I. and a charter of incorporation from Charles II., as well as the right to return two members to parliament. It was disfranchised at the Union in 1800.

LONGHI, PIETRO (1702-1762), Venetian painter, was born in Venice. He was a pupil of Antonio Palestra and Giuseppe Maria Crespi at Bologna, and devoted himself to the painting of the elegance of the social life in 18th-century Venice. The republic was dying fast, but her sons, even in this period of political decline, retained their love of pageants and ceremonies and of extravagant splendour in attire. The art of Venice was vanishing like her political power; and the only painters who attempted to stem the tide of artistic decadence were the Canaletti, Guardi, Tiepolo and Longhi. But whilst the Canaletti and Guardi dwelt upon the architectural glories of Venice, and Tiepolo applied himself to decorative schemes in which he continued the tradition of Paolo Veronese and Tintoretto, Longhi became the chronicler of the life of his compatriots. In a way his art may be set beside Hogarth's, though the Venetian did not play the part of a satirical moralist. He has aptly been called the Goldoni of painting. His sphere is that of light social comedy—the life at the café, the hairdresser's, at the dancing-school, at the dressmaker's. The tragic, or even the serious, note is hardly sounded in his work, which, in its colour, is generally distinguished by a rich mellow quality of tone. Most of his paintings are in the public and private collections of Venice. They are generally on a small scale, but the staircase of the Palazzo Grassi in Venice is decorated by him with seven frescoes, representing scenes of fashionable life. At the Venice academy are a number of his genre pictures and a portrait of the architect Temanza; at the Palazzo Quirini-Stampalia the portrait of Daniele Dolfino, "The Seven Sacraments" (etched by Pitteri), a "Temptation of St Anthony," a "Circus," a "Gambling Scene," and several other genre pictures and portraits; at the Museo Correr a dozen scenes of Venetian life and a portrait of Goldoni. In England the National Gallery owns "The Exhibition of a Rhinoceros in an Arena," a "Domestic Group," "The Fortune-Teller," and the portrait of the Chevalier Andrea Tron; two genre pictures are at Hampton Court Palace, and others in the Richter and Mond collections. Many of his works have been engraved by Alessandro Longhi, Bartolozzi, Cattini, Faldoni and others. Longhi died in Venice in 1762.

LONGINUS, CASSIUS (*c.* A.D. 213-273), Greek rhetorician and philosophical critic, surnamed PHILOLOGUS. The origin of his gentile name Cassius is unknown; it can only be conjectured that he adopted it from a Roman patron. He was perhaps a native of Emesa (Homs) in Syria, the birthplace of his uncle Fronto the rhetorician. He studied at Alexandria under Origen the heathen, and taught for thirty years at Athens, one of his pupils being the Neoplatonist Porphyry. Longinus did not embrace the new speculations then being developed by Plotinus, but continued a Platonist of the old type. He upheld, in opposition to Plotinus, the doctrine that the Platonic ideas existed outside the divine ὅτι ἔξω τοῦ νοῦ ὑφέστηκε τὰ νοητά: see F. Überweg, *Grundriss der Geschichte der Philosophie*, 9th ed., 1903, i. § 72). Plotinus, after reading his treatise Περὶ ἀρχῶν (*On First Principles*), remarked that Longinus might be a scholar (φιλόλογος), but that he was no philosopher (φιλόσοφος). The reputation which Longinus acquired by his learning was immense; he is described by Porphyry as "the first of critics," and by Eunapius as "a living library and a walking museum" or encyclopaedia. During a visit to the East he became teacher in Greek, and subsequently chief counsellor in state affairs, to Zenobia, queen of Palmyra. It was by his advice that she endeavoured to regain her independence; Aurelian, however, crushed the attempt, and while Zenobia was led captive to Rome to grace Aurelian's triumph, Longinus paid the forfeit of his life.

Longinus was the author of a large number of works, nearly all of which have perished. Among those mentioned by Suïdas are *Quaestiones Homericae*, *An Homerus fuerit philosophus*, *Problemata Homeri et solutiones*, *Atticorum vocabulorum editiones duae*; the most important of his philological works, Φιλόλογοι ὁμιλίαι (*Philological Discourses*) consisting of at least 21 books, is omitted. A considerable fragment of the Περὶ τέλους (*De finibus, On the Chief End*) is preserved in the *Life of Plotinus* by Porphyry (§ 20). Under his name there are also extant Prolegomena to the *Encheiridion* of Hephaestion on metre (printed in R. Westphal, *Scriptores Metrici Graeci*, i. 1866) and the fragment of a treatise on rhetoric (L. Spengel, *Rhetores Graeci*, i. pp. 299-320), inserted in the middle of a similar treatise by Apsines. It gives brief practical hints on invention, arrangement, style, memory and other things useful to the student. Some important excerpts ἐκ τῶν Λογγίνου (Spengel, i. 325-328) may possibly be from the φιλόλογοι ὁμιλίαι.

It is as the reputed author of the well-known and remarkable work Περὶ ὕψους (generally, but inadequately, rendered *On the Sublime*) that Longinus is best known. Modern scholars, however, with few exceptions, are agreed that it cannot with any certainty be ascribed to him, and that the question of authorship cannot be determined (see Introduction to Roberts's edition). The following are the chief arguments against Longinus. (1) The treatise is not mentioned by any classical author, nor in any lists of the works attributed to him. (2) The evidence of the MSS. shows that doubts existed even in early times. In the most important (No. 2036 in the Paris Library, 10th century) the heading is Διονυσίου ἢ Λογγίνου, thus giving an alternative author Dionysius; in the Laurentian MS. at Florence the title has ἀνωνύμου, implying that the author was unknown. The ascription in the Paris MS. led to the addition of Dionysius to the name of the reputed author—Dionysius Cassius Longinus, accounted for by the supposition that his early name was Dionysius, Cassius Longinus being subsequently adopted from a Roman patron whose client he had been. (3) The absence of any reference to the famous writers on rhetoric of the age of the Antonines, such as Hermogenes and Alexander son of Numenius. (4) The opening sentences show that the Περὶ ὕψους was written with a view of correcting the faults of style and method in a treatise by Caecilius (*q.v.*) of Calactē on the same subject. As Caecilius flourished during the reign of Augustus, it is hardly likely that his work would have been selected for purposes of criticism in the 3rd century. (5) General considerations of style and language and of the point of view from which the work is written. In favour of Longinus: (1) The traditional ascription, which held its ground unchallenged till the beginning of the 18th century. (2) The philosophical colouring of the first chapter and the numerous quotations from Plato are in accordance with what is known of his philosophical opinions. (3) The treatise is the kind of work to be expected from one who was styled "the first of critics." (4) The Ammonius referred to (xiii. 3) is supposed to be Ammonius Saccas (*c.* 175-242), but it appears from the Venetian scholia to the *Iliad* that there was an earlier Ammonius (fl. *c.* 140 B.C.), a pupil and successor of Aristarchus at Alexandria, who, judging from the context, is no doubt the writer in question. The reference is therefore an argument against Longinus.

The work is dedicated to a certain Terentianus, of whom nothing is known (see Roberts's edition, p. 18).

The alternative author Dionysius of the MSS. has been variously identified with the rhetorician and historian Dionysius of Halicarnassus, the Atticist Aelius Dionysius of Halicarnassus, Dionysius Atticus of Pergamum, Dionysius of Miletus. Other suggested claimants to the authorship are Plutarch (L. Vaucher in *Études critiques sur le traité du sublime* (Geneva, 1854) and Aelius Theon of Alexandria (W. Christ), the author of a work on the *Arrangement of Speech*. But it seems most probable that the author was an unknown writer who flourished in the 1st century soon after Caecilius and before Hermogenes. Wilamowitz-Möllendorff gives his date as about A.D. 40.

The rendering *On the Sublime* implies more than is intended by the Greek Περὶ ὕψους ("impressiveness in style," Jebb). Nothing abnormal, such as is associated with the word "sublime," is the subject of discussion; it is rather a treatise on style. According to the author's own definitions, "Sublimity is a certain distinction and excellence in expression," "sublimity consists in elevation," "sublimity is the echo (or expression) of a great soul" (see note in Roberts).

The treatise is especially valuable for the numerous quotations from classical authors, above all, for the preservation of the famous fragment of Sappho, the ode to Anactoria, beginning

φαίνεταί μοι κῆνος ἴσος θεοῖσιν,

imitated by Catullus (li.) *Ad Lesbiam*,

"Ille mi par esse deo videtur."

"Its main object is to point out the essential elements of an impressive style which, avoiding all tumidity, puerility, affectation and bad taste, finds its inspiration in grandeur of thought and intensity of feeling, and its expression in nobility of diction and in skilfully ordered composition" (Sandys).

A full bibliography of the subject will be found in the edition by W. R. Roberts (Cambridge, 2nd ed., 1907), containing an Introduction, Analysis, Translation and Appendices (textual, linguistic, literary and bibliographical), to which may be added F. Marx, *Wiener Studien*, xx. (1898), and F. Kaibel, *Hermes*, xxxiv. (1899), who respectively advocate and reject the claims of Longinus to the authorship; J. E. Sandys, *History of Classical Scholarship* (2nd ed., 1906), pp. 288, 338, should also be consulted. The number of translations in all the languages of Europe is large, including the famous one by Boileau, which made the work a favourite text-book of the bellelettristic critics of the 18th century. A text and translation was published by A. O. Prickard (1907-1908).

LONG ISLAND, an island, 118 m. long and 12 to 23 m. wide, with its axis E.N.E. and W.S.W., roughly parallel with the S. shore of Connecticut, U.S.A., from which it is separated by Long Island Sound (115 m. long and 20-25 m. wide) and lying S.E. of the mainland of New York state, of which it is a part, and immediately E. of Manhattan Island. Area, 1682 sq. m. The east end is divided into two narrow peninsulas (the northern culminating in Orient Point about 25 m. long, the southern ending in Montauk Point, the eastern extremity of the island, about 40 m. long) by the three bays, Great Peconic, Little Peconic (in which lies Shelter Island) and Gardiners (in which lies Gardiners Island). The N. shore is broken in its western half by the fjords of Flushing Bay, Little Neck Bay, Manhasset Bay, Cold Spring Harbor; Huntington Bay (nearly landlocked), Smithtown Bay and Port Jefferson Harbor, which also is nearly landlocked. East of Port Jefferson the N. shore is comparatively unbroken. The S. shore has two bays, Jamaica Bay with many low islands and nearly cut off from the ocean by the narrow spur of Rockaway Beach; and the ill-defined Great South Bay, which is separated from the Atlantic by the narrow Long Beach, Jones Beach and Oak Island Beach, and by the long peninsula (35 or 40 m.), called Fire Island or Great South Beach. Still farther E. and immediately S. of Great Peconic Bay is Shinnecock Bay, about 10 m. long and cut off from the ocean by a narrow beach.

The N. side of the island was largely built by deposits along the front of the continental glacier, and its peculiar surface is due to such deposits. At Astoria the dark gneiss bed rock is visible. The S. half of the island is mostly built of a light sandy or loamy soil and is low, except for the hills (140-195 ft.) of Montauk peninsula, which are a part of the "back-bone" of the island elsewhere running through the centre from E. to W. and reaching its highest point in its western extremity, Oakley's High Hill (384 ft.) and Hempstead Harbor Hill, W. of which are the flat and fertile Hempstead Plains. North of the back-bone or central ridge the country is hilly with glacial drift and many boulders along the coast and with soil stonier and more fertile than that of the "South Side." There is good clay at Whitestone and at Lloyd's Point on the north side. This north shore is comparatively well wooded; the middle of the island is covered with stunted oaks and scrubby pines; the south side is a floral mean between the other divisions. It is cut in its middle part by a few creeks and tidal rivers[1] flowing into the Great South Bay. Another "river," the Peconic, about 15 m. long, runs E. into Peconic Bay. On the north side there are few waterways save Nissequoge river, partly tidal, which runs N. into Smithtown Bay. Near the centre of the island is Lake Ronkonkoma, which is well below the level of the surrounding country, and whose deep cold waters with their unexplained ebb and flow are said to have been so feared by the Indians that they would not fish there. There are salt marshes (probably 100 sq. m. in all) on the shore of the Sound and of the Great South Bay.

As regards its fauna Long Island is a meeting-place for equatorial and arctic species of birds and fish; in winter it is visited occasionally by the auk and in summer sometimes by the turkey buzzard. James E. DeKay in his botanical and zoological survey (1842-1849) of New York state estimated that on Long Island there were representatives of two-thirds of the species of land birds of the United States and seven-eighths of the water birds—probably an exaggerated estimate for the time and certainly not true now. There is snipe and duck shooting, especially on the shores of the Great South Bay; there is good deer hunting, especially in Islip town; and there are several private preserves, some stocked with English game birds, within 50 m. of New York City. There are many excellent trout streams and the island was known in aboriginal times for its fresh and salt water fish. Indian names referring to fishing places are discussed in Wm. W. Tooker's *Some Indian Fishing Stations upon Long Island*. Long Island wampum was singularly good—the Indian name, Seawanhacky (Seawanhaka, &c.), of the island has been interpreted to mean "shell treasury"—and black wampum was made from the purple part of the shell of the quahaug. Soft clams are dug on the north shore at low tide and hard clams are found along the southern shore, where (at Islip) they were first successfully canned; scallops and other small shell fish are taken, especially at the E. end of the island. But the most important shell fishery is that of oysters. The famous Blue Points grow in the Great South Bay, particularly at Sayville and Bellport, where seed oysters planted from Long Island Sound develop into the Blue Points with characteristics of no other variety of oyster. Farther west, on the S. shore are grown the well-known Rockaway oysters. The New York State Fish Commission has a hatchery at Cold Spring Harbor on the N. shore. The largest commercial fisheries are on the south side, in the ocean off Fire Island Beach, where there are great "pounds" in which captured fish are kept alive before shipment to market. Sag Harbor and East Hampton on the E. end of the island were important whaling ports in the 18th century and the first part of the 19th, and they and other fishing villages afterward did a large business in the capture of menhaden (*Brevoortia tyrannus*), a small shad-like fish, which, following the custom of the Indians, they manufactured into fertilizer. At Glen Cove there are now great starch factories.

The west end of the island has been called New York's market garden. On the Hempstead Plains and immediately E. of them along the north shore great quantities of cabbage and cucumbers are grown and manufactured into sauerkraut and pickles. There are large cranberry fields near the village of Calverton, immediately W. of Riverhead.

There are a few large farms on Long Island, mostly on the north side, but it is becoming more and more a place of suburban residence. This change is due in part to cool summer and warm winter winds from the ocean, which makes the July mean temperature 68° to 70° F. at the east end and the south side, and 72° on the north shore, as contrasted with 74° for the west end and New York City. The range of temperature is said to be less than in any other place in the United States with the exception of Corpus Christi (Tex.), Eureka (California), Galveston (Texas), and Key West (Florida). Even on the south shore the humidity for August and September is less than that of any location on the Atlantic coast, or Los Angeles and San Diego on the Pacific, according to Dr Le Grand N. Denslow in a paper, "The Climate of Long Island" (1901). Surf-bathing on the south shore, yachting and boating on the Sound, the Great South Bay and the Ocean, and hunting and fishing are attractions. At Garden City, Nassau (Glen Cove), Great River and Shinnecock Hills are well-known golf links; there are several hunt clubs; and at Southampton are some of the best turf tennis-courts in the United States. Few parts of the island are summer resorts in the ordinary use of the word; there are large hotels hardly anywhere save on Coney Island, at Far Rockaway, on Long Beach and on Shelter Island; and a large part of the summer population lives in private mansions. Some Long Island "country places" are huge estates with game and fish preserves and luxurious "châteaux." The roads are good. The course of the Vanderbilt automobile races is along the roads of the Hempstead Plains. Also on the Hempstead Plains are the Creedmoor Rifle Range, where, in an Interstate Park, E. of Jamaica, annual international rifle shooting tournaments for the championship of America were held until 1909; Garden City, which was founded by A. T. Stewart for the purpose of providing comfortable homes at low cost to his employés and others, and where are the Protestant Episcopal Cathedral of the Incarnation, St Paul's School for Boys and St Mary's School for Girls; and, near Hempstead, the grounds of the Meadowbrook (hunt and polo) Club and those of the Farm Kennel Club. The only railway is the Long Island Railroad (owned by the Pennsylvania Railroad) with western termini on Manhattan and in Long Island City and Brooklyn, whence lines meet at Jamaica, and thence three principal lines branch, the north shore to Wading River, the main line

to Greenport, and the south side to Montauk.

Long Island is a part of New York State, its western third forming Brooklyn and Queens boroughs of New York City—these boroughs were formed respectively from Kings county and from the w. half of Queens county upon the erection of Greater New York, what was formerly the E. half of Queens county then became Nassau county (area 252 sq. m.; pop., in 1900, 55,448, in 1905, 69,477), whose county-seat is Mineola. The eastern and the larger part of the island is the less thickly settled Suffolk county with an area of 918 sq. m. and a population in 1900 of 77,582 and in 1905 of 81,653. The county-seat of Suffolk county is Riverhead, so named from its position at the head of the Peconic river on the W. end of Great Peconic Bay. The ten townships of Suffolk county are large governmental units, showing, by their similarity to the towns of New England, the relation of the early settlers to New England. The largest in area is Brookhaven, which reaches all the way across the island near its central part. The townships of Suffolk county with their population in 1905 were: Huntington (10,236). Babylon (7919), Smithtown (3325), Islip (13,721), Brookhaven (16,050), Riverhead (4950), Shelter Island (1105), Easthampton (4303), Southold (8989) and Southampton (11,024). The total population of Long Island was 1,452,611 in 1900, and 1,718,056 in 1905 (state census), the population of the borough of Brooklyn alone for these years being 1,166,582 and 1,358,686.

History.—The principal Indian tribes on Long Island at the time of the first settlement by the whites were the Montauk, on the eastern end of the island, where they gave their name to the "point" and where their last "king," David Pharoah, died in 1785; the Shinnecock, who, much admixed with negro blood, now live on the reservation between Canoe Place and Shinnecock Hills; the Manhasset, on what is now Shelter Island; the Patchogue, near the present village of that name; the Massapequa, between the Hempstead Plains and what is now Islip, who were defeated and practically exterminated in 1653 by John Underhill; the Canarsie, who lived near the present Jamaica; and on the north side the Nessaquague or Nissequoge (in the present town of Smithtown), and the Sealtocot who gave their name to Setauket in Brookhaven town. The first pastor of the church (Presbyterian-Congregational) at Easthampton, Thomas James (*c.* 1620-1696), is supposed to have translated a catechism and parts of the Bible into the dialect of the Montauk, among whom Samson Occum had a school between 1755 and 1765.

The territory of Long Island was included in the grant of 1620 by James I. to the Plymouth Company and in 1635 was conveyed to William Alexander, earl of Stirling. The conflicting claims of English and Dutch were the subject of the treaty concluded at Hartford, Connecticut, in 1650, by which the Dutch were to hold everything west of Oyster Bay, the English everything east—a provision which accomplished no agreement, since Oyster Bay itself was the matter of contention, and English settlers on what the Dutch called the west side of Oyster Bay refused to remove. Long Island was included in the territory assigned to the duke of York in 1663-1664, when the New England towns on the island objected to separation from Connecticut. On the recovery of New York by the Dutch in 1673 the eastern towns refused to submit to the Dutch governor. In 1674 by the treaty of Westminster Long Island became a part of the British colony of New York. The Dutch settlements were more important ethnically than historically; on the west end of the Island the Dutch Reformed Church is still strong and there are many Dutch names; at West Sayville, on the "south side," about 50 m. from New York, in a settlement made about 1786 by Gustav Tukker, who did much to develop the oyster fisheries, Holland Dutch was the common speech until the last quarter of the 19th century. The "Five Dutch Towns" were: Nieuw Amersfoord (after 1801 officially called Flatlands), on Jamaica Bay, where the first settlement was made about 1623 and the first grant in 1636; Midwout (later Vlackte-Bosch and Flatbush), settled between 1645 and 1650 and having in 1654 the first Dutch church; Nieuw Utrecht, settled soon after 1650 and incorporated in 1660; Breuckelen (now Brooklyn), which was settled a little before its organization as a town in 1646; and Boswijck (Bushwick), first settled by Swedes and Norwegians and incorporated in 1660. These five towns became one administrative district in 1661.

Apparently the earliest English settlement was at Hempstead in 1640 by colonists from Lynn, Massachusetts, who based their claim on the patent (1621) of Nova Scotia to Lord Stirling, but were almost immediately driven out by the Dutch. In 1643 another English settlement was made at Hempstead by men from Stamford, Connecticut, who in 1644 secured a patent from Governor Kieft of New Netherland. In 1645 Kieft granted land at Gravesend to Lady Deborah Moody, who had settled there about 1643, when she had left Lynn and the Salem church because of her anti-pedobaptist views. At Gravesend in 1664 Colonel Richard Nicolls first landed the English troops which occupied the island; and in 1693 it became one of its three ports of entry. The Connecticut towns on Long Island were as follows: Southampton was settled in 1640 by the Lynn men driven out of Hempstead by the Dutch, and in 1644-1664 was in the Connecticut jurisdiction. Southold (the "South Hold of New Haven"), called from 1640 until 1644 by the Indian name Yennicock, had a church in 1640, and a court based on the Levitical law, which was abolished in 1643 upon the remonstrance of the authorities of New Haven. The Southold settlers were from Hingham, Norfolk and New Haven, and the colony joined New Haven in 1648, in which year the colony of Forrett's (now Shelter) Island also submitted to New Haven. Easthampton was settled in 1648 from Lynn. Oyster Bay was also settled by Lynn men in 1640 and contested by the Dutch and English. Newtown, officially called Middleburgh, was settled in 1652, purchased from the Indians in 1656, "annexed to the other side of the Sound" in 1662, in the same year took the name of Hastings, in 1706 was the scene of the arrest of the Presbyterian itinerants Francis Mackemie and John Hampton, and in 1766 was the site of the Methodist Episcopal Society at Middle Village, the second oldest of that denomination in America. Huntington was settled in 1653 from New Haven, Hempstead, Southold and Southampton. Other early settlements were: Jamaica, about 1657; Brookhaven, first settled at Ashford (now Setauket) from Boston in 1655, and Smithtown, patented in 1677 to Richard Smith of Setauket, who was said to be a soldier of Cromwell, and of whom there is a story that having bargained with the Indians for as much land as a bull could cover in a day he rode his trained bull in a great circuit about the land he coveted and was thereafter known as "Bull" Smith. Almost all these English settlements were made by Presbyterians and from Jamaica east this was the prevailing denomination. During the war of Independence the battle of Long Island (see below) was fought within what is now the borough of Brooklyn.

Authorities.—Benj. F. Thompson, *The History of Long Island* (New York, 2nd ed. 1843); Nathaniel S. Prime, *History of Long Island* (New York, 1845), especially valuable for ecclesiastical history, particularly of the Presbyterian church; Martha B. Flint, *Early Long Island* (New York, 1896); Gabriel Furman, *Antiquities of Long Island* (New York, 1875), edited by Frank Moore; and the publications of the Long Island Historical Society (of Brooklyn) and of the Suffolk County Historical Society (of Riverhead).

(R. We.)

Battle of Long Island, 1776.—The interest of this battle lies in the fact that it was the first engagement in the campaign of 1776 (see American War of Independence) and was expected in England to be decisive of the contest in the colonies. After the evacuation of Boston (March 1776), Lord Howe moved against New York City, which he thought would afford a better base of operations for the future. The Americans undertook its defence although recognizing the difficulties in the case, as the bay and rivers adjoining would enable the British fleet to co-operate effectively with the army. To protect his left flank Washington was forced to throw a portion of his troops over to the Long Island side of the East river; they fortified themselves there on the site of the present Borough of Brooklyn. Lord Howe, who had encamped on Staten Island at the entrance to the harbour, determined to attack this isolated left wing, and on the 22nd of August landed at Gravesend Bay, Long Island, with about 20,000 men. The Americans maintained strong

outposts in the wooded hills in advance of their fortified lines. On the morning of the 27th Howe, after four days' reconnaissance, attacked these posts with three columns, the left and centre delivering the holding attack, and the right and strongest column turning the enemy's left by a détour. Howe himself, accompanied by Generals (Sir H.) Clinton and Lord Cornwallis, led the turning movement, which came upon the rear of the enemy at the moment when they were engaged with the two other columns. By noon the Americans had been driven back into the Brooklyn lines in considerable confusion, and with the loss of about half their number. This constituted the battle. The completeness of the English victory was due to the neglect of the Americans in guarding the left of their outposts. Howe has been criticized for not immediately assaulting the American works which he might have carried on the evening of the battle. In view of the fact that he had only defeated a small portion of the American forces, and that the works were of considerable strength, he decided to make a formal siege, and Washington took advantage of the delay in operations to retreat across the river to New York on the night of the 29th. This successful movement repaired to some extent the bad moral effect of the defeat of the 27th in the American camp. In the engagement of Long Island Washington lost about 1200 prisoners and 30 guns, and 400 killed and wounded; of the latter the British lost nearly the same number.

(C. F. A.)

1 G. K. Gilbert, in an article, "The Deflection of Streams" in the *American Journal of Science* (xxvii. 427-432), points out that each of these streams is "bounded on the west or right side by a bluff 10 to 20 ft. high."

LONG ISLAND CITY, formerly a city of Queens county, New York, U.S.A., and since the 1st of January 1898 the first ward of the Borough of Queens, New York City. Pop. (1880) 17,129, (1890) 30,506, (1900) 48,272, of whom 15,899 were foreign-born. It has a river front, on East river and Long Island Sound, of 10 m., and is the eastern terminal and the headquarters of the Long Island railway, having a large Y.M.C.A. building (the gift of Mrs Russell Sage) for employees of this railway. Among manufactures are chemicals, pottery, varnish, silk, &c., and there are oil-storage warehouses. Most of the borough offices of Queens borough are in Long Island City, which was formerly the county-seat of Queens county. The first settlement within the limits of what subsequently became Long Island City was made in 1640 by a Dutch blacksmith, Hendrick Harmensen, who soon afterward was murdered by an Indian. Other settlers, both Dutch and English, soon followed, and established detached villages, which became known as Hunter's Point, Blissville, Astoria, Ravenswood, Dutch Kills, Middleton and Steinway. In 1853 this group of villages, by that time virtually one community, was called Long Island City, and it was formally incorporated under that name in 1870. In 1871-1872 the city was laid out by a commission of which General W. B. Franklin was president. Political convictions, economic considerations and fear combined to make the residents in this region largely loyalist in their attitude during the War of Independence. From 1776 to 1783 British troops occupied Newtown, a village to the S. E. In January 1776 the committee on the state of New York in Congress reported a resolution that "Whereas a majority of the inhabitants of Queens county, in the colony of New York, being incapable of resolving to live and die free men,... all such persons as voted against sending deputies to the present convention in New York ... be put out of the protection of the United Colonies," &c., an action which led to the arrest and imprisonment of many of the accused persons.

See J. S. Kelsey, *History of Long Island City* (Long Island City, 1896).

LONGITUDE (from Lat. *longitudo*, "length"), the angle which the terrestrial meridian from the pole through a point on the earth's surface makes with some standard meridian, commonly that of Greenwich. It is equal to the difference between local time on the standard meridian, and at the place defined, one hour of time corresponding to 15° difference of longitude. Formerly each nation took its own capital or principal observatory as the standard meridian from which longitudes were measured. Another system had a meridian passing through or near the island of Ferro, defined as 20° W. of Paris, as the standard. While the system of counting from the capital of the country is still used for local purposes, the tendency in recent years is to use the meridian of Greenwich for nautical and international purposes. France, however, uses the meridian of the Paris observatory as its standard for all nautical and astronomical purposes (see TIME). In astronomy, the longitude of a celestial body is the distance of its projection upon the ecliptic from the vernal equinox, counted in the direction west to east from 0° to 360°.

LONGLEY, CHARLES THOMAS (1794-1868), archbishop of Canterbury, was born at Rochester, and educated at Westminster and Oxford. He was ordained in 1818, and was appointed vicar of Cowley, Oxford, in 1823. In 1827 he received the rectory of west Tytherley, Hampshire, and two years later he was elected headmaster of Harrow. This office he held until 1836, when he was consecrated bishop of the new see of Ripon. In 1856 he was translated to the see of Durham, and in 1860 he became archbishop of York. In 1862 he succeeded John Bird Sumner as archbishop of Canterbury. Soon afterwards the questions connected with the deposition of Bishop Colenso were referred to him, but, while regarding Colenso's opinions as heretical and his deposition as justifiable, he refused to pronounce upon the legal difficulties of the case. The chief event of his primacy was the meeting at Lambeth, in 1867, of the first Pan-Anglican conference of British, colonial and foreign bishops (see LAMBETH CONFERENCES). His published works include numerous sermons and addresses. He died on the 27th of October 1868 at Addington Park, near Croydon.

LONGMANS, a firm of English publishers. The founder of the firm, Thomas Longman (1) (1699-1755), born in 1699, was the son of Ezekiel Longman (d. 1708), a gentleman of Bristol. Thomas was apprenticed in 1716 to John Osborn, a London bookseller. At the expiration of his apprenticeship he married Osborn's daughter, and in August 1724 purchased the stock and household goods of William Taylor, the first publisher of *Robinson Crusoe*, for £2282 9s. 6d. Taylor's two shops were known respectively as the Black Swan and the Ship, and occupied the ground in Paternoster Row upon which the present publishing house stands. Osborn, who afterwards entered into partnership with his son-in-law, held one-sixth of the shares in Ephraim Chambers's *Cyclopaedia of the Arts and Sciences*, and Thomas Longman was one of the six booksellers who undertook the responsibility of Samuel Johnson's *Dictionary*. In 1754 Thomas Longman took his nephew into partnership, the title of the firm becoming T. and T. Longman.

Upon the death of his uncle in 1755, Thomas Longman (2) (1730-1797) became sole proprietor. He greatly extended the colonial trade of the firm. He had three sons. Of these, Thomas Norton Longman (3) (1771-1842) succeeded to the business. In 1794 Owen Rees became a partner, and Thomas Brown, who was for many years after 1811 a partner, entered the house as an apprentice. Brown died in 1869 at the age of 92. In 1799 Longman purchased the copyright of Lindley Murray's *English Grammar*, which had an annual sale of about 50,000 copies; he also purchased, about 1800, the copyright, from Joseph Cottle, of Bristol, of Southey's *Joan of Arc* and Wordsworth's *Lyrical Ballads*. He published the works of Wordsworth, Coleridge, Southey and Scott, and acted as London agent for the *Edinburgh Review*, which was started in 1802. In 1804 two more partners were admitted; and in 1824 the title of the firm was changed to Longman, Hurst, Rees, Orme, Brown & Green. In 1814 arrangements were made with Thomas Moore for the publication of *Lalla Rookh*, for which he received £3000; and when Archibald Constable failed in 1826, Longmans became the proprietors of the *Edinburgh Review*. They issued in 1829 Lardner's *Cabinet Encyclopaedia*, and in 1832 M'Culloch's *Commercial Dictionary*.

Thomas Norton Longman (3) died on the 29th of August 1842, leaving his two sons, Thomas (4) (1804-1879) and William Longman (1813-1877), in control of the business in Paternoster Row. Their first success was the publication of Macaulay's *Lays of Ancient Rome*, which was followed in 1849 by the issue of the first two volumes of his *History of England*, which in a few years had a sale of 40,000 copies. The two brothers were well known for their literary talent; Thomas Longman edited a beautifully illustrated edition of the New Testament, and William Longman was the author of several important books, among them a *History of the Three Cathedrals dedicated to St Paul* (1869) and a work on the *History of the Life and Times of Edward III.* (1873). In 1863 the firm took over the business of Mr J. W. Parker, and with it *Fraser's Magazine*, and the publication of the works of John Stuart Mill and J. A. Froude; while in 1890 they incorporated with their own all the publications of the old firm of Rivington, established in 1711. The family control of the firm (now Longmans, Green & Co.) was continued by Thomas Norton Longman (5), son of Thomas Longman (4).

LONGOMONTANUS (or LONGBERG), CHRISTIAN SEVERIN (1562-1647), Danish astronomer, was born at the village of Longberg in Jutland, Denmark, on the 4th of October 1562. The appellation Longomontanus was a Latinized form of the name of his birthplace. His father, a poor labourer called Sören, or Severin, died when he was eight years old. An uncle thereupon took charge of him, and procured him instruction at Lemvig; but after three years sent him back to his mother, who needed his help in field-work. She agreed, however, to permit him to study during the winter months with the clergyman of the parish; and this arrangement subsisted until 1577, when the illwill of some of his relatives and his own desire for knowledge impelled him to run away to Viborg. There he attended the grammar-school, defraying his expenses by manual labour, and carried with him to Copenhagen in 1588 a high reputation for learning and ability. Engaged by Tycho Brahe in 1589 as his assistant in his great astronomical observatory of Uraniborg, he rendered him invaluable services there during eight years. He quitted the island of Hveen with his master, but obtained his discharge at Copenhagen on the 1st of June 1597, for the purpose of studying at some German universities. He rejoined Tycho at Prague in January 1600, and having completed the Tychonic lunar theory, turned homeward again in August. He visited Frauenburg, where Copernicus had made his observations, took a master's degree at Rostock, and at Copenhagen found a patron in Christian Friis, chancellor of Denmark, who gave him employment in his household. Appointed in 1603 rector of the school of Viborg, he was elected two years later to a professorship in the university of Copenhagen, and his promotion to the chair of mathematics ensued in 1607. This post he held till his death, on the 8th of October 1647.

Longomontanus, although an excellent astronomer, was not an advanced thinker. He adhered to Tycho's erroneous views about refraction, held comets to be messengers of evil and imagined that he had squared the circle. He found that the circle whose diameter is 43 has for its circumference the square root of 18252—which gives 3.14185... for the value of π. John Pell and others vainly endeavoured to convince him of his error. He inaugurated, at Copenhagen in 1632, the erection of a stately astronomical tower, but did not live to witness its completion. Christian IV. of Denmark, to whom he dedicated his *Astronomia Danica*, an exposition of the Tychonic system of the world, conferred upon him the canonry of Lunden in Schleswig.

The following is a list of his more important works in mathematics and astronomy: *Systematis Mathematici*, &c. (1611); *Cyclometria e Lunulis reciproce demonstrata*, &c. (1612); *Disputatio de Eclipsibus* (1616); *Astronomia Danica*, &c. (1622); *Disputationes quatuor Astrologicae* (1622); *Pentas Problematum Philosophiae* (1623); *De Chronolabio Historico, seu de Tempore Disputationes tres* (1627); *Geometriae quaesita XIII. de Cyclometria rationali et vera* (1631); *Inventio Quadraturae Circuli* (1634); *Disputatio de Matheseos Indole* (1636); *Coronis Problematica ex Mysteriis trium Numerorum* (1637); *Problemata duo Geometrica* (1638); *Problema contra Paulum Guldinum de Circuli Mensura* (1638); *Introductio in Theatrum Astronomicum* (1639); *Rotundi in Plano*, &c. (1644); *Admiranda Operatio trium Numerorum 6, 7, 8*, &c. (1645); *Caput tertium Libri primi de absoluta Mensura Rotundi plani*, &c. (1646).

See E. P. F. Vindingius, *Regia Academia Havinensis*, p. 212 (1665); R. Nyerup and Kraft, *Almindeligt Litteraturlexikon*, p. 350 (1820); Ch. G. Jöcher, *Allgemeines Gelehrten-lexikon*, ii. 2518, iii. 2111; Jens Worm, *Forsög til*

et Lexikon over danske, norske og islandske laerde Maend, p. 617, 1771, &c.; P. Bayle, *Hist. and Crit. Dictionary*, iii. 861 (2nd ed. 1736); J. B. J. Delambre, *Hist. de l'astr. moderne*, i. 262; J. S. Bailly, *Hist. de l'astr. moderne*, ii. 141; J. L. E. Dreyer, *Tycho Brahe*, pp. 126, 259, 288, 299; F. Hoeffer, *Hist. de l'astronomie*, p. 391; J. Mädler, *Geschichte der Himmelskunde*, i. 195; J. F. Weidler, *Hist. Astronomiae*, p. 451.

LONGSTREET, JAMES (1821-1904), American soldier, lieutenant-general in the Confederate army, was born on the 8th of February 1821 in Edgefield district, South Carolina, and graduated at West Point in 1842. He served in the Mexican War, was severely wounded, and received two brevets for gallantry. In 1861, having attained the rank of major, he resigned when his state seceded, and became a brigadier-general in the Confederate army. In this rank he fought at the first battle of Bull Run, and subsequently at the head of a division in the Peninsular campaign and the Seven Days. This division subsequently became the nucleus of the I. corps, Army of Northern Virginia, which was commanded throughout the war by Longstreet. This corps took part in the battles of second Bull Run and Antietam, and held the left of Lee's front at Fredericksburg. Most of the corps was absent in North Carolina when the battle of Chancellorsville took place, but Longstreet, now a lieutenant-general, returned to Lee in time to take part in the campaign of Gettysburg. At that battle he disapproved of the attack because of the exceptionally strong position of the Federals. He has been charged with tardiness in getting into the action, but his delay was in part authorized by Lee to await an absent brigade, and in part was the result of instructions to conceal his movements, which caused circuitous marching. The most conspicuous fighting in the battle was conducted by Longstreet. In September 1863 he took his corps to the west and bore a conspicuous part in the great battle of Chickamauga. In November he commanded the unsuccessful expedition against Knoxville. In 1864 he rejoined Lee's army in Virginia, and on the 6th of May arrived upon the field of the Wilderness as the Confederate right had been turned and routed. His attack was a model of impetuosity and skill, and drove the enemy back until their entire force upon that flank was in confusion. At this critical moment, as Longstreet in person, at the head of fresh troops, was pushing the attack in the forest, he was fired upon by mistake by his own men and desperately wounded. This mischance stayed the Confederate assault for two hours, and enabled the enemy to provide effective means to meet it. In October 1864 he resumed command of his corps, which he retained until the surrender, although paralysed in his right arm. During the period of Reconstruction Longstreet's attitude towards the political problem, and the discussion of certain military incidents, notably the responsibility for the Gettysburg failure, brought the general into extreme unpopularity, and in the course of a controversy, which lasted for many years, much was said and written by both sides which could be condoned only by irritation. His acceptance of a Federal office at New Orleans brought him, in a riot, into armed conflict with his old Confederate soldiers. His admiration for General Grant and his loyalty to the Republican party accentuated the ill-feeling of the Southern people. But in time his services in former days were recalled, and he became once more "General Lee's war-horse" to his old soldiers and the people of the South. He held several civil offices, among them being that of minister to Turkey under Grant and that of commissioner of Pacific railways under Presidents McKinley and Roosevelt. In 1896 he published *From Manassas to Appomattox*, and in his later years he prepared an account of Gettysburg, which was published soon after his death, with notes and reminiscences of his whole military career. General Longstreet died at Gainesville, Georgia, on the 2nd of January 1904.

See *Lee and Longstreet at High Tide*, by Helen D. Longstreet (Gainesville, Ga., 1904).

LONGTON, a market-town of Staffordshire, England, on the North Staffordshire railway, 2½ m. S.E. of Stoke-on-Trent, within which parliamentary and municipal borough it is included. Pop. (1901) 35,815. The town is in the Potteries district, and in the neighbourhood of coal and iron mines. It was governed by a mayor, 10 aldermen and 30 councillors until under the "Potteries Federation" scheme (1908) it became part of the borough of Stoke-on-Trent in 1910.

LONGUEVILLE, the name of a French family which originated with Jean, count of Dunois, the "Bastard of Orleans," to whom Charles VII. gave the countship of Longueville in Normandy in 1443. François of Orleans, count of Longueville, was created duke in 1505. The marriage of his brother Louis with Jeanne, daughter and heiress of Philip, count of Baden-Hochberg-Sausenberg (d. 1503), added considerable estates to the house of Longueville. Henry, duc de Longueville (d. 1663), took an important part in the Fronde, and for a long time held the royal troops in check in Normandy. His wife, Anne Geneviève (see below), was a leading figure in the political dissensions of the time. The last of the family was Jean Louis, the Abbé d'Orléans, who died in 1694. The numismatist, Charles d'Orléans-Rothelin (1691-1744), belonged to a bastard branch of the family.

LONGUEVILLE, ANNE GENEVIÈVE, Duchesse de (1619-1679), was the only daughter of Henri de

Bourbon, Prince de Condé, and his wife Charlotte Marguerite de Montmorency, and the sister of Louis, the great Condé. She was born on the 28th of August 1619, in the prison of Vincennes, into which her father and mother had been thrown for opposition to Marshal D'Ancre, the favourite of Marie de' Medici, who was then regent in the minority of Louis XIII. She was educated with great strictness in the convent of the Carmelites in the Rue St Jacques at Paris. Her early years were clouded by the execution of the duc de Montmorency, her mother's only brother, for intriguing against Richelieu in 1631, and that of her mother's cousin the comte de Montmorency-Boutteville for duelling in 1635; but her parents made their peace with Richelieu, and being introduced into society in 1635 she soon became one of the stars of the Hôtel Rambouillet, at that time the centre of all that was learned, witty and gay in France. In 1642 she was married to the duc de Longueville, governor of Normandy, a widower twice her age. The marriage was not happy. After Richelieu's death her father became chief of the council of regency during the minority of Louis XIV., her brother Louis won the great victory of Rocroy in 1643 (see Condé), and the duchess became of political importance. In 1646 she accompanied her husband to Münster, where he was sent by Mazarin as chief envoy, and where she charmed the German diplomatists who were making the treaty of Westphalia, and was addressed as the "goddess of peace and concord." On her return she fell in love with the duc de la Rochefoucauld, the author of the *Maxims*, who made use of her love to obtain influence over her brother, and thus win honours for himself. She was the guiding spirit of the first Fronde, when she brought over Armand, Prince de Conti, her second brother, and her husband to the malcontents, but she failed to attract Condé himself, whose loyalty to the court overthrew the first Fronde. It was during the first Fronde that she lived at the Hôtel de Ville and took the city of Paris as god-mother for the child born to her there. The peace did not satisfy her, although La Rochefoucauld won the titles he desired. The second Fronde was largely her work, and in it she played the most prominent part in attracting to the rebels first Condé and later Turenne. In the last year of the war she was accompanied into Guienne by the duc de Nemours, her intimacy with whom gave La Rochefoucauld an excuse for abandoning her, and who himself immediately returned to his old mistress the duchesse de Chevreuse. Thus abandoned, and in disgrace at court, the duchess betook herself to religion. She accompanied her husband to his government at Rouen, and devoted herself to good works. She took for her director M. Singlin, famous in the history of Port Royal. She chiefly lived in Normandy till 1663, when her husband died, and she came to Paris. There she became more and more Jansenist in opinion, and her piety and the remembrance of her influence during the disastrous days of the Fronde, and above all the love her brother, the great Condé, bore her, made her conspicuous. The king pardoned her and in every way showed respect for her. She became the great protectress of the Jansenists; it was in her house that Arnauld, Nicole and De Lane were protected; and to her influence must be in great part attributed the release of Lemaistre De Sacy from the Bastille, the introduction of Pomponne into the ministry and of Arnauld to the king. Her famous letters to the pope are part of the history of Port Royal (*q.v.*), and as long as she lived the nuns of Port Royal des Champs were left in safety. Her elder son resigned his title and estates, and became a Jesuit under the name of the Abbé d'Orléans, while the younger, after leading a debauched life, was killed leading the attack in the passage of the Rhine in 1673. As her health failed she hardly ever left the convent of the Carmelites in which she had been educated. On her death in 1679 she was buried with great splendour by her brother Condé, and her heart, as she had directed, was sent to the nuns of the Port Royal des Champs.

The chief authority for Madame de Longueville's life is a little book in two volumes by Villefore the Jansenist, published in 1738. Victor Cousin has devoted four volumes to her, which, though immensely diffuse, give a vivid picture of her time. See also Sainte-Beuve, *Portraits des femmes* (1840). Her connexion with Port Royal should be studied in Arnauld's *Memoirs*, and in the different histories of that institution.

LONGUS, Greek sophist and romancer, author of *Daphnis and Chloë*. Nothing is known of his life, and all that can be said is that he probably lived at the end of the 2nd or the beginning of the 3rd century A.D. It has been suggested that the name Longus is merely a misreading of the last word of the title Λεσβιακῶν ἐρωτικῶν λόγοι δ´ in the Florentine MS.; Seiler also observes that the best MS. begins and ends with λόγου (not λόγγου) ποιμενικῶν. If his name was really Longus, he was probably a freedman of some Roman family which bore it. Longus's style is rhetorical, his shepherds and shepherdesses are wholly conventional, but he has imparted human interest to a purely fanciful picture. As an analysis of feeling, *Daphnis and Chloë* makes a nearer approach to the modern novel than its chief rival among Greek erotic romances, the *Aethiopica* of Heliodorus, which is remarkable mainly for the ingenious succession of incidents. Daphnis and Chloë, two children found by shepherds, grow up together, nourishing a mutual love which neither suspects. The development of this simple passion forms the chief interest, and there are few incidents. Chloë is carried off by a pirate, and ultimately regains her family. Rivals alarm the peace of mind of Daphnis; but the two lovers are recognized by their parents, and return to a happy married life in the country. *Daphnis and Chloë* was the model of *La Sireine* of Honoré d'Urfé, the *Diana enamorada* of Montemayor, the *Aminta of Tasso*, and *The Gentle Shepherd* of Allan Ramsay. The celebrated *Paul et Virginie* is an echo of the same story.

See J. Dunlop's *History of Prose Fiction* (1888), and especially E. Rohde, *Der griechische Roman* (1900). Longus found an incomparable translator in Jacques Amyot, bishop of Auxerre, whose French version, as revised by Paul Louis Courier, is better known than the original. It appeared in 1559, thirty-nine years before the publication of the Greek text at Florence by Columbani. The chief subsequent editions are those by G. Jungermann (1605), J. B. de Villoison (1778, the first standard text with commentary), A. Coraes (Coray) (1802), P. L. Courier (1810, with a newly discovered passage), E. Seiler (1835), R. Hercher (1858), N. Piccolos (Paris, 1866) and Kiefer (Leipzig, 1904), W. D. Lowe (Cambridge, 1908). A. J. Pons's edition (1878) of Courier's version contains an exhaustive bibliography. There are English translations by G. Thorneley (1733, reprinted 1893), C. V. Le Grice (1803), R. Smith (in Bohn's *Classical Library*), and the rare Elizabethan version by Angel Day from Amyot's translation (ed. J. Jacobs in *Tudor Library*, 1890). The illustrated editions, generally of Amyot's version, are numerous and some are beautiful, Prudhon's designs being especially celebrated.

LONGWY, a fortified town of north-eastern France in the department of Meurthe-et-Moselle, 89 m. N.N.W of Nancy by rail. Pop. (1906) 8523. Longwy is situated on a plateau overlooking the Chiers, a right-bank affluent of the

Meuse, near the frontiers of Belgium and Luxemburg. It comprises an upper and a lower town; the former, on a hill, 390 ft. above the Chiers valley, commands the Luxemburg road, and is strengthened by an enceinte and a few outlying fortifications. There is garrison accommodation for 5000 men and 800 horses, but the permanent garrison is small. The lower town is the industrial centre. The 17th-century church has a lofty square tower, the hôtel de ville dates from 1730, and there is a fine hospital. Iron is extensively mined in the district, and supplies numerous blast furnaces. Several iron and steel works are in operation, and metal utensils, fire-proof ware and porcelain are manufactured. Longwy (*Longus vicus*) came into the possession of the French in 1678 and was at once fortified by Vauban. It was captured by the Prussians in 1792, 1815 and 1871.

LÖNNROT, ELIAS (1802-1884), Finnish philologist and discoverer of the *Kalevala*, was born at Nyland in Finland on the 9th of April 1802. He was an apothecary's assistant, but entered the university of Åbo in 1822, and after taking his successive degrees became a physician in 1832. But before this, as early as 1827, he had begun to publish contributions to the study of the ancient Finnish language, and to collect the national ballads and folklore, a field which was at that time uncultivated. In 1833 he settled as a doctor in the country district of Kajana, and began to travel throughout Finland and the adjoining Russian provinces in his leisure time, collecting songs and legends. In this way he was able to put together the great epic of Finland, the *Kalevala*, the first edition of which he published in 1835; he continued to add to it, and in 1849 issued a larger and completer text. In 1840 Lönnrot issued his important collection of the Kanteletar, or folk-songs of ancient Finland, which he had taken down from oral tradition. The *Proverbs of Finland* followed in 1842. In 1853, on the death of Castrén, Lönnrot became professor of the Finnish language and literature at the high school of Helsingfors; he retired from this chair in 1862. He died on the 19th of March 1884.

LONSDALE, EARLS OF. This English earldom is held by the ancient family of Lowther, which traces its descent to Sir Hugh Lowther, who flourished in the reign of Edward I. Sir Hugh's descendant Sir Richard Lowther (1529-1607) received Mary queen of Scots on her flight into England in 1568, and in the two following years was concerned with his brother Gerard in attempts to release her from captivity. He was sheriff of Cumberland and lord warden of the west marches. A house built by Gerard Lowther at Penrith is now the "Two Lions Inn." Sir Richard's eldest son, Sir Christopher Lowther (d. 1617), was the ancestor of the later Lowthers, and another son. Sir Gerard Lowther (d. 1624), was judge of the common pleas in Ireland.

One of Sir Christopher's descendants was Sir John Lowther, Bart. (d. 1706), the founder of the trade of Whitehaven, and another was John Lowther (1655-1700), who was created Viscount Lonsdale in 1696. Before this creation John had succeeded his grandfather, another Sir John Lowther (d. 1675), as a baronet, and had been member of parliament for Westmorland from 1675 to 1696. In 1688 he was serviceable in securing Cumberland and Westmorland for William of Orange; in 1690 he was first lord of the treasury, and he was lord privy seal from March 1699 until his death in July 1700. Lonsdale wrote: *Memoirs of the Reign of James II.*, which were printed in 1808 and again in 1857. His family became extinct when his son Henry, the 3rd viscount (1694-1751), died unmarried in March 1751.

James Lowther, 1st earl of Lonsdale (1736-1802), was a son of Robert Lowther (d. 1745) of Maulds Meaburn, Westmorland, who was for some time governor of Barbados, and was descended from Sir Christopher Lowther; through his mother Catherine Pennington, James was a great-grandson of the 1st viscount Lonsdale. He inherited one of the family baronetcies in 1751, and from three sources he obtained immense wealth, being the heir of the 3rd viscount Lonsdale, of Sir James Lowther, Bart. (d. 1755) of Whitehaven, and of Sir William Lowther, Bart. (d. 1756). From 1757 to 1784 he was a member of parliament, exercising enormous influence on elections in the north of England and usually controlling nine seats in the House of Commons, where his nominees were known as "Sir James's ninepins." He secured the election of William Pitt as member for his borough of Appleby in 1781, and his dispute with the 3rd duke of Portland over the possession of the socage manor of Carlisle and the forest of Inglewood gave rise to lengthy proceedings, both in parliament and in the law courts. In 1784 Lowther was created earl of Lonsdale and in 1797 Viscount Lowther with an extended remainder. The earl's enormous wealth enabled him to gratify his political ambitions. Sir N. W. Wraxall (*Historical and Posthumous Memoirs*, ed. H. B. Wheatley, 1884), who gives interesting glimpses of his life, speaks of his "prodigious property" and quotes Junius, who called him "the little contemptible tyrant of the north." He was known as the "bad earl," and Horace Walpole and others speak slightingly of him; he was, however, a benefactor to Whitehaven, where he boasted he owned the "land, fire and water."

He married Mary (1768-1824) daughter of George III.'s favourite, John Stuart, 3rd earl of Bute, but died childless on the 24th of May 1802, when the earldom became extinct; but a kinsman, Sir William Lowther, Bart. (1757-1844), of Swillington, became 2nd viscount Lowther. This viscount, who was created earl of Lonsdale in 1807, is chiefly famous as the friend of Wordsworth and the builder of Lowther Castle, Penrith. His son, William Lowther, 3rd earl of Lonsdale (1787-1872), held several subordinate positions in various Tory ministries, and was lord president of the council in 1852. He died unmarried, and was succeeded by his nephew Henry (1818-1876), whose son Hugh Cecil (b. 1857) succeeded his brother as 6th earl of Lonsdale in 1882.

Other prominent members of the Lowther family are the Right Hon. James William Lowther (b. 1855), who became speaker of the House of Commons in 1905; Sir Gerard Augustus Lowther (b. 1858), who became British ambassador at Constantinople in 1908; and the Right Hon. James Lowther (1840-1904), who was a well-known Conservative member of parliament from 1865, onwards, and chief secretary for Ireland from 1878 to 1880.

LONSDALE, WILLIAM (1794-1871), English geologist and palaeontologist, was born at Bath on the 9th of September 1794. He was educated for the army and in 1810 obtained a commission as ensign in the 4th (King's Own) regiment. He served in the Peninsular War at the battles of Salamanca and Waterloo, for both of which he received medals; and he retired as lieutenant. Residing afterwards for some years at Batheaston he collected a series of rocks and fossils which he presented to the Literary and Scientific Institution of Bath. He became the first honorary curator of the natural history department of the museum, and worked until 1829 when he was appointed assistant secretary and curator of the Geological Society of London at Somerset House. There he held office until 1842, when ill-health led him to resign. The ability with which he edited the publications of the society and advised the council "on every obscure and difficult point" was commented on by Murchison in his presidential address (1843). In 1829 Lonsdale read before the society an important paper "On the Oolitic District of Bath" (*Trans. Geol. Soc.* ser. 2, vol. iii.), the results of a survey begun in 1827; later he was engaged in a survey of the Oolitic strata of Gloucestershire (1832), at the instigation of the Geological Society, and he laid down on the one-inch ordnance maps the boundaries of the various geological formations. He gave particular attention to the study of corals, becoming the highest authority in England on the subject, and he described fossil forms from the Tertiary and Cretaceous strata of North America and from the older strata of Britain and Russia. In 1837 he suggested from a study of the fossils of the South Devon limestones that they would prove to be of an age intermediate between the Carboniferous and Silurian systems. This suggestion was adopted by Sedgwick and Murchison in 1839, and may be regarded as the basis on which they founded the Devonian system. Lonsdale's paper, "Notes on the Age of the Limestones of South Devonshire" (read 1840), was published in the same volume of the *Transactions of the Geological Society* (ser. 2, vol. v.) with Sedgwick and Murchison's famous paper "On the Physical Structure of Devonshire," and these authors observe that "the conclusion arrived at by Mr Lonsdale, we now apply without reserve both to the five groups of our North Devon section, and to the fossiliferous slates of Cornwall." The later years of Lonsdale's life were spent in retirement, and he died at Bristol on the 11th of November 1871.

(H. B. Wo.)

LONS-LE-SAUNIER, a town of eastern France, capital of the department of Jura, 76 m. N.N.E. of Lyons on the Paris-Lyons railway, on which it is a junction for Chalon-sur-Saône, Dôle, Besançon and Champagnole. Pop. (1906) 10,648. The town is built on both sides of the river Vallière and is surrounded by the vine-clad hills of the western Jura. It owes its name to the salt mines of Montmorot, its western suburb, which have been used from a very remote period. The church of St Désiré, a building of the 12th and 15th centuries, preserves a huge Romanesque crypt. The town is the seat of a prefects and of a court of assizes, and there are tribunals of first instance and of commerce, a chamber of commerce, lycées and training-colleges for both sexes, and a branch of the Bank of France. There is an establishment for the use of the mineral waters, which are sodio-chlorinated and have strengthening properties. The principal industry of the place is the manufacture of sparkling wines, the Étoile growth being the best for this purpose. Trade is in cheese, cereals, horses, cattle, wood, &c.

Lons-le-Saunier, known as *Ledo* in the time of the Gauls, was fortified by the Romans, who added the surname *Salinarius* to the Gallic name. An object of contention owing to the value of its salt, it belonged for a long time during the medieval period to the powerful house of Chalon, a younger branch of that of Burgundy. It was burned in 1364 by the English, and again in 1637, when it was seized by the duke of Longueville for Louis XIII. It became definitively French in 1674. It was here that the meeting between Ney and Napoleon took place, on the return of the latter from Elba in 1815. Rouget de l'Isle, the author of the *Marseillaise*, was born at Montaigu near this town, where there is a statue erected to him.

LOO (formerly called "Lanterloo," Fr. *lanturlu*, the refrain of a popular 17th-century song), a round game of cards, played by any number of persons; from five to seven makes the best game. "Three-card loo" is the game usually played. An ordinary pack of fifty-two cards is used and the deal passes after each round. Each player must have the same number of deals; but if there is a "loo" (the sum forfeited by a player who plays, but does not win a trick) in the last deal of a round, the game continues till there is a hand without a loo. The dealer deals three cards face downwards, one by one, to each player and an extra hand called "miss," and turns up the top of the undealt cards for trumps. Each player contributes to the pool a sum previously agreed upon. The unit for a single stake should be divisible by three without a remainder, *e.g.* three counters or three pence. The players are bound to put in the stake before the deal is completed. Each player in rotation, beginning from the dealer's left, looks at his cards, and declares whether he will play, or pass, or take "miss." If the former, he says "I play." If he takes miss he places his cards face downwards in the middle of the table, and takes up the extra hand. If he passes, he similarly places his cards face downwards in the middle of the table. If miss is taken, the subsequent players only have the option of playing or passing. A player who takes miss must play. Those who are now left in play one card each in rotation, beginning from the dealer's left, the cards thus played constituting a trick. The trick is won by the highest card of the suit led, or, if trumped, by the highest trump, the cards ranking as at whist. The winner of the trick leads to the next, and so on, until the hand is played out. The cards remain face upwards in front of the persons placing them.

If the leader holds ace of trumps he must lead it (or king, if ace is turned up). If the leader has two trumps he must lead one of them, and if one is ace (or king, ace being turned up) he must lead it. With this exception the leader is not bound to lead his highest trump if more than two declare to play; *but if there are only two declared players* the leader with more than one trump must lead the highest. Except with trumps as above stated he may lead any card he chooses. The subsequent players must head the trick if able, and must follow suit if able. Holding none of the suit led, they must head the trick with a trump, if able. Otherwise they may play any card they please. The winner of the first trick is subject to the rules already stated respecting the lead, and in addition he must lead a trump if able (called *trump after*

trick).

When the hand has been played out, the winners of the tricks divide the pool, each receiving one-third of the amount for each trick. If only one has declared to play, the dealer plays miss either for himself or for the pool. If he plays for the pool he must declare before seeing miss that he does not play for himself. Any tricks he may win, when playing for the pool, remain there as an addition to the next pool. Other rules provide that the dealer must play, if only one player stands, with his own cards or with "miss." If miss is gone and against him, he may defend with the three top cards of the pack, excluding the trump card; these cards are called "master."

If each declared player wins at least one trick it is a *single*, *i.e.* a fresh pool is made as already described; but if one of the declared players fails to make a trick he is looed. Then only the player who is looed contributes to the next pool. If more than one player is looed, each has to contribute.

At *unlimited loo* each player looed has to put in the amount there was in the pool. But it is often agreed to limit the loo, so that it shall not exceed a certain fixed sum. Thus, at eighteen-penny loo, the loo is generally limited to half a guinea. If there is less than the limit in the pool the payment is regulated as before; but if there is more than the limit, the loo is the fixed sum agreed on.

The game is sometimes varied by "forces," *i.e.* by compelling every one to play in the first deal, or when there is no loo the previous deal, or whenever clubs are trumps ("club law"). When there is a force no miss is dealt. "Irish loo" is played by allowing declared players to exchange some or all of their cards for cards dealt from the top of the pack. There is no miss, and it is not compulsory to lead a trump with two trumps, unless there are only two declared players. At "five-card loo" each player has five cards instead of three, and a single stake should be divisible by five. "Pam" (knave of clubs) ranks as the highest trump, whatever suit is turned up. There is no miss, and cards may be exchanged as at Irish loo. If ace of trumps is led, the leader says "Pam be civil," when the holder of that card must pass the trick if he can do so without revoking. A flush (five cards of the same suit, or four with Pam) "loos the board," *i.e.* the holder receives the amount of a loo from every one, and the hand is not played. A trump flush takes precedence of flushes in other suits. If more than one flush is held, or if Pam is held, the holder is exempted from payment. As between two flushes which do not take precedence, the elder hand wins. A single stake should be divisible by five.

LOOE, a seaport and market town in the Bodmin parliamentary division of Cornwall, England, 17 m. by sea W. of Plymouth, a terminus of the Liskeard & Looe light railway. Pop. (1901) 2548. It is divided by the river into East Looe and West Looe; and is sheltered so completely by the surrounding hills that myrtles, geraniums, fuchsias and other delicate plants flourish at all seasons in the open air. Its lanes are narrow, steep and winding; many of the houses are entered by wooden staircases; and though considerably modernized the town has a medieval air. Inland, the shores of the river are richly wooded; and towards the sea they rise on the south into rugged cliffs. The parish church of St Martin, which stands 1 m. outside the town, has a Norman doorway and font. Among other buildings may be mentioned the ancient chapel of St Nicholas in West Looe, restored in 1862; and the old town-hall, where the ancient pillory is preserved. A considerable export trade in copper, tin and granite was formerly carried on, and the last is still exported, but the chief trade is in grain; while timber, coal and limestone are imported. There are also thriving fisheries, the Looe fishermen being particularly expert with the seine on a rocky bottom. The inlet of Trelawne is one of the most exquisite wooded coombes in Cornwall. At its head are the remains of a camp, connected with the Giant's Hedge, a raised earthwork which extends for 7 m. in a straight line, as far as a larger camp, on Bury Down, and is of Danish or Saxon construction. Trelawne, a fine old mansion belonging to the family of Trelawny, dates in part from the 15th century, but has been very largely restored.

The harbourage was probably the original cause of settlement at Looe. At the time of the Domesday Survey East Looe was assessed under Pendrym, which was of the king's demesne and West Looe under Hamelin's manor of Trelowia. In the 14th century the former manor was held by the family of Bodrugan; the latter by that of Dauney, who had inherited it from the Treverbyns. In 1237 Henry Bodrugan received the grant of a market on Fridays and a fair at Michaelmas in his manor of Pendrym. In 1301 his grandson and namesake granted to East Looe a market and fair, view of frank pledge, ducking stool and pillory and assize of bread and ale. Otto Bodrugan in 1320 granted the burgesses the privilege of electing their own portreeve and controlling the trade of the town. A charter of incorporation was granted in 1558 under which the common council was to consist of a mayor and 8 chief burgesses. There was to be a court of record, a market on Saturdays and fairs at Michaelmas and Candlemas. In 1685 James II. provided that there should be a mayor and 11 aldermen, 36 free burgesses, 4 fairs and a court of pie powder. East Looe was governed under this charter until 1885. West Looe (known also as Porpighan or Porbuan) benefited by a charter granted by Richard king of the Romans to Odo Treverbyn and ratified in 1325 constituting it a free borough whose burgesses were to be free of all custom throughout Cornwall. Residence for a year and a day within the borough conferred freedom from servitude. There were to be a market on Wednesdays and a fair at Michaelmas. Hugh son of Odo Treverbyn gave West Looe the privileges enjoyed by Helston and Launceston. Upon the attainder of the earl of Devon in 1539 the borough fell to the crown and was annexed to the duchy. In 1574 a charter of incorporation was granted, providing for a mayor and 11 burgesses, also for a market on Wednesdays and two fairs. West Looe continued to be administered under this charter until 1869, when the death of the mayor deprived the council of its only surviving member and elector. Parliamentary representation was conferred upon East Looe in 1571 and upon West Looe in 1553. In the debate on the reform bill O'Connell stated that there was but one borough more rotten than East Looe and that was West Looe. Looe was second only to Fowey as a port in the 15th century. It furnished 20 ships for the siege of Calais. Of the markets and fairs only the markets on Wednesdays and Saturdays and a fair on the 6th of May remain.

LOOM, or Loon (Icelandic, *Lómr*), a name applied to water-birds of three distinct families, remarkable for their clumsy gait on land.[1] The first is the *Colymbidae*, to which the term diver (*q.v.*) is usually restricted in books; the

second the *Podicipedidae*, or grebes (*q.v.*); and the third the *Alcidae*. The form loon is most commonly used both in the British Islands and in North America for all species of the genus *Colymbus*, or *Eudytes* according to some ornithologists, frequently with the prefix sprat, indicating the fish on which they are supposed to prey; though it is the local name of the great crested grebe (*Podiceps cristatus*) wherever that bird is sufficiently well known to have one; and, as appears from Grew (*Mus. Reg. Soc.* p. 69), it was formerly given to the little grebe or dabchick (*P. fluviatilis* or *minor*). The other form loo*m* seems more confined in its application to the north, and is said by T. Edmonston (*Etym. Gloss. Shetl. and Orkn. Dialect*, p. 67) to be the proper name in Shetland of *Colymbus septentrionalis*;[2] but it has come into use among Arctic seamen as the name of the guillemot (*Alca arra* or *bruennichi*) which throngs the cliffs of northern lands, from whose "loomeries" they obtain a wholesome food; while the writer believes he has heard the word locally applied to the razorbill (*q.v.*).

(A. N.)

1 The word also takes the form "lumme" (*fide* Montagu), and, as Professor Skeat observes, is probably connected with *lame*. The signification of *loon*, a clumsy fellow, and metaphorically a simpleton, is obvious to any one who has seen the attempt of the birds to which the name is given to walk.

2 Dunn and Saxby, however, agree in giving "rain-goose" as the name of the species in Scotland.

LOOM, a machine for weaving fabrics by intersecting the longitudinal threads, the "warp," *i.e.* "that which is thrown across" (O.E. *wearp*, from *weorpan*, to throw, cf. Ger. *werfen*) with the transverse threads, the "weft," *i.e.* "that which is woven" (O.E. *wefta*, from *wefan*, to weave, cf. Ger. *weben*). The O.E. *geloma* and M.E. *lome* meant an implement or tool of any kind. In the sense of property, furniture, &c., it appears in heirloom (*q.v.*). The earliest example with its specific meaning quoted by the *New English Dictionary* is from the *Nottingham Records* of 1404 (see Weaving).

"Loom" in the sense of "to appear indistinctly," to come into view in an exaggerated indistinct shape, must be distinguished from the above word. This appears to have been a sailor's term for the indistinct or exaggerated appearance of land, a vessel or other object through haze or darkness at sea. It is of obscure origin, but has been connected through the O. Fr. *lumer*, modern *allumer*, with Lat. *lumen*, light, and with the root seen in "lame," in the sense of "moving slowly towards one."

LOÓN, the largest town of the province of Bohol, island of Bohol, Philippine Islands, on the extreme W. coast. Pop. (1903) 18,114. Loón is picturesquely situated on the W. slope of a hill, and is reached from the sea by steps cut in the rocks. The harbour is in a sheltered bay on the N. side of the town. The cultivation of coco-nuts, coffee, cocoa, maguey, tobacco, cotton and Indian corn, and the raising of livestock are the principal industries; there is also considerable commerce and some manufacturing. The language is chiefly Bohol-Visayan.

LOOP. (1) A curve or bend, particularly a bend in a string, rope, &c., formed by doubling back one part so as to leave an opening; similarly a ring of metal or other material leaving an aperture. (2) In architecture or fortification, "loop," more usually in the form "loophole," is an opening in the wall of a building, very narrow on the outside and splayed within, from which arrows or darts might be discharged on an enemy, or through which light might be admitted. They are often in the form of a cross, and generally have round holes at the ends (see Oillets). (3) The word is also a term in iron and steel manufacturing for a mass of metal ready for hammering or rolling, a "bloom."

This last word is represented in French by *loupe*, from which it is probably adapted. The earlier English form was also *loupe*, and it was also applied to precious stones which were of inferior brilliancy; the same also appears in French. Of the word in its two first meanings, a bend or circle in a line of string, metal, rails, &c., and "loophole," the derivation is uncertain. Skeat takes the word in both meanings to be the same and to be of Scandinavian origin, the old Norwegian *hlaup*, a leap, being the direct source. The base is the Teutonic *hlaufan*, to run, to leap, German *laufen*. The *New English Dictionary* considers the Swedish example, *löp-knut*, "running knot," and others given by Skeat in support of his derivation to be Germanisms, and also that the pronunciation of the word would have been *lowp* rather than *lūp*. "Loop" in meaning (2) "loophole" is also taken to be a different word, and is derived from Dutch *luipen*, to peer, watch. In modern Dutch the word for a narrow opening is *gluip*.

LOOSESTRIFE, in botany, the common name of *Lysimachia vulgaris*, an erect plant, 2 to 4 ft. high, common on river banks in England; the branched stem bears tapering leaves in pairs or whorls, and terminal panicles of rather large deep yellow flowers. It is a member of the primrose family. *L. nemorum*, yellow pimpernel, or wood loosestrife, a low-growing plant with slender spreading stem, and somewhat similar yellow flowers standing singly in the leaf-axils,

is frequent in copses. *L. Nummularia* is the well-known creeping jenny or money-wort, a larger plant with widely creeping stem, pairs of shining leaves and large solitary yellow flowers; it is found on banks of rivers and damp woods, and is a common rockery plant. Purple loosestrife, *Lythrum Salicaria*, belongs to a different family, *Lythraceae*. It is a handsome plant growing 2 to 6 ft. high on river banks and ditches, with a branched angled stem bearing whorls of narrow pointed stalkless leaves and ending in tall tapering spikes of beautiful rose-purple flowers. The flowers are trimorphic, that is to say, exist in three forms which differ in the relative length of the styles and stamens and are known as long-styled, mid-styled and short-styled forms respectively; the size and colour of the pollen also differ. These differences play an important part in the pollination of the flower.

LOOT, plunder or spoil taken from an enemy in war, especially the indiscriminate plunder taken by the victor after the capture of a city. The word came into English from India. It is adapted from the Hindi *lūt*, which is either from Sanskrit *luṇṭ*, to rob, plunder, or *lōtra*, *lōptra*, booty.

LOPES, FERNÃO (1380?-1459?), the patriarch of Portuguese historians, was appointed keeper of the royal archives, then housed in the castle of St George in Lisbon, by King John I. in November 1418. He acted as private secretary to the Infants D. Duarte and D. Fernando, and when the former ascended the throne he charged Lopes, by letter of the 19th of March 1434, with the work of "putting into chronicles the stories of the kings of old time as well as the great and lofty actions of the most virtuous king my lord and father" (John I.). The form of the appointment marked its limits, and is a sufficient reply to those modern critics who have censured Lopes for partiality. Notwithstanding his official title of chief chronicler of the realm, he was the king's man (*Vassallo del Rei*), and received his salary from the royal treasury. King Alphonso V. confirmed him in his post by letter of the 3rd of June 1449, and in 1454, after thirty-six years' service in the archives and twenty as chronicler, he resigned in favour of Gomez Eannes de Azurara. The latter pays a tribute to his predecessor as "a notable person, a man of rare knowledge and great authority," and the modern historian Herculano says, "there is not only history in the chronicles of Fernão Lopes, there is poetry and drama as well; there is the middle age with its faith, its enthusiasm, its love of glory." Lopes has been called the Portuguese Froissart, and that rare gift, the power of making their subjects live, is common to the two writers; indeed, had the former written in a better-known language, there can be little doubt that the general opinion of critics would have confirmed that of Robert Southey, who called Lopes "beyond all comparison the best chronicler of any age or nation." Lopes was the first to put in order the stories of the earlier Portuguese monarchs, and he composed a general chronicle of the kingdom, which, though it never appeared under his name, almost certainly served as a foundation for the chronicles of Ruy de Pina (*q.v.*). Lopes prepared himself for his work with care and diligence, as he tells us, not only by wide reading of books in different languages, but also by a study of the archives belonging to municipalities, monasteries and churches, both in Portugal and Spain. He is usually a trustworthy guide in facts, and charms the reader by the naïve simplicity of his style.

His works that have come down are: (1) *Chronica del Rei D. João I. de boa memoria*, parts 1 and 2 (Lisbon, 1644). The third part relating the capture of Ceuta was added by Azurara. A corrected text of the chronicle has been issued by instalments in the *Archivo Historico Portuguez*. (2) "Chronica do senhor rei D. Pedro I.," in vol. iv. of the *Collecção de Livros Ineditos da Historia Portugueza*, published by the Academy of Sciences (Lisbon, 1816); a much better text than that published by Father Bayão in his edition of the same chronicle (Lisbon, 1760). (3) *Chronica do senhor rei D. Fernando* published in the same volume and collection. The British Museum has some important 16th-century MSS. of the chronicles.

See Damião de Goes, *Chronica del Rei Dom Manoel*, part iv. ch. 38; Araãgo Morato, introduction to vol. iv. of the above collection; Herculano, *Opusculos*, vol. v.

(E. Pr.)

LOPEZ, CARLOS ANTONIO (1790-1862), Paraguayan autocrat, was born at Asuncion on the 4th of November 1790, and was educated in the ecclesiastical seminary of that city. He attracted the hostility of the dictator, Francia, and he was forced to keep in hiding for several years. He acquired, however, so unusual a knowledge of law and governmental affairs that, on Francia's death in 1840, he obtained an almost undisputed control of the Paraguayan state, which he maintained uninterruptedly until his death on the 10th of September 1862. He was successively secretary of the ruling military *junta* (1840-1841), one of the two consuls (1841-1844), and president with dictatorial powers (1844-1862) by successive elections for ten and three years, and in 1857 again for ten years, with power to nominate his own successor. Though nominally a president acting under a republican constitution, he ruled despotically. His government was in general directed with wise energy towards developing the material resources and strengthening the military power of the country. His jealousy of foreign approach several times involved him in diplomatic disputes with Brazil, England, and the United States, which nearly resulted in war, but each time he extricated himself by skilful evasions.

His eldest son, Francisco Solano Lopez (1826-1870), was born near Asuncion on the 24th of July 1826. When in his nineteenth year he was made commander-in-chief of the Paraguayan army, during the spasmodic hostilities then prevailing with the Argentine Republic. He was sent in 1853 as minister to England, France and Italy, and spent a year and a half in Europe. He purchased large quantities of arms and military supplies, together with several steamers, and organized a project for building a railroad and establishing a French colony in Paraguay. He also formed the

acquaintance of Madame Lynch, an Irish adventuress of many talents and popular qualities, who became his mistress, and strongly influenced his later ambitious schemes. Returning to Paraguay, he became in 1855 minister of war, and on his father's death in 1862 at once assumed the reins of government as vice-president, in accordance with a provision of his father's will, and called a congress by which he was chosen president for ten years. In 1864, in his self-styled capacity of "protector of the equilibrium of the La Plata," he demanded that Brazil should abandon her armed interference in a revolutionary struggle then in progress in Uruguay. No attention being paid to his demand, he seized a Brazilian merchant steamer in the harbour of Asuncion, and threw into prison the Brazilian governor of the province of Matto Grosso who was on board. In the following month (December 1864) he despatched a force to invade Matto Grosso, which seized and sacked its capital Cuyabá, and took possession of the province and its diamond mines. Lopez next sought to send an army to the relief of the Uruguayan president Aguirro against the revolutionary aspirant Flores, who was supported by Brazilian troops. The refusal of the Argentine president, Mitre, to allow this force to cross the intervening province of Corrientes, was seized upon by Lopez as an occasion for war with the Argentine Republic. A congress, hastily summoned, and composed of his own nominees, bestowed upon Lopez the title of marshal, with extraordinary war powers, and on April 13, 1865, he declared war, at the same time seizing two Argentine war-vessels in the bay of Corrientes, and on the next day occupied the town of Corrientes, instituted a provisional government of his Argentine partisans, and summarily announced the annexation to Paraguay of the provinces of Corrientes and Entre Rios. Meantime the party of Flores had been successful in Uruguay, and that state on April the 18th united with the Argentine Republic in a declaration of war on Paraguay. On the 1st of May Brazil joined these two states in a secret alliance, which stipulated that they should unitedly prosecute the war "until the existing government of Paraguay should be overthrown," and "until no arms or elements of war should be left to it." This agreement was literally carried out. The war which ensued, lasting until the 1st of April 1870, was carried on with great stubbornness and with alternating fortunes, though with a steadily increasing tide of disasters to Lopez (see Paraguay). In 1868, when the allies were pressing him hard, his mind, naturally suspicious and revengeful, led him to conceive that a conspiracy had been formed against his life in his own capital and by his chief adherents. Thereupon several hundred of the chief Paraguayan citizens were seized and executed by his order, including his brothers and brothers-in-law, cabinet ministers, judges, prefects, military officers, bishops and priests, and nine-tenths of the civil officers, together with more than two hundred foreigners, among them several members of the diplomatic legations. Lopez was at last driven with a mere handful of troops to the northern frontier of Paraguay, where, on the 1st of April 1870, he was surprised by a Brazilian force and killed as he was endeavouring to escape by swimming the river Aquidaban.

LOPEZ DE GÓMARA, FRANCISCO (1510?-1555?), Spanish historian, was educated at the university of Alcalá, where he took orders. Soon after 1540 he entered the household of the famous Cortés, who supplied him with most of the material for his *Historia de las Indias* (1552), and *Crónica de la conquista de Nueva España* (1552). The pleasing style and novel matter enchanted the Spanish public, but the unmeasured laudation of Cortés at the expense of his lieutenants and companions brought about a violent reaction. Though the *Historia* was dedicated to Charles V., both works were forbidden on the 17th of November 1553, and no editions of them were issued between 1554 and 1727. Italian and French versions of his books were published in 1556 and 1578 respectively.

LOP-NOR or Lob-nor, a lake of Central Asia, in the Gobi Desert, between the Astin-tagh (Altyn-tagh) on the south and the Kuruk-tagh on the north. Previous to 1876 it was placed in nearly all maps at 42° 30′ N., a position which agreed with the accounts and the maps of ancient Chinese geographers. In the year mentioned the Russian explorer Przhevalsky discovered two closely connected lake-basins, Kara-buran and Kara-koshun, fully one degree farther south, and considerably east of the site of the old Lop-nor, which lake-basins he nevertheless regarded as being identical with the old Lop-nor of the Chinese. But the water they contained he pronounced to be fresh water. This identification was disputed by Baron von Richthofen, on the ground that the Lop-nor, the "Salt Lake" of the Chinese geographers, could not be filled with fresh water; moreover, being the final gathering basin of the desert stream, the Tarim, it was bound to be salt, more especially as the lake had no outflow. Przhevalsky visited the Lop-nor region again in 1885, and adhered to his opinion. But ten years later it was explored anew by Dr Sven Hedin, who ascertained that the Tarim empties part of its waters into another lake, or rather string of lakes (Avullu-köl, Kara-köl, Tayek-köl and Arka-köl), which *are* situated in 42° 30′ N., and thus so far justified the views of von Richthofen, and confirmed the Chinese accounts. At the same time he advanced reasons for believing that Przhevalsky's lake-basins, the southern Lop-nor, are of quite recent origin—indeed, he fixed upon 1720 as the probably approximate date of their formation, a date which von Richthofen would alter to 1750. Besides this, Sven Hedin argued that there exists a close inter-relation between the northern Lop-nor lakes and the southern Lop-nor lakes, so that as the water in the one group increases, it decreases to the same proportion and volume in the other. He also argued that the four lakes of northern Lop-nor are slowly moving westwards under the incessant impetus of wind and sandstorm (*buran*). These conclusions were afterwards controverted by the Russian traveller, P. K. Kozlov, who visited the Lop-nor region in 1893-1894—that is, before Dr Sven Hedin's examination. He practically only reiterated Przhevalsky's contention, that the ancient Chinese maps were erroneously drawn, and that the Kara-koshun, in spite of the freshness of its water, was the old Lop-nor, *the* Salt Lake *par excellence* of the Chinese. Finally, in 1900, Dr Sven Hedin, following up the course of the Kum-darya, discovered—at the foot of the Kuruk-tagh, and at the E. (lowest) extremity of the now desiccated Kuruk-darya, with traces of dead forest and other vegetation beside it and beside the river-bed—the basin of a desiccated salt lake, which he holds to be the true ancient Lop-nor of the Chinese geographers, and at the same time he found that the Kara-koshun or Lop-nor of Przhevalsky had extended towards the north, but shrunk on the south. Thus the old Lop-nor no longer exists, but in place of it there are a number of much smaller lakes of newer formation. It may fairly be inferred that, owing to the uniform level of the region, the sluggish flow of the Tarim, its unceasing tendency to divide and reunite, conjoined with the violence and persistency of the winds (mostly from the east and north-east), and the rapid and dense growth of the reed-beds in the shallow marshes, the drainage waters of the Tarim basin gather now in greater volume in one depression, and now in greater volume in another; and this view derives support from the

extreme shallowness of the lakes in both Sven Hedin's northern Lop-nor and Przhevalsky's southern Lop-nor, together with the uniformly horizontal level of the entire region.

See Delmar Morgan's translation of Przhevalsky's *From Kuja across the Tian-shan to Lop-nor* (London, 1879); Von Richthofen's "Bemerkungen zu den Ergebnissen von Oberst-Leutenant Prjewalskis Reise nach dem Lop-nor" in *Verhandl. der Gesch. f. Erdkunde zu Berlin* (1878), pp. 121 seq.; Sven Hedin's *Scientific Results of a Journey in Central Asia, 1899-1902* (vols. i. and ii., Stockholm, 1905-1906), where Kozlov's share of the controversy is summarized (cf. ii., 270-280).

(J. T. Be.)

LOQUAT, Japanese Plum or Japanese Medlar, known botanically as *Eriobotrya japonica*, small evergreen tree belonging to the natural order Rosaceae, with large thick oval-oblong leaves borne near the ends of the branches, and dark green above with a rusty tomentum on the lower face. The fruit is pear-shaped, yellow, about 1½ in. long and contains large stony seeds; it has an agreeable acid flavour. The plant is a native of China and Japan, but is widely grown for its fruit and as a decorative plant. It is a familiar object in the Mediterranean region and in the southern United States.

LORAIN, a city of Lorain county, Ohio, U.S.A., on Lake Erie, at the mouth of the Black river, and about 25 m. W. by S. of Cleveland. Pop. (1890) 4863; (1900) 16,028, of whom 4730 were foreign-born and 359 negroes; (1910 census) 28,883. Lorain is served by the New York, Chicago & St. Louis, and the Baltimore & Ohio railways, by the Lake Shore Electric railway, and by several of the more important steamboat lines on the Great Lakes. It has a Carnegie library, the Lake View Hospital and the Saint Joseph's Hospital. There is a good harbour, and the city's chief interests are in the shipping of great quantities of coal, iron-ore, grain and lumber, in the building of large steel vessels, in railway shops, and in the manufacture of iron pipes, gas engines, stoves and automatic steam shovels. The value of the factory products increased from $9,481,388 in 1900 to $14,491,091 in 1905, or 52.8%. The municipality owns and operates the waterworks. A Moravian mission was established here in 1787-1788, and a trading post in 1807, but no permanent settlement was made until several years later. In 1836 the place was incorporated as a village under the name "Charleston"; in 1874 the present name was adopted, and in 1896 Lorain became a city of the second class.

LORALAI, a town and district of India, in Baluchistan. The town, which is situated 4700 ft. above the sea, 35 m. by road from the railway station of Harnai, was occupied as a military station in 1886, and has quarters for a native cavalry and a native infantry regiment. Pop. (1901) 3561.

The District of Loralai was formed in 1903. It consists of a series of long, narrow valleys, hemmed in by rugged mountains, and bordered E. by Dera Ghazi Khan district of the Punjab. Area 7999 sq. m.; pop. (1901) 67,864, of whom the majority are Afghans. The principal crops are wheat and millet; but the chief wealth of the inhabitants is derived from their herds of cattle, sheep and goats.

LORCA, a town of eastern Spain, in the province of Murcia, on the right bank of the river Sangonera (here called the Guadalantin or Guadalentin) and on the Murcia-Baza railway. Pop. (1900) 69,836. It occupies a height crowned by a medieval fortress, among the foothills of the Sierra del Caño. Its older parts, Moorish in many features and with narrow irregular streets, contrast with the modern parts, which have broad streets and squares, and many fine public buildings—theatre, town hall, hospitals, courts of justice and a bridge over the Sangonera. There is an important trade in agricultural products and live stock, as well as manufactures of woollen stuffs, leather, gunpowder, chemicals and porcelain. Silver, sulphur and lead are found in the neighbourhood.

Lorca is the Roman *Eliocroca* (perhaps also the *Ilorci* of Pliny, *N.H.* iii. 3) and the Moorish *Lurka*. It was the key of Murcia during the Moorish wars, and was frequently taken and retaken. On the 30th of April 1802 it suffered severely by the bursting of the reservoir known as the Pantano de Puentes, in which the waters of the Sangonera were stored for purposes of irrigation (1775-1785); the district adjoining the river, known as the Barrio de San Cristobal, was completely ruined, and more than six hundred persons perished. In 1810 Lorca suffered greatly from the French invasion. In 1886 the Pantano, which was one of the largest of European reservoirs, being formed by a dam 800 ft. long and 160 ft. high, was successfully rebuilt.

LORCH, a town in the Prussian province of Hesse-Nassau, romantically situated on the right bank of the Rhine, 8 m. below Rüdesheim by the railway Frankfort-on-Main-Wiesbaden-Cologne. Pop. (1905) 2269. It has a fine Gothic Roman Catholic church—St Martin's—dating from the 14th century. The slopes of the hills descending to the Rhine are covered with vineyards, which produce excellent wine. In the neighbourhood of Lorch, which was mentioned as early as 832, is the ruined castle of Nollich.

LORCH, a town in the kingdom of Württemberg, on the Rems, 26 m. E. from Stuttgart by the railway to Nördlingen. Pop. (1905) 3033. It possesses a fine Protestant church dating from the 12th century. Its industries include carriage-building and the manufacture of cement and paper. On the Marienberg lying above the town stands the former Benedictine monastery of Lorch, founded about 1108 by Frederick of Hohenstaufen, and in 1563 converted into an Evangelical college. Here Schiller passed a portion of his school days. The church contains several tombs of the Hohenstaufen family. The Roman *limes* began at Lorch and Roman remains have been found in the neighbourhood of the town.

See Kirn, *Führer durch das Kloster Lorch* (Lorch, 1888); and Steimle, *Kastell Lorch* (Heidelberg, 1897).

LORD, JOHN (1810-1894), American historical writer and lecturer, was born in Portsmouth, New Hampshire, on the 27th of December 1810. He was the nephew of Nathan Lord (1792-1870), president of Dartmouth College from 1828 to 1863. He graduated at Dartmouth in 1833, and at Andover Theological Seminary in 1837. His course at the Seminary was interrupted by a period of teaching—at Windham, Connecticut (1834), and at Norwich (1834-1835)—and by a tour in 1836 through New York and Ohio, in which he lectured on the dark ages. He was agent and lecturer for the American Peace Society (1837-1839), and for a brief time was a Congregational pastor in turn at New Marlboro and West Stockbridge, Massachusetts, and at Utica, New York. About 1840 he became a professional lecturer on history. He lectured extensively for fifty years, especially in the United States and Great Britain, and introduced, with success, the mid-day lecture. He was lecturer on history in Dartmouth from 1869 to 1876. He received, in 1864, the degree of LL.D. from the University of the City of New York. From 1854 he made his home in Stamford, Connecticut, where he died on the 15th of December 1894. His works include, besides several school and college histories, *The Old Roman World: the Grandeur and Failure of Civilization* (1867); *Ancient States and Empires* (1869); *Two German Giants: Frederick the Great and Bismarck* (1885); and *Beacon Lights of History* (8 vols., 1884-1896), his chief contribution to historical literature.

See *The Life of John Lord* (1896) by Rev. Alexander S. Twombley, D. D. (in "Beacon Lights of History"), which is based chiefly upon Lord's *Reminiscences of Fifty Years in the Lecture Field*.

LORD (O. Eng. *hláford*, *i.e. hláfweard*, the warder or keeper of bread, *hláf*, loaf; the word is not represented in any other Teutonic language), in its primary sense, the head of a household, the master of those dependent on him for their daily bread, correlative to O. Eng. *hláf-aéta*, loaf-eater, servant; the word frequently occurs in this sense in the Bible, cf. Matt. xxiv. 45. As a term implying the ownership of property, "lord" survives in "lord of the manor" and "landlord." The chief applications are due to its use as the equivalent of Lat. *dominus*, Gr. κύριος and Fr. *seigneur*; thus in the Old Testament it represents *Yahweh*, Jehovah, and in the New Testament κύριος, as a title of Jesus Christ. Selden's words may be quoted for the more general meanings of "lord"; "the name Dominus is ... to be thought of only as a distinguishing attribute of Greatness and as our English word Lord is; and that without any relation of it to an Interest of property or to servitude, and only as it denotes such Superiours as King or Subjects of the greater Nobility with us and men of special Eminency in other States, known by the names of Heeren, Dons, Sieurs, signiors, seigneurs ... and the like." It is thus not only a general word for a prince or sovereign, but also the common word for a feudal superior, and particularly of a feudal tenant holding directly of the king, a baron (*q.v.*), hence a peer of the realm, a member of the House of Lords, constituted of the lords temporal and the lords spiritual; this is the chief modern usage. The prefix "lord" is ordinarily used as a less formal alternative to the full title, whether held by right or by courtesy, of marquess, earl or viscount, and is always so used in the case of a baron (which in English usage is generally confined to the holder of a foreign title). Where the name is territorial, the "of" is dropped, thus, the marquess of A., but Lord A. The younger sons of dukes and marquesses have, by courtesy, the title of Lord prefixed to the Christian and surname, *e.g.* Lord John Russell. In the case of bishops, the full and formal title of address is the Lord Bishop of A., whether he be a spiritual peer or not. Many high officials of the British government have the word "lord" prefixed to their titles; some of them are treated in separate articles; for lord privy seal see PRIVY SEAL. In certain cases the members of a board which has taken the place of an office of state are known as lords commissioners or, shortly, lords of the office in question, *e.g.* lords of the treasury, civil or naval lords of the admiralty. For lord lieutenant and lord mayor see LIEUTENANT and MAYOR. As the proper form of address "my lord" is used not only to those members of the nobility to whom the title "Lord" is applicable, and to bishops, but also to all judges of the High Court in England, and of the Scottish and Irish Superior Courts, and to lord mayors and lord provosts (see also LADY).

LORD ADVOCATE, or king's advocate, the principal law-officer of the crown in Scotland. His business is to act as a public prosecutor, and to plead in all causes that concern the crown. He is at the head of the system of public prosecutions by which criminal justice is administered in Scotland, and thus his functions are of a far more extensive character than those of the English law-officers of the crown. He is aided by a solicitor-general and by subordinate assistants called advocates-depute. The office of king's advocate seems to have been established about the beginning of the 16th century. Originally he had no power to prosecute crimes without the concurrence of a private party; but in the year 1597 he was empowered to prosecute crimes at his own instance. He has the privilege of pleading in court with his hat on.

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