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APPLETONS' POPULAR SCIENCE MONTHLY.

NOVEMBER, 1898.

WAS MIDDLE AMERICA PEOPLED FROM ASIA?

By Prof. EDWARD S. MORSE.

The controversies over the question of the origin of Central American culture are to be again awakened by the exploration organized under the direction of the American Museum of Natural History through the liberality of its president, Morris K. Jesup, Esq. The plans embrace an ethnographic survey of the races between the Columbia and Amoor Rivers. Many similarities in customs, folklore, etc., will doubtless be found among these northern races. How far traces of an ancient avenue will be established through which came the unique cult of middle America, and for which in a way the surveys have been instituted, remains to be seen. The question is one of perennial interest, and all honor to the scientific spirit of Mr. Jesup, whose munificence has provided the means for this work.

It may be of interest to remind those who have only a vague idea of the contention that there are many earnest scholars who insist that the wonderful architectural remains in Mexico, Yucatan, and other regions of the west coast are due to Asiatic contact in the past. As proofs of this contact are cited similarities as seen in the monuments, the facial characteristics of certain tribes, ancient customs, astronomical ideas, serpent worship, certain games, etc. Particularly is it believed by the scholars that the "land of Fusang" mentioned in early Chinese historical records is no other than Mexico or some contiguous country.

Space will not permit even the briefest mention of the evidences which have led to these conclusions, and the reader is referred to a remarkably condensed history of the whole question embodied in a volume by Mr. Edward P. Vining entitled An Inglorious Columbus. Under this [2] unfortunate title one may find the most painstaking collocation of the many memoirs written upon this subject, with the Chinese account of the land of Fusang in Chinese characters, and appended thereto the various translations of the document by De Guines, Williams, Julien, and other eminent sinologues.

To the French Orientalist, M. de Guines, we are indebted for our first knowledge of certain ancient records of the Chinese, which briefly record the visit of Chinese Buddhist monks to the land of Fusang in the year 458 of our era, and the return of a single Buddhist monk from this land in 499. De Guines's memoir appeared in 1761, and for forty years but little attention was drawn to it. Humboldt says that, according to the learned researches of Father Gaubil, it appears doubtful whether the Chinese ever visited the western coast of America at the time stated by De Guines. In 1831, Klaproth, the eminent German Orientalist, combated the idea that Fusang was Mexico, and insisted that it was Japan. In 1844 the Chevalier de Paravey argued that Fusang should be looked for in America. Prof. Karl Friedrich Neumann also defended this idea. In magazine articles in 1850-1862, and finally in book form in 1875, Mr. C. G. Leland supported with great ingenuity the idea of Chinese contact based on the Fusang account. In 1862 M. José Perez also defended the idea. In 1865 M. Gustave d'Eichthal published his memoir on the Buddhistic origin of American civilization, and in the same year M. Vivien de Saint-Martin combated the theory, and since that time many others have written upon the subject in favor or in opposition to the idea of Asiatic contact.

These hasty citations are only a few of the many that I have drawn from Mr. Vining's encyclopedic compilation.

It is extraordinary what a keen fascination the obscure paths of regions beyond history and usually beyond verification have to many minds, and the fascination is as justifiable as the desire to explore unknown regions of the earth. In the one case, however, we have a tangled mass of legendary tales coming down from a time when dragons were supposed to exist, when trees were miles in height, when people lived to a thousand years, when every unit of measurement was distorted and every physical truth, as we know it to-day, had no recognition, while in the other case we have at least a continuity of the same land and sea extending to the unexplored beyond. This impulse of the human mind finds an attractive problem in the question as to the origin of the American races. Dr. Brinton has insisted on the unreasonable nature of the inquiry by asking an analogous one: "Whence came the African negroes? All will reply, 'From Africa, of course.' 'Originally?' 'Yes, originally; they constitute the African or negro subspecies of man.'" By bringing [3] together isolated features which have resemblances in common, the American Indian has been traced to nearly every known stock. Mr. Henry W. Henshaw, in an admirable address entitled Who are the American Indians? says: "If you have special bias or predilection you have only to choose for yourself. If there be any among you who decline to find the ancestors of our Indians among the Jews, Phœnicians, Scandinavians, Irish, Welsh, Egyptians, or Tartars, then you still have a choice among the Hindu, Malay, Polynesian, Chinese, or Japanese, or indeed among almost any other of the children of men." Had this address been written a few years later he might have added Hittite!

There are two propositions involved in the controversy as to the Asiatic origin of the American race: the one is that America was peopled from Asia by invasions or migrations in pre-savage or pre-glacial times; the other is that the peculiar civilization of Central America was induced by Buddhist monks, who traveled from Asia to Mexico and Central America in the fifth century of our era. Those who sustain the first thesis are without exception men trained in the science of anthropology; those who sustain the second thesis are with a few conspicuous exceptions travelers, geographers, sinologues, missionaries, and the like.

If Asia should ever prove to be the cradle of the human race, or of any portion of it which had advanced well beyond the creature known as *Pithecanthropus erectus*, then unquestionably an Asian people may be accounted the progenitors of the American Indians. Any effort, however, to establish an identity at this stage would probably take us far beyond the origin of speech or the ability to fabricate an implement.

The controversy has not raged on this ground, however; the numerous volumes and memoirs on the subject have dealt almost exclusively with culture contacts or direct invasions from Asia in our era, and more particularly with the supposed visits of Chinese Buddhist monks to Mexico and Central America already alluded to. Believing in the unity of the human race, the dispersion of the species seems more naturally to have occurred along the northern borders of the great continents rather than across the wide ocean. From the naturalist's standpoint the avenues have been quite as open for the circumpolar distribution of man as they have been for the circumpolar distribution of other animals and plants down to the minutest land snail and low fungus. The ethnic resemblances supposed to exist between the peoples of the two sides of the Pacific may be the result of an ancient distribution around the northern regions of the globe. Even to-day social relations are said to exist between the peoples of the Mackenzie and the Lena delta, and it is not [4] improbable that the carrying band of the Ainu in Yeso and a similar device depicted on ancient codices and stone monuments in Mexico may have had a common origin. Advancing to a time

when man acquired the art of recording his thoughts, the question of any contact between the peoples of the eastern and western shores of the Pacific, south of latitude 40°, compels us to examine the avenues which have been so potent in the distribution of life in the past—namely, the oceanic currents. We are at once led to the great Japan current, the Kuro Shiwo, which sweeps up by the coast of Japan and spends its force on the northwest coast of America. Records show a number of instances of Japanese junks cast ashore on the Oregon coast and shores to the north. [1]

It must be evidences of Japanese and not Chinese contact that we are to look for—tangible evidences, for example, in the form of relics, methods of burial, etc. That the Japanese bear resemblances to certain northern people there can be no doubt. Dr. Torell brought before the Swedish Anthropological Society, some years ago, the results of a comparative study of Eskimo and Japanese. The anatomical and ethnographical resemblances appeared so striking to him as to give additional strength to the theory of the settlement of America from Asia by way of Bering Strait. That there are certain resemblances among individuals of different races we have abundant evidences. At a reception in Philadelphia I introduced a Japanese commissioner (who had been a Cambridge wrangler) to a full-blooded Omaha Indian dressed in our costume, and the commissioner began a conversation with him in Japanese; nor could he believe me when I assured him that it was an Indian that he was addressing, and not one of his own countrymen. I was told by an *attaché* of the Japanese legation at Washington that after carefully scrutinizing the features of a gentleman with whom he was traveling he ventured to introduce himself as a fellow-countryman, and found to his astonishment that the man was a native of the Malay Peninsula. That the Malays bear a strong resemblance to the Chinese is quite true. Dr. Baelz, of the Medical College of Japan, can find no differences between the crania and pelves of the Chinese and Malays. Wallace assures us that even the Malay of Java, when dressed as a Chinese, is not to be [5] distinguished from them, and Peschel classifies the Malays with the Mongoloid people. In these approximate regions one might expect close intermixtures. If resemblances are established between the Japanese and the Eskimo, they would probably have arisen from a circumpolar race which has left its traces on northern peoples the world around. We turn naturally to Japan as the region from which a migration might reasonably have been supposed to take place. Its position on the Asiatic coast with a series of larger and smaller stepping-stones—the Kuriles—to Kamchatka, and thence across the strait to America and seaward, the broad and powerful Japanese current sweeping by its coast and across the Pacific, arrested only by the northwestern coast of America. With these various avenues of approach one might certainly expect evidences of contact in past times. A somewhat extended study in Japan of its prehistoric and early historic remains in the way of shell-heap pottery from the north to the south, much of it of an exceedingly curious character; the later stone implements, many of them of the most extraordinary types; the bronze mirrors, swords, spear points, and the so-called bronze bells; the wide distribution of a curious comma-shaped ornament of stone known as the *magatama*, with a number of varieties, and many other kinds of objects, leads me to say that no counterpart or even remote parallelism has been found in the western hemisphere. Certain rude forms of decoration of the northern shell-heap pottery of Japan, such as the cord-mark and crenulated fillet, are world-wide in their distribution, and a similar wide dispersal is seen of the rude stone implements and notched and barbed bone and horn. Here, however, the similarity ends. The lathe-turned unglazed mortuary vessels so common in ancient graves in Japan and Korea have equally no counterpart on our western coast. If now we examine the early records of Japan in her two famous works—the Kojiki and Nihonji, which contain rituals, ceremonies, and historical data going back with considerable accuracy to the third and fourth centuries of our era—we shall find many curious details of customs and arts and references to objects which have since been exhumed from burial mounds, yet we look in vain for a similar cult in Mexico or Central America. Turning aside from Japan as an impossible ground in which to trace resemblances, we glance at the unique character of the ancient pottery of Central America, with its representations of natural forms, such as fishes, turtles, frogs, shells, etc., its peculiar motives of decoration in color, and find no counterpart in Asia. The pyramidal rock structure and rounded burial mounds are supposed to have their counterparts in the East, but the pyramidal form is common in various parts of the world, simply because it is the most economical and most enduring type of architecture, and facilitates by its [6] form the erection of the highest stone structures. The rounding dome of an earth mound and the angular side of a rock pyramid are the result of material only.

If we now turn to China as a possible region from which migrations may have come in the past, we have only to study the historical records of that ancient people to realize how hopeless it is to establish any relationship. Let one study the Ceremonial Usages of the Chinese (1121 B.C.—translated by Gingell), and he will then appreciate the wonderful advancement of the Chinese at that early date—the organized government, the arts, customs, manufactures, and the minute observances and regulations concerning every detail of life. With these records before him he may search in vain for the direct introduction of any art or device described in this old Chinese work. A few similarities are certainly found between the East and the West, but these arise from the identity in man's mental and physical structure. With two legs only, for example, it is found difficult to sit on a seat comfortably in more than a few ways. One may sit with both legs down, with one leg under, with legs crossed *à la* Turk, or the unconventional way throughout the world with one leg over the other at various angles. It would seem with this limited number of adjustments that any similarities in the attitude of certain stone statues in America and Asia could have but little weight. Prof. F. W. Putnam believes that he has established an Asiatic origin of certain jade ornaments found in Central America. If this conclusion could be sustained, we should then have evidences of contact with an Asiatic people in the stone age, which in itself was one of great antiquity for the Chinese, and one long antedating the origin of Buddhism. In the

Chinese work above alluded to the whetstone is mentioned for sharpening swords, and the craft employed in polishing the musical stone. Confucius also refers to the musical stone in his Analects. This is as near as we get to the use of stone eleven hundred years before Christ. It is to the merit of Putnam to have first called attention to the fact that many of the jade ornaments, amulets, etc., of Central America had originally been portions of jade celts. The discovery is one of importance, whatever explanation may be reached as to the origin of the stone. In Costa Rica these celt-derived ornaments have been cut from celts composed of the native rock, and it would seem that these old implements handed down in the family led to their being preserved in the form of beads, amulets, etc., much in the same spirit that animates us to-day in making paper-cutters, penholders, and the like from wood of the Charter Oak, frigate Constitution, and other venerated relics. Among other evidences of contact the existence of the Chinese calendar in [7] Mexico is cited. Dr. Brinton shows, however, that the Mexican calendar is an indigenous production, and has no relation to the calendar of the Chinese. In a similar way the Mexican game of *patolli* is correlated with the East Indian game of *parchesi* by Dr. E. B. Tylor. Dr. Stewart Culin, who has made a profound study of the games of the world, and Mr. Frank Hamilton Cushing, the distinguished student of the ethnology of southern North America, are both convinced that this game had an independent origin in various parts of the world. Mexican divisions of time marked by five colors are recognized as being allied to a similar device in China. The application of colors to the meaning of certain ideographs is common in other parts of the world as well. It is important to remark that the colors named include nearly the whole category as selected by barbarous people, and in the use of colors in this way it would be difficult to avoid similarities.

The evidences of contact in early times must be settled by the comparison of early relics of the two shores of the Pacific. Resemblances there are, and none will dispute them, but that they are fortuitous and have no value in the discussion is unquestionable. As illustrations of these fortuitous resemblances may be cited a tazza from the United States of Colombia having a high support with triangular perforations identical in form with that of a similar object found among the mortuary vessels of Korea, and Greece as well. A curious, three-lobed knob of a pot rim, so common in the shell mounds of Omori, Japan, has its exact counterpart in the shell mounds of the upper Amazon. In the Omori pottery a peculiar curtain-shaped decoration on a special form of jar has its exact parallel in the ancient pottery of Porto Rico. These instances might be multiplied, but such coincidences as are often seen in the identity of certain words are familiar to all students. The account of the land of Fusang appears in the records of the Liang dynasty contained in the Nanshi, or History of the South, written by Li Yen-Shau, who lived in the beginning of the seventh century. It purports to have been told by a monk who returned from the land of Fusang in 499 of our era. This hypothetical region has been believed to be Japan, Saghalin, and Mexico. The record is filled with fabulous statements of impossible animals, trees of impossible dimensions, and is so utterly beyond credence in many ways that it should have no weight as evidence. If it had any foundation in fact, then one might infer that some traveler had entered Saghalin from the north, had crossed to Yeso and Japan, and found his way back to China. His own recollections, supplemented by stories told him by others, would form the substance of his account. The record is brief, but any one familiar with Japan as Klaproth was is persuaded with him that the account refers to Japan and adjacent regions. The twenty thousand *li* [8] the monk is said to have traveled may parallel his mulberry trees several thousand feet high and his silkworms seven feet long. In a more remote Chinese record, as mentioned by Dr. Gustave Schlegel, the statement is made that the inhabitants had to dig down ten thousand feet to obtain blue tenacious clay for roofing tiles! A number of ardent writers convinced that signs of Chinese contact are seen in the relics of middle America have seized upon this account of Fusang in support of this belief. These convictions have arisen by finding it difficult to believe that the ancient civilizations of Mexico and Peru could have been indigenous. In seeking for an exterior origin in the Fusang account overweight has been credited to every possible resemblance, and all discrepancies have been ignored.

The fabulous account of the land of Fusang evidently supplied documentary evidence, and Mexico was conceived to be the mythical Fusang. Mr. Vining goes so far as to declare that "some time in the past the nations of Mexico, Yucatan, and Central America were powerfully affected by the introduction of Asiatic arts, customs, and religious belief." To establish the details in the Chinese account the entire western hemisphere is laid under contribution: now it is the buffalo of North America, then the llama of Peru, the reindeer of the arctic, or some native word. These writers do not hesitate to bring to life animals that became extinct in the upper Tertiaries, and to account for the absence of others by supposing them to have become extinct. Literal statements of horses dragging wheeled vehicles are interpreted as an allusion in Buddhist cult which refers by metaphor to attributes and not to actual objects. As an illustration of the wild way in which some of these resemblances are established, Mr. Vining quotes the account of M. José Perez (*Revue Orientale et Américaine*, vol. viii). Perez reminds us that the inhabitants of the New World gave Old World names to places in the new continent, citing New York, New Orleans, and New Brunswick as examples, and then says that at some remote epoch the Asiatics had given to the cities of the New World the same names as the cities of their mother country; so the name of the famous Japanese city Ohosaka (Osaka), to the west of the Pacific, became Oaxaca in Mexico on the eastern side. Now it is well known that the ancient name of Osaka was Namihawa; this became corrupted into Naniwa, and not till 1492 does the name Osaka appear. Rev. J. Summers gives a full account of these successive names with their meanings (Transactions of the Asiatic Society of Japan, vol. vii, part iv). The real question to be answered is not what might have been accomplished by ancient explorers from Asia, but what was accomplished. It is shown that Chinese Buddhist priests went to India in the years 388, 399, 629, and so on, and the question is [9] asked, Why may they not have reached Mexico on the east? Migration on parallels of latitude

with no intervening ocean is one matter; to go from latitude 30° on one side of the Pacific almost to the Arctic Ocean, and down on the other side nearly to the equator, is quite another exploit. It is assumed that five priests had gone to Mexico in 468 A.D., and there ingrafted Buddhistic cult on the races with whom they came in contact. It is simply beyond reason to believe that the introduction of Buddhism into Mexico antedated by half a century its introduction into Japan. Communication between Korea and Japan has been from the earliest times one without effort or peril: in the one case a trip of a day or more, in the other case a journey of unnumbered thousands of miles through perilous seas, across stormy fiords and raging waters, including arctic and tropical climates and contact with multitudinous savage hordes. Those who hold that Mexico and Central America were powerfully affected by Asiatic contact must be called upon to explain the absence of certain Asiatic arts and customs which would have been introduced by any contact of sufficient magnitude to leave its impress so strongly in other directions. A savage people takes but little from a civilized people save its diseases, gunpowder, and rum. The contact of barbarous with civilized people results in an interchange of many useful objects and ideas, but these introductions must be through repeated invasions and by considerable numbers. Peschel, while believing in the Asiatic origin of the American race, would place the time far back in the savage state. He repudiates the Fusang idea, and expresses his belief that "a high state of civilization can not be transmitted by a few individuals, and that the progress in culture takes place in dense populations and by means of a division of labor which fits each individual into a highly complex but most effective organization," and then insists that "the phenomena of American civilization originated independently and spontaneously"; and Keane shows how interesting the social, religious, and political institutions of America become when "once severed from the fictitious Asiatic connection and influences." That the savage derives little or derives slowly from contact with a superior race is seen in the fact that he still remains savage. Thus the Ainu, a low, savage people, though they have been in contact with the Japanese for nearly two thousand years, have never acquired the more powerful Mongolian arrow release, while the Persians, though Aryan, yet early acquired this release from their Mongolian neighbors. The Scandinavians, who in prehistoric times practiced the primary release, yet later acquired the more efficient Mediterranean method. Let us for a moment consider what would have occurred as a result of an Asiatic contact with a people advanced enough to have been powerfully affected [10] in their "arts, customs, and religious belief." It seems reasonable to believe that traces of a Mongolian release would be found in Central America, the more so as a warlike people would eagerly seize upon a more powerful method of pulling the bow, yet no trace of a stone or metal thumb ring has ever been found in the western hemisphere. Ancient Mexican codices, while depicting the archer, reveal no trace of the Mongolian method. In the Old World this release crept westward as a result of the migration of, or contact with, Asiatic tribes, and metal thumb rings are dug up on the Mediterranean littoral. While the arrow release of China might not have effected a lodgment in America, the terra-cotta roofing tile certainly would. This important device, according to Schlegel, was probably known in China 2200 B.C., in Korea 500 B.C., and in Japan in the early years of our era. In the ancient records of Japan reference is made to "breaking a hole in the roof tiles of the hall," etc., and green-glazed tiles are dug up on the sites of ancient temples in Japan. The fragments are not only unmistakable but indestructible. I have shown elsewhere[2] that the primitive roofing tile crept into Europe from the East, distributing itself along both shores of the Mediterranean, and extending north to latitude 44°. Graeber finds its earliest use in the temple of Hira in Olympia, 1000 B.C. The ancient Greeks had no knowledge of the roofing tile. Among the thousands of fragments and multitudinous articles of pottery found by Schliemann in the ruins of Ilios, not a trace of the roofing tile was discovered. One is forced to believe that so useful an object, and one so easily made, would have been immediately adopted by a people so skillful in the making of pottery as the ancient Mexicans. Certainly these people and those of contiguous countries were equal to the ancient Greeks in the variety of their fictile products. Huge jars, whistles, masks, men in armor, curious pots of an infinite variety attest to their skill as potters, yet the western hemisphere has not revealed a single fragment of a pre-Columbian roofing tile. Vining, in his work, cites an observation of the Rev. W. Lobscheid, the author of a Chinese grammar. In crossing the Isthmus of Panama this writer was much struck with the similarities to China; "the principal edifices on elevated ground and the roofing tiles identical to those of China." The roofing tile is indeed identical with that of China. It is the form that I have elsewhere defined as the normal or Asiatic tile, but it reached America for the first time by way of the Mediterranean and Spain, and thence with the Spaniards across the Atlantic, where it immediately gained a footing, and rapidly spread through South America and along the [11] west coast north, as may be seen in the old mission buildings in California.

In China, Korea, and Japan the sandal has a bifurcated toe cord, the base of which, springing from the front of the sandal, passes between the first and second toes. It belongs to the Old World through its entire extent. It is the only form represented in ancient Egyptian, Assyrian, and Greek sculpture. One would have expected that with any close contact with Asian people this method of holding the sandal to the foot would have been established in Central America, yet one may seek in vain for the evidences of even a sporadic introduction of this method. Where representations are given in the sculptured stone pottery, or codex, the sandal is represented with two cords, one passing between the first and second and the other between the third and fourth toes. Dr. Otis T. Mason, who has given us an exhaustive monograph of the foot gear of the world, says that every authority on Mexico and Central America pictures the sandal with two cords, and he further says, in a general article on the same subject, "An examination of any collection of pottery of middle America reveals the fact at once, if the human foot is portrayed, that the single toe string was not anciently known."

The Thibetans, Chinese, Koreans, and Japanese have used the serviceable carrying stick from

time immemorial. The nearest approach to this method in this country is seen in Guadalajara, where a shoulder piece is used to carry jars. The representation of this method shows that the pole rests across the back in such a manner that the load is steadied by both the right and left hand simultaneously—identical, in fact, with methods in vogue to-day through western Europe. We find, however, the northern races, as the Ainu and Kamchadels, use the head band in carrying loads, and this method has been depicted in ancient American sculpture. The carrying stick, so peculiarly Asiatic, according to Dr. Mason, is not met with on this continent.

With the evidences of Asiatic contact supposed to be so strong in Central America, one might have imagined that so useful a device as the simple chopsticks would have secured a footing. These two sticks, held in one hand and known in China as "hasteners or nimble lads," are certainly the most useful, the most economical, and the most efficient device for their purposes ever invented by man. Throughout that vast Asian region, embracing a population of five hundred million, the chopstick is used as a substitute for fork, tongs, and certain forms of tweezers. Even fish, omelet, and cake are separated with the chopsticks, and the cook, the street scavenger, and the watch repairer use this device in the form of iron, long bamboo, and delicate ivory. The bamboo chopstick was known in China 1000 B.C., and shortly after this date the ivory form was [12] devised. Their use is one of great antiquity in Japan, as attested by references to it in the ancient records of that country. One may search in vain for the trace of any object in the nature of a chopstick in Central or South America. Knitting needles of wood are found in the work baskets associated with ancient Peruvian mummies, but the chopstick has not been found. Curious pottery rests for the chopsticks are exhumed in Japan, but even this enduring testimony of its early use is yet to be revealed in this country.

The plow in all its varieties has existed in China for countless centuries. Its ideograph is written in a score of ways. It was early introduced into Korea and Japan, and spread westward through the Old World to Scandinavia. There it has been found in the peat bogs. It is figured on ancient Egyptian monuments, yet it made its appearance in the New World only with the advent of the Spaniards. This indispensable implement of agriculture when once introduced was instantly adopted by the races who came in contact with the Spaniards. Even in Peru, with its wonderful agricultural development and irrigating canals, no trace of this device is anciently known, and to-day the tribes of Central and South America still follow the rude and primitive model first introduced by their conquerors.

If we study the musical instruments of the New World races we find various forms of whistles, flutes, rattles, split bells, and drums, but seek in vain for a stringed instrument of any kind. This is all the more surprising when we find evidences of the ancient use of the bow. If Dr. Tylor is right, we may well imagine that the lute of ancient Egypt was evolved from the musical bow with its gourd resonator (so common in various parts of Africa), and this in turn an outgrowth of the archer's bow, or, what at the moment seems quite as probable, the musical bow might have been the primitive form from which was evolved the archer's bow on the one hand and the lute on the other. Dr. Mason, in a brief study of the musical bow, finds it in various forms in Africa and sporadic cases of it in this country, and expresses the conviction that stringed musical instruments were not known to any of the aborigines of the western hemisphere before Columbus. Dr. Brinton is inclined to dispute this conclusion, though I am led to believe that Dr. Mason is right; for had this simple musical device been known anciently in this country, it would have spread so widely that its pre-Columbian use would have been beyond any contention. In Japan evidences of a stringed instrument run back to the third or fourth century of our era, and in China the *kin* (five strings) and *seih* (thirteen strings) were known a thousand years before Christ. These were played in temples of worship, at religious rites, times of offering, etc. It seems [13] incredible that any contact sufficient to affect the religious customs of Mexico or Central America could have occurred without the introduction of a stringed instrument of some kind.[3]

In the Ceremonial Usages of the Chinese (1100 B.C.), a work already referred to, one may find allusions to a number of forms of wheeled carriages, with directions for their construction. Minute details even are given as to material and dimensions, such as measuring the spoke holes in the rim with millet seed (reminding one of the modern method of ascertaining the cubic contents of crania), all indicating the advanced development of wheeled vehicles. If from this early date in China up to the fifth century A.D., any people had found their way from China to middle America, one wonders why the wheel was not introduced. Its absence must be accounted for. It was certainly not for lack of good roads or constructive skill. Its appearance in this hemisphere was synchronous with the Spanish invasion, and when once introduced spread rapidly north and south. Like the plow, it still remains to-day the clumsy and primitive model of its Spanish prototype.

The potter's wheel is known to have existed in Asia from the earliest times; the evidence is not only historical, but is attested by the occurrence of lathe-turned pottery in ancient graves. We look in vain for a trace of a potter's wheel in America previous to the sixteenth century. Mr. Henry C. Mercer regards a potter's device used in Yucatan as a potter's wheel, and believes it to have been pre-Columbian. This device, known as the *kabal*, consists of a thick disk of wood which rests on a slippery board, the potter turning the disk with his feet. The primitive workman uses his feet to turn, hold, and move objects in many operations. The primitive potter has always turned his jar in manipulation rather than move himself about it. Resting the vessel on a block and revolving it with his feet is certainly the initial step toward the potter's wheel, but so simple an expedient must not be regarded as having any relation to the true potter's wheel, which originated in regions where other kinds of wheels revolving on pivots were known.

It seems reasonable to believe that had the Chinese, Japanese, or Koreans visited the Mexican coast in such numbers as is believed they did, we ought certainly to find some influence, some faint strain, at least, of the Chinese method of writing in the hitherto unfathomable inscriptions of

Maya and Aztec. Until recently it was not known whether they were phonetic or ideographic; indeed, Dr. Brinton has devised a new word to express their character, which he calls ikonomatic. [14] This distinguished philologist of the American languages confesses that not even the threshold of investigation in the solution of these enigmatical puzzles has been passed. Had the Chinese introduced or modified or even influenced in any way the method of writing as seen on the rock inscriptions of Central America, one familiar with Chinese might have found some clew, as was the case in deciphering the ancient writings of Assyria and Egypt. Grotefend's work on cuneiform inscriptions and Champollion's interpretation of Egyptian came about by the assumption of certain inclosures representing historic characters, which were revealed in one case by an inference and in another by an accompanying Greek inscription. If we examine the early Chinese characters as shown on ancient coins of the Hea dynasty (1756 to 2142 B.C.), or the characters on ancient bronze vases of the Shang dynasty (1113 to 1755 B.C.), we find most of them readily deciphered by sinologists, and coming down a few centuries later the characters are quite like those as written to-day. On some of the many inscribed stone monuments of Central America one might expect to find some traces of Chinese characters if any intercourse had taken place, whereas the Maya glypts are remotely unlike either Chinese or Egyptian writing. Some acute students of this subject are inclined to believe that these undecipherable characters have been evolved from pictographs which were primarily derived from the simple picture writing so common among the races of the New World.

It seems clearly impossible that any intercourse could have taken place between Asia and America without an interchange of certain social commodities. The "divine weed," tobacco, has been the comfort of the races of the western hemisphere north and south for unnumbered centuries: stone tobacco pipes are exhumed in various parts of the continent; cigarettes made of corn husks are found in ancient graves and caves; the metatarsals of a deer, doubly perforated, through which to inhale tobacco or its smoke in some form, are dug up on the shores of Lake Titicaca.

The question naturally arises why tobacco was not carried back to Asia by some of the returning emigrants, or why tea was not introduced into this country by those early invaders. A Buddhist priest without tea or tobacco would be an anomaly. There are many other herbs, food plants, etc., that should not have waited for the Spanish invasion on the one hand, or the Dutch and Portuguese navigator along the Chinese coast on the other.

Finally, if evidences of Asiatic contact exist, they should certainly be found in those matters most closely connected with man, such as his weapons, clothing, sandals, methods of conveyance, pottery making and devices thereon, musical instruments, and above all house structure and [15] modes of burial. More remote perhaps would be survivals of language, and if the invaders had a written one, the characters, whether phonetic or ideographic, would have been left in the enduring rock inscriptions. If now a study of the aborigines of the western hemisphere from Hudson Bay to Tierra del Fuego fails to reveal even a remote suggestion of resemblance to any of these various matters above enumerated, their absence must in some way be accounted for by Asiaticists.

[1] Mr. Charles Walcott Brooks presented to the California Academy of Sciences a report of Japanese vessels wrecked on the North Pacific Ocean in which many instances are given. He says: "Every junk found stranded on the coast of North America or on the Hawaiian or adjacent islands has, on examination, proved to be Japanese, and no single instance of a Chinese vessel has ever been reported, nor is any believed to have existed.... There also exists an ocean stream of cold water emerging from the Arctic Ocean which sets close in along the eastern coast of Asia. This fully accounts for the absence of Chinese junks on the Pacific, as vessels disabled off their coast would naturally drift southward."

[2] On the Older Forms of Terra-Cotta Roofing Tiles. Essex Institute Bulletin, 1882.

[3] Since the above was written Dr. Brinton and Mr. Saville have called my attention to such evidences as would warrant the belief in the existence of a pre-Columbian stringed musical instrument. The devices are, however, of such a nature as to indicate their independent origin.

THE POSSIBLE FIBER INDUSTRIES OF THE UNITED STATES.

By CHARLES RICHARDS DODGE.

The wealth of any community is dependent on the variety and extent of its industries, the utilization of local natural resources, and the employment of the labor of all classes of its population. In locations of successful industrial operations the farmer derives increased incomes, the value of his products is greater, his lands of higher value, and the wages of agricultural labor larger. The rural population contiguous to large towns, therefore, is more prosperous than the larger farming contingent more remote from manufacturing or industrial centers. The farmers of the first class are prosperous because they have a home market for their dairy products, fruits, vegetables, and other "truck," which they are able to produce, for the most part, on small areas by high culture, while those of the second class are forced to expend their energies on commercial commodities such as cotton, wool, meat, grain, etc., with long hauls in transportation, and with heavy competition, international as well as domestic.

In times of depression, or when competition has grown too heavy, the cultivation of certain

staples may cease to be remunerative, and the unfortunate producer is compelled to diversify his agriculture, or adopt some other means of livelihood.

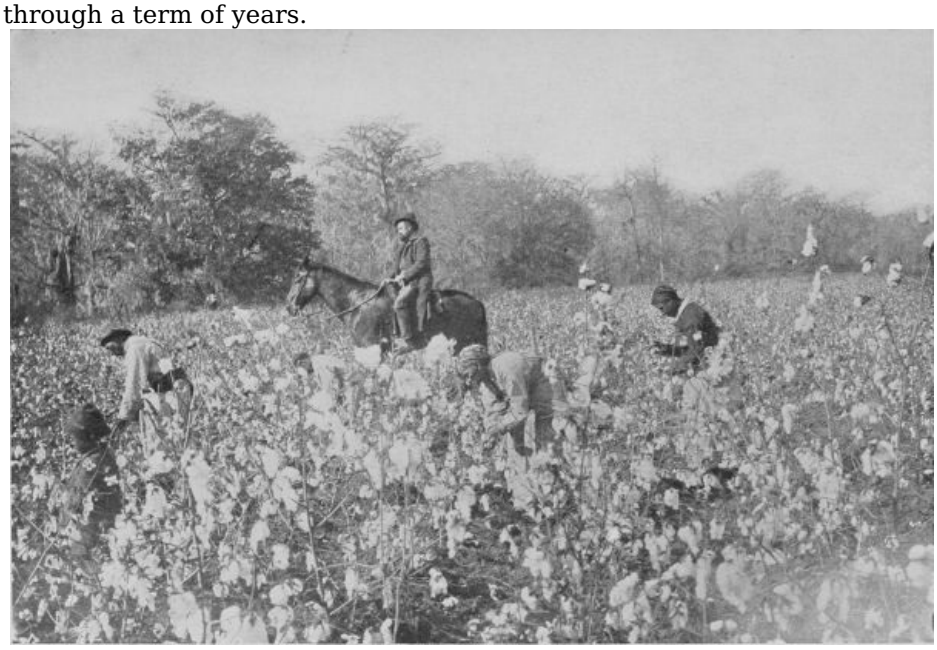
Just such a misfortune has overtaken many farmers in the United States within the past few years. Within two years, in fact, wheat has been a drug in the market, while corn has been cheaper in some sections than coal, and cotton is now so low that it hardly pays to grow it, without considering the necessity, for the Southern farmer, of competing against the seventy-five thousand bales of Egyptian cotton which enter our ports in a year. Confronted with these conditions, there never has been a time when farmers were more anxious to discover new paying [16] crops. Among the possible new rural industries that have attracted the attention of the agricultural class is that of fiber production, though the growth of certain kinds of fibers in past time has been a source of income to the country. Already there is a widespread interest in the subject throughout the West and South, and farmers are only seeking information regarding the particular practice involved in the cultivation of flax, ramie, and other fibers, cost of production, market, etc., but many are asking where the proper seed can be secured with which to make a start.

The importation of unmanufactured flax, hemp, textile grasses, and other fibers amounts annually to a sum ranging from fifteen million to twenty million dollars, while the imported manufactures of these fibers amount to almost double this value, or, in round numbers, approximately forty-five million dollars. With the establishment and extension of three or four fiber industries in this country, and with the new manufacturing enterprises that would grow out of such establishment and extension, an immense sum could be readily saved to the country, and the money representing the growth of these fibers would add just so much to the wealth of the farming class.

There are two ways in which we may arrive at a solution of this problem: by direct Government aid, and through the intelligently directed efforts of private enterprise.

Government experiments for the development or extension of vegetable fiber industries have been instituted, at different times, in many countries. In some instances these have been confined to testing the strength of native fibrous substances for comparison with similar tests of commercial fibers. Such were the almost exhaustive experiments of Roxburgh in India early in the present century. Another direction for Government experimentation has been the testing of machines to supersede costly hand labor in the preparation of the raw material for market, or in the development of chemical processes for the further preparation of the fibers for manufacture. The broadest field of experiment, however, has been the growth of the plants under different conditions, either to introduce their culture, or to economically develop the industries growing out of their culture, when such industries need to be fostered. The introduction of ramie culture is an example of the first instance, the fostering of the almost extinct flax industry of our grandfathers' days an illustration of the second.

The United States has conducted experiments or instituted inquiries in the fiber interest at various times in the last fifty years, but it is only since 1890 that an office of practical experiment and inquiry has been established by the United States Department of Agriculture, that has been [17] continuous through a term of years.



A Cotton Field in Mississippi.

In the present work the efforts of the Government have been mainly directed in the line of collecting and disseminating authoritative information relating to all branches of the industry, in [18] importing proper seed for experimental cultivation, and in directing experiments, either on its own account or in co-operation with State and even private interests. The testing of new labor-saving machinery has also come within its province.

The subject in its details will be better understood by considering the list of the more important commercial fibers known to our market. The list is not a long one, for it barely reaches a total of fifteen species. The fibers of the first rank are the spinning fibers—namely, cotton, flax, hemp, jute; of the second rank, or cordage fibers, Sisal, Manila, Sunn and Mauritius hemps, and New Zealand flax; and of the third rank, Tampico, or ixtle, African fiber or palmetto, coir or cocoanut, piassaba, Mexican whisk, raffia, and Spanish moss, which are used in brush manufacture, in

upholstery, and for other rough manufactures. Of these fifteen forms, only cotton, hemp, palmetto, and Spanish moss are produced in the United States in commercial quantity, though flax line has been produced to some extent in the past. Of those not produced in commercial quantity in this country, but which would thrive in cultivation, may be mentioned jute, New Zealand flax, Sisal hemp, cocoanut, and possibly Sunn hemp in subtropical Florida, with a few "substitutes," which will be mentioned hereafter.

I have neglected to mention in this list the sponge cucumber, a species of *Luffa* used as a bath sponge, which is imported from Japan in quantity, and which grows in the United States.

Passing the list of recognized commercial fibers, we come to a large number of species, forms allied to the above, that are either employed locally, chiefly by the natives in the countries where grown, or that would be capable of employment in the world's manufacture were they not inferior to the standard commercial forms at present recognized, and with which they would necessarily compete at a disadvantage. This list is a long one, for in the single genus *Agave*, to which belong the plant producing the Sisal hemp of commerce, there are over one hundred species in Mexico alone, more than one half of which would produce good fiber. In our own country it would be possible to enumerate twenty species of plants that are recognized as American weeds, the fibers of which could be employed as hemp, flax, or jute substitutes were these materials unobtainable, besides half as many structural fiber plants similar to the agave, the products of which could be employed as cordage fiber substitutes in the same manner. Many of these uncultivated plants have been known to the aborigines for years, possibly for centuries, as we find their fiber, produced in varied forms of rude manufacture, in ancient tombs or other burial places.

[19]

PULLING FLAX IN MINNESOTA.

[20] After exhausting the list of plants that may be termed commercial fiber substitutes, in different countries where they grow, there still remains a much larger list of species that are chiefly interesting in a scientific enumeration of those plants which produce in their stalks, leaves, or seed vessels what may be termed fibrous substance. My own catalogue of the fibers of the world already foots up over one thousand species of plants, and the complete catalogue for all countries might extend the list to a thousand more.

In considering the undeveloped fibers of the United States, it will be seen we should only recognize the actual commercial forms which we do not produce, but which may be produced within our borders, or such native growths as may be economically employed as their substitutes, and which possibly might be brought into commercial importance.

The hemp industry is already established, though it should be extended in order to recover its lost position among American rural industries. Where in the past we produced forty thousand tons of hemp in the United States, we now produce less than a fifth of this quantity. The cultivation of flax in the United States before the days of the present factory system was so widespread that it was of national importance. Its manufacture was largely a home industry, however, conducted by the fireside, and, as in ancient Greece and Rome, the work was performed by the women of the household. With the advent of the factory system came competition; the housewife laid aside her spinning wheel, the clumsy home-made loom fell into disuse, and the farmer grew no more flax for fiber. Then the flaxseed industry was extended, and after the close of the war a large demand sprang up for coarse fiber for the roughest of uses—for bagging and upholstery, in connection with hemp—and hundreds of little tow mills came into existence in the Middle and Western States.

The introduction of jute opened another chapter, and the decline of this crude attempt at a flax industry is recorded. Meanwhile some line flax was produced, but the extension of spinning and weaving establishments made a larger demand for this fiber, which was chiefly imported. Land in the old flax-growing States became more valuable for other crops, especially with the low prices brought about by foreign competition, and gradually the flax culture in the United States became a thing of the past.

In recent years similar causes have served to operate against the industry in foreign flax countries where old and plodding methods are still in vogue, with additional factors in impoverished soils and high rental for land, and the cultural industry abroad is declining. With the opening of new and fertile Western lands in this country, and with the employment of the [21] finest labor-saving agricultural implements in the world, the conditions

are again changed, and are now favorable for American agriculture to re-establish this industry, and to make good a declining foreign supply. Our farmers are ready for the work, but they have not only lost their skill and cunning in producing the straw and preparing the fiber for the spinner, but new and more economical methods must be adopted to place the culture on a solid basis.

HACKLING FLAX.

A million acres of flax are grown for seed annually, but the growth of flax for seed and flax for fiber are two very different things; moreover, Old World methods do not coincide with the progressive ideas of the educated farmers of the United States, for the peasant class does not exist in this country. A practice essentially American must be followed in order to make the culture profitable, and to equalize the difference in wages on the two sides of the Atlantic. This difference is more apparent than real, for it can be readily overcome by intelligently directed effort, by difference in soil fertility and rentals, and especially by the use of certain forms of labor-saving machines that already have been devised and are being rapidly improved. The "American practice," then, means, first, an intelligent practice, with a view to economy of effort and involving the use of machinery in the place of plodding foreign methods; and, second, the co-operation of farm labor and capital to the end of systematizing the work—i.e., the farmers of a community growing the flax, and capital, represented by a central mill, turning the straw when grown into a grade of fiber that the spinners can afford to purchase. Here is the solution of the flax problem in a nutshell. The scheme has already been tested in practice with favorable results, [22] but the farmers in any community can do little until capital is more generally interested.

CALIFORNIA HEMP.

This brings up an important point and presents another obstacle, for great harm has been done to all new fiber industries in recent years by the misdirected efforts of some professional promoters. In certain instances the organized fiber companies have been mere stock-jobbing concerns. They have had their rise and fall, men with idle money have burned their fingers, and the particular industry has received a "black eye."

The story of Government effort toward the establishment of the flax industry need not be told here; there has been widespread prejudice to overcome, with the opposition of the importers, discouragements to be studied and explained, the unvarnished truth to be told, and practical and authoritative information to be given to all who may seek it. The literature of the subject has been disseminated by thousands of copies, and new editions are being ordered.

As to the results: Superior flax has been produced in this country in limited quantities since the work began, and through extended field experiments flax regions have been discovered that are thought to equal the best flax centers of Europe. The department experiments in the Puget Sound region of Washington have demonstrated that we possess in that State a climate and soil that bid

fair to rival the celebrated flax region of Courtrai, and from these experiments scutched flax has been produced that is valued by manufacturers in Ireland at three hundred and fifty dollars per ton, and hackled flax worth five hundred dollars per ton. Much has been done, but a great deal [23] more remains to be accomplished in bringing together the farmer and capitalist in the practical [24] work of growing, *retting, scutching, and preparing for market* American flax fiber, for questions of culture are settled.

SPREADING HEMP IN KENTUCKY.

We should restore our hemp industry to its former proportions by producing high-grade instead of low-grade fiber. The growth of a grade of American hemp that will sell for six to eight cents per pound, instead of three to three and a half cents per pound, as at the present time, means that our farmers must follow more closely the careful practices of Europe, and especially that they must adopt water retting in place of the present practice of dew retting, which gives a fiber dark in color and uneven in quality. A careful consideration of the practices of Italy and France as set forth in Fiber Report No. 11, Department of Agriculture, will materially aid those who desire to change their product from the cheaper dark hemps, for which there is small demand, to the higher-priced light hemps, which will compete with the imported commodity.

One of the most interesting problems of the day in the utilization of the new fiber material, and one that is attracting the attention of all civilized countries, is the industrial production of that wonderful substance known in the Orient as China grass, in India as rhea, and in Europe and America as ramie. The money spent by governments and by private enterprise throughout the world, in experiments and inventions, in the effort to establish the ramie industry, would make up the total of a princely fortune. Obstacle after obstacle has been overcome in the years of persistent effort, and now we stand before the last barrier, baffled for the time, but still hopeful, and with efforts unrelaxed. The difficulty may be stated in a few words: ramie culture will only become a paying industry when an economically successful machine for stripping the fiber has been placed on the market. Hundreds of thousands of dollars have been spent in efforts to perfect a machine, but no Government fiber expert in the world recognizes that we have such a machine at the present time, though great progress has been made in machine construction.

The world's interest in this fiber began in 1869, when a reward of five thousand pounds was offered by the Government of India for the best machine with which to decorticate the green stalks. The first exhibition and trial of machines took place in 1872, resulting in utter failure. The reward was again offered, and in 1879 a second official trial was held, at which ten machines competed, though none filled the requirements, and subsequently the offer was withdrawn. The immediate result was to stimulate invention in many countries, and from 1869 to the present time inventors have been untiring in their efforts to produce a successful machine. The [25] commercial history of ramie, therefore, does not extend further back than 1869.

The first French official trials took place in 1888, followed by the trials of 1889, in Paris, at which the writer was present, and which are recorded in the official reports of the Fiber Investigation series. Another trial was held in 1891, and in the same year the first official trials in America took place, in the State of Vera Cruz, in Mexico, followed the next year by the official trials of American machines in the United States, these being followed by the trials of 1894. Since that year further progress in machine construction has been made, and a third official trial should be held in the near future.

GROWTH OF JUTE IN LOUISIANA.

The first records of Chinese shipments of this fiber to European markets show that in 1872 two hundred or three hundred tons of the fiber were sent to London, valued at eighty pounds per ton, or about four hundred dollars. India also sent small shipments, but there was a light demand, with a considerable reduction in price, the quotations being thirty pounds to forty pounds per ton for Chinese and ten pounds to thirty pounds for the Indian product.

Those who are unacquainted with the properties and uses of this wonderful textile may peruse with interest the following paragraph from Fiber Report 7, on the Cultivation of Ramie, issued by the Department of Agriculture:

"The fiber of ramie is strong and durable, is of all fibers least affected by moisture, and from these characteristics must take first rank in value as a textile substance. It has three times the strength of Russian hemp, while its filaments can be separated almost to the fineness of silk. In [26] manufacture it has been spun on various forms of textile machinery, also used in connection with cotton, wool, and silk, and can be employed as a substitute in certain forms of manufacture for all these textiles and for flax also, where elasticity is not essential. It likewise produces superior paper, the fineness and close texture of its pulp making it a most valuable bank-note paper. In England, France, Germany, Austria, and in our own country to an experimental extent, the fiber has also been woven into a great variety of fabrics, covering the widest range of uses, such as lace, lace curtains, handkerchiefs, cloth, or white goods resembling fine linen, dress goods, napkins, table damask, table covers, bedspreads, drapery for curtains or lambrequins, plush, and even carpets and fabrics suitable for clothing. The fiber can be dyed in all desirable shades or colors, some examples having the luster and brilliancy of silk. In China and Japan the fiber is extracted by hand labor; it is not only manufactured into cordage, fish lines, nets, and similar coarse manufactures, but woven into the finest and most beautiful of fabrics."

China is at present the source of supply of the raw product, and the world's demand is only about ten thousand tons, nine tenths of this quantity being absorbed in Oriental countries. The ramie situation in the United States at the present time may be briefly summarized as follows:

The plant can be grown successfully in California and in the Gulf States, and will produce from two to four crops per year without replanting, giving from two hundred and fifty to eight hundred pounds of fiber per acre, dependent upon the number of cuttings, worth perhaps four cents per pound. The machines for preparing this fiber for market are hardly able at the present time to clean the product of one acre (single crop) in a day, and the fiber is quite inferior to the commercial China grass. A new French machine produces a quality of fiber which approaches the China grass of commerce, but its output per day is too small to make its use profitable in this country. All obstacles in chemical treatment of the fiber and in spinning and manufacture are overcome, and the world is waiting for the successful device which will economically prepare the raw material for market.

The part the United States Government is taking in the work is to co-operate in experiments, to issue publications giving all desired information regarding culture, the machine question, and the utilization of the fiber. It tests new decorticators and reports to the public upon their merits or

demerits. It cautions farmers and capitalists, for the present, to go into the industry with their eyes open, for the professional promoter has seized upon this industry, above all others in the fiber interest, as one in which he can more readily gull a gullible public. Nevertheless, [27] responsible capitalists are making every legitimate effort to place the manufacturing industry on a solid basis in this country, and to attain to the progress made in other countries where manufacture has already been established, and where the Chinese fiber is employed as the raw material.

A Florida Sisal Hemp Plant.

Thus far I have only considered spinning fibers. More than one half of the raw fibers imported in the United States are employed in the manufacture of rope and small twine, or bagging for baling the cotton crop. Cordage is manufactured chiefly from the Manila and Sisal hemps, the former derived from the Philippine Islands, the latter from Yucatan. Some jute is also used in this industry, though the fiber is more largely employed in bagging; and some common hemp, such as is grown in Kentucky, is also used.

We can not produce Manila hemp in the United States, and this substance will always hold its own for marine cordage. Jute will grow to perfection in many of the Southern States, but it is doubtful if we can produce it at a price low enough to compete with the cheaper grades of the [28] imported India fiber. Rough flax and common hemp might be used in lieu of jute, in bagging manufacture, but the question of competition is still a factor. Sisal hemp, which has been imported to the value of seven million dollars a year, when prices were high, will grow in southern Florida, and the plant has been the subject of exhaustive study and experiment. This plant was first grown in the United States on Indian Key, Florida, about 1836, a few plants having been introduced from Mexico by Dr. Henry Perrine, and from this early attempt at cultivation the species has spread over southern Florida, the remains of former small experimental tracts being found at many points, though uncared for.

PINEAPPLE FIELD IN FLORIDA.

The high prices of cordage fibers in 1890 and 1891, brought about by the schemes of certain cordage concerns, called attention to the necessity of producing, if possible, a portion of the supply of these hard fibers within our own borders. In 1891, in response to requests for definite information regarding the growth of the Sisal hemp plant, a preliminary survey of the Key system and Biscayne Bay region of southern Florida was made by the Department of Agriculture, and in the following year an experimental factory was established at Cocoanut Grove with special [29] machinery sent down for the work. With this equipment, and with a fast-sailing yacht at the disposal of the special agent in charge of the experiments, a careful study of the Sisal hemp plant, its fiber, and the possibility of the industry was made, and the results were duly published. About this time the Bahaman Government became interested in the industry, and with shiploads of plants, both purchased and gathered without cost on the uninhabited Florida Keys, the Bahamans *began the new industry* by setting out extensive plantations on the different islands of the group. The high prices of 1890 having overstimulated production in Yucatan, two or three years later there was a tremendous fall in the market price of Sisal hemp, and Florida's interest in the new fiber subsided, though small plantations had been attempted. In the meantime, American invention having continued its efforts in the construction of cleaning devices, two successful machines for preparing the raw fiber have been produced which have, in a measure, superseded the clumsy *raspadore* hitherto universally employed for the purpose, and one of the obstacles to the production of the fiber in Florida is removed. The reaction toward better prices has already begun, and the future establishment of an American Sisal hemp industry in southern Florida is a possibility, though there are several practical questions yet to be settled.

Pineapple culture is already a flourishing industry in the Sisal hemp region. A pineapple plant matures but one apple in a season, and after the harvest of fruit the old leaves are of no further use to the plant, and may be removed. The leaves have the same structural system as the agaves —that is, they are composed of a cellular mass through which the fibers extend, and when the epidermis and pulpy matter are eliminated the residue is a soft, silklike filament, the value of which has long been recognized. Only fifty pounds of this fiber can be obtained from a ton of leaves, but, as the product would doubtless command double the price of Sisal hemp, its production would be profitable. How to secure this fiber cheaply is the problem. The Sisal hemp machines are too rough in action for so fine a fiber, and, at the rate of ten leaves to the pound, working up a ton of the material would mean the handling of over twenty thousand leaves to secure perhaps three dollars' worth of the commercial product. Were the fiber utilized in the arts, however, and its place established, it would compete in a measure with flax as a spinning fiber, for its filaments are divisible to the ten-thousandth of an inch. The substance has already been utilized to a slight extent in Eastern countries (being hand-prepared) in the manufacture of costly, filmy, cobweblike fabrics that will almost float in air.

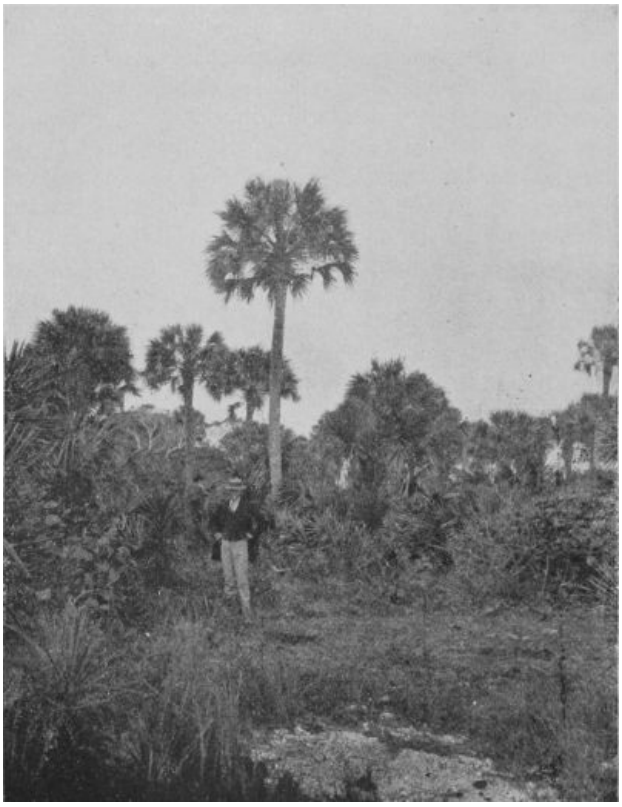
Another possible fiber industry for Florida is the cultivation of bowstring hemp, or the fiber of a [30] species of *Sansevieria* that grows in rank luxuriance throughout the subtropical region of the State. The fiber is finer and softer than Sisal hemp, though not so fine as pineapple fiber, and would command in price a figure between the two. The yield is about sixty pounds to the ton of leaves. Many other textile plants might be named that have been experimented with by the Government or through private enterprise, but the most important, in a commercial sense, have been named.

A Plant of New Zealand Flax.

There is a considerable list of plants, however, which are the subject of frequent inquiry, but which will never be utilized commercially as long as other more useful fibers hold the market. These for the most part produce bast fiber, and the farmer knows them as wild field growths or weeds. They are interesting in themselves, and many of them produce a fair quality of fiber, but to what extent they might be brought into cultivation, or how economically the raw material might be prepared, are questions the details of which only experiment can determine. But the [31] fact that at best they can only be regarded as the substitutes for better, already established, commercial fibers has prevented serious experiment to ascertain their place. They are continually brought to notice, however, for again and again the thrifty farmer, as he finds their bleached and weather-beaten filaments clinging to the dead stalks in the fields, deludes himself in believing that he has made a discovery which may lead to untold wealth, and a letter and the specimen are promptly dispatched to the fiber expert for information concerning them. In such cases all that can be done is to give full information, taking care to let the inquirer down as easily as possible.

The limit of practical work in the direction of new textile industries is so clearly defined that the expert need never be in doubt regarding the economic value of any fiber plant that may be submitted to him for an opinion, and the long catalogue of mere fibrous substances will never demand his serious attention.

In studying the problem of the establishment of new fiber industries, therefore, we should consider "materials" rather than particular species of plants—utility or adaptation rather than acclimatization. We should study the entire range of textile manufacture, and before giving attention to questions of cultivation we should first ascertain how far the plants which we already know can be produced within our own borders may be depended upon to supply the "material" adapted to present demands in manufacture. If the larger part of our better fabrics—cordage and fine twines, bagging, and similar rough goods—can be made from cotton, flax, common hemp, and Sisal hemp, which we ought to be able to produce in quantity at home, there is no further need of costly experiments with other fibers. Unfortunately, however, it is possible for manufacturers to "discriminate" against a particular fiber when the use of another fiber better subserves their private interests. As an example, common hemp was discriminated against in a certain form of small cordage, in extensive use, because by employing other, imported fibers, it has been possible in the past to control the supply, and in this day of trusts such control is an important factor in regulating the profits. With common hemp grown on a thousand American farms in 1890, the price of Sisal and Manila hemp binding twine, of which fifty thousand tons were used, would never have been forced up to sixteen and twenty cents a pound, when common hemp, which is just as good for the purpose, could have been produced in unlimited quantity for three and a half cents. The bagging with which the cotton crop is baled is made of imported jute, but common hemp or even low-grade flax would make better bagging. A change from jute to hemp or flax in the manufacture of bagging (it would only be a return to these fibers), could it be [32] brought about, would mean an advantage of at least three million dollars to our farmers. Yet in considering such a desirable change we are confronted with two questions: Is it possible to compete with foreign jute? and can prejudice be overcome? For it is true that there are, even among farmers, those who would hesitate to buy hemp bagging at the same price as jute bagging because it was not the thing they were familiar with. But some of them will buy inferior jute twine, colored to resemble hemp, at the price of hemp, and never question the fraud.



CABBAGE PALMETTO IN FLORIDA.

Our farmers waste the fibrous straw produced on the million acres of flax grown for seed. It has little value, it is true, for the production of good spinning flax, yet by modifying present methods of culture, salable fiber can be produced and the seed saved as well, giving two paying crops from the same harvest where now the flaxseed grower secures but one.

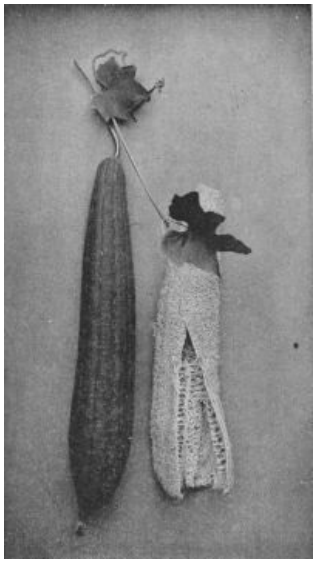
In summarizing the situation in this country, therefore, it will be seen that, out of the hundreds [33] of fibrous plants known to the botanist and to the fiber expert, the textile economist need only consider four or five species and their varieties, all of them supplying well-known commercial products that are regularly quoted in the world's market price current, the cultivation and preparation of which are known quantities. Were the future of new fiber industries in this country to rest upon this simple statement, there would be little need of further effort. The problem, however, is one of economical adaptation to conditions not widely understood in the first place, and not altogether within control in the second.

Twenty flax farmers in a community decide to grow flax for fiber, and two of these farmers are perhaps acquainted with the culture. They go to work each in his own way; ten make a positive failure in cultivation for lack of proper direction, five of the remaining ten fail in retting the straw, and five succeed in turning out as many different grades of flax line, only one grade of which may come up to the standard required by the spinners. And all of them will have lost money. If the failure is investigated it will be discovered that the proper seed was not used; in some instances the soil was not adapted to the culture, and old-fashioned ideas prevailed in the practice followed. The straw was not pulled at the proper time, and it was improperly retted. The breaking and scutching were accomplished in a primitive way, because the farmers could not afford to purchase the necessary machinery, and of course they all lost money, and decided in future to let flax alone.

But the next year the president of the local bank, the secretary of the town board of trade, and three or four prosperous merchants formed a little company and built a flax mill. A competent superintendent—perhaps an old country flax-man—was employed, a quantity of good seed was imported, and the company contracted with these twenty farmers to grow five, ten, or fifteen acres of flax straw each, under the direction of the old Scotch superintendent. The seed was sold to them to be paid for in product; they were advised regarding proper soil and the best practice to follow; they grew good straw, and when it was ready to harvest the company took it off their hands at a stipulated price per ton. The superintendent of the mill assumed all further responsibility, attended to the retting, and worked up the product. Result: several carloads of salable flax fiber shipped to the Eastern market in the winter, the twenty farmers had "money to burn" instead of flax straw, and the company was able to declare a dividend. This is not altogether a supposititious case, and it illustrates the point that in this day of specialties the fiber industry can only be established by co-operation.

In all these industries, whether the fiber cultivated is flax, ramie, or jute, the machine question [34] enters so largely into the problem of their successful establishment that the business must be conducted on a large scale. Even in the growth of Sisal hemp in Florida, should it be attempted, the enterprise will only pay when the necessary mill plant for extracting the fiber is able to draw upon a cultivated area of five hundred acres. In other words, the small farmer can never become a fiber producer independently, but must represent a single wheel in the combination.

The subject is a vast one, and, while I have been able to set forth the importance of these industries as new sources of national prosperity, only an outline has been given of the difficulties which are factors in the industrial problem. Summing up the points of vantage, the market is already assured; through years of study and experiment we are



THE LUFFA, OR SPONGE CUCUMBER.

beginning to better understand the particular conditions that influence success or failure in this country; we have the best agricultural implements in the world, and American inventive genius will be able, doubtless, in time, to perfect the new mechanical devices which are so essential to economical production; our farmers are intelligent and industrious, and need only the promise of a fair return for their labor to enter heart and soul into this work.

WHAT IS SOCIAL EVOLUTION?

[35]

BY HERBERT SPENCER.

THOUGH to Mr. Mallock the matter will doubtless seem otherwise, to most it will seem that he is not prudent in returning to the question he has raised; since the result must be to show again how unwarranted is the interpretation he has given of my views. Let me dispose of the personal question before passing to the impersonal one.

He says that I, declining to take any notice of those other passages which he has quoted from me, treat his criticism as though it were "founded exclusively on the particular passage which" I deal with, "or at all events to rest on that passage as its principal foundation and justification."[4] It would be a sufficient reply that in a letter to a newspaper numerous extracts are inadmissible; but there is the further reply that I had his own warrant for regarding the passage in question as conclusively showing the truth of his representations. He writes:—

> Should any doubt as to the matter still remain in the reader's mind, it will be dispelled by the quotation of one further passage. "*A true social aggregate*," he says ["*as distinct from a mere large family*], *is a union of like individuals, independent of one another in parentage, and approximately equal in capacities*."[5]

I do not see how, having small liberty of quotation, I could do better than take, as summarizing his meaning, this sentence which he gives as dissipating "any doubt." But now let me repeat the paragraph in which I have pointed out how distorted is Mr. Mallock's interpretation of this sentence.

> Every reader will assume that this extract is from some passage treating of human societies. He will be wrong, however. It forms part of a section describing Super-Organic Evolution at large ("Principles of Sociology," sec. 3), and treating, more especially, of the social insects; the purpose of the section being to exclude these from consideration. It is implied that the inquiry about to be entered upon concerns societies formed of like units, and not societies formed of units extremely unlike. It is pointed out that among the *Termites* there are six unlike forms, and among the Sauba ants, besides the two sexually-developed forms, there are three classes of workers—one indoor and two outdoor. The members of such communities—queens, males, soldiers, workers—differ widely in their structures, instincts, and powers. These communities formed of units extremely unequal in their capacities are contrasted with communities formed of units approximately equal in their capacities—the human communities about to be dealt [36] with. When I thus distinguished between groups of individuals having widely different sets of faculties, and groups of individuals having similar sets of faculties (constituting their common human nature), I never imagined that by speaking of these last as having approximately equal capacities, in contrast with the first as having extremely unequal ones, I might be supposed to deny that any considerable differences existed among these last. Mr. Mallock, however, detaching this passage from its context, represents it as a deliberate characterization to be thereafter taken for granted; and, on the strength of it, ascribes to me the absurd belief that there are no marked superiorities and inferiorities among men! or, that if there are, no social results flow from them![6]

Though I thought it well thus to repudiate the absurd belief ascribed to me, I did not think it well to enter upon a discussion of Mr. Mallock's allegations at large. He says I ought to have given to the matter "more than the partial and inconclusive attention he has [I have] bestowed upon it." Apparently he forgets that if a writer on many subjects deals in full with all who

challenge his conclusions, he will have time for nothing else; and he forgets that one who, at the close of life, has but a small remnant of energy left, while some things of moment remain to be done, must as a rule leave assailants unanswered or fail in his more important aims. Now, however, that Mr. Mallock has widely diffused his misinterpretations, I feel obliged, much to my regret, to deal with them. He will find that my reply does not consist merely of a repudiation of the absurdity he ascribes to me.

The title of his book is a misnomer. I do not refer to the fact that the word "Aristocracy," though used in a legitimate sense, is used in a sense so unlike that now current as to be misleading: that is patent. Nor do I refer to the fact that the word "Evolution," covering, as it does, all orders of phenomena, is wrongly used when it is applied to that single group of phenomena constituting Social Evolution. But I refer to the fact that his book does not concern Social Evolution at all: it concerns social life, social activity, social prosperity. Its facts bear somewhat the same relation to the facts of Social Evolution as an account of a man's nutrition and physical welfare bears to an account of his bodily structure and functions.

In an essay on "Progress: its Law and Cause," published in 1857, containing an outline of the doctrine which I have since elaborated in the ten volumes of *Synthetic Philosophy*, I commenced by pointing out defects in the current conception of progress.

> It takes in not so much the reality of Progress as its accompaniments—not so much the substance as the shadow. That progress in intelligence seen during the growth of the child into the man, or the savage into the philosopher, is commonly regarded as [37]
> consisting in the greater number of facts known and laws understood: whereas the actual progress consists in those internal modifications of which this increased knowledge is the expression. Social progress is supposed to consist in the produce of a greater quantity and variety of the articles required for satisfying men's wants; in the increasing security of person and property; in widening freedom of action: whereas, rightly understood, social progress consists in those changes of structure in the social organism which have entailed these consequences. The current conception is a teleological one. The phenomena are contemplated solely as bearing on human happiness. Only those changes are held to constitute progress which directly or indirectly tend to heighten human happiness. And they are thought to constitute progress simply *because* they tend to heighten human happiness. But rightly to understand progress, we must inquire what is the nature of these changes, considered apart from our interests.[7]

With the view of excluding these anthropocentric interpretations and also because it served better to cover those inorganic changes which the word "progress" suggests but vaguely, I employed the word "evolution." But my hope that, by the use of this word, irrelevant facts and considerations would be set aside, proves ill-grounded. Mr. Mallock now includes under it those things which I endeavored to exclude. He is dominated by the current idea of progress as a process of improvement, in the human sense; and is thus led to join with those social changes which constitute advance in social organization, those social changes which are ancillary to it—not constituting parts of the advance itself, but yielding fit materials and conditions. It is true that he recognizes social science as aiming "to deduce our civilization of to-day from the condition of the primitive savage." It is true that he says social science "primarily sets itself to explain, not how a given set of social conditions affects those who live among them, but how social conditions at one epoch are different from those of another, how each set of conditions is the resultant of those preceding it."[8] But in his conception as thus indicated he masses together not the phenomena of developing social structures and functions only, but all those which accompany them; as is shown by the complaint he approvingly cites that the sociological theory set forth by me does not yield manifest solutions of current social problems:[9] clearly implying the belief that an account of social evolution containing no lessons which he who runs may read is erroneous.

While Mr. Mallock's statements and arguments thus recognize Social Evolution in a general way, and its continuity with evolution of simpler kinds, they do not recognize that definition of evolution under its various forms, social included, which it has been all along my purpose to [38]
illustrate in detail. He refers to evolution as exhibited in the change from a savage to a civilized state; but he does not ask in what the change essentially consists, and, not asking this, does not see what alone is to be included in an account of it. Let us contemplate for a moment the two extremes of the process.

Here is a wandering cluster of men, or rather of families, concerning which, considered as an aggregate, little more can be said than can be said of a transitory crowd: the group considered as a whole is to be described not so much by characters as by the absence of characters. It is so loose as hardly to constitute an aggregate, and it is practically structureless. Turn now to a civilized society. No longer a small wandering group but a vast stationary nation, it presents us with a multitude of parts which, though separate in various degrees, are tied together by their mutual dependence. The cluster of families forming a primitive tribe separates with impunity: now increase of size, now dissension, now need for finding food, causes it from time to time to divide; and the resulting smaller clusters carry on what social life they have just as readily as before. But it is otherwise with a developed society. Not only by its stationariness is this prevented from dividing bodily, but its parts, though distinct, have become so closely connected that they can not live without mutual aid. It is impossible for the agricultural community to carry on its business if it has not the clothing which the manufacturing community furnishes. Without

fires neither urban nor rural populations can do their work, any more than can the multitudinous manufacturers who need engines and furnaces; so that these are all dependent on coal-miners. The tasks of the mason and the builder must be left undone unless the quarryman and the carpenter have been active. Throughout all towns and villages retail traders obtain from the Manchester district the calicoes they want, from Leeds their woolens, from Sheffield their cutlery. And so throughout, in general and in detail. That is to say, the whole nation is made coherent by the dependence of its parts on one another—a dependence so great that an extensive strike of coal-miners checks the production of iron, throws many thousands of ship-builders out of work, adds to the outlay for coal in all households, and diminishes railway dividends. Here then is one primary contrast—the primitive tribe is incoherent, the civilized nation is coherent.

While the developing society has thus become integrated, it has passed from its original uniform state into a multiform state. Among savages there are no unlikenesses of occupations. Every man is hunter and upon occasion warrior; every man builds his own hut, makes his own [39] weapons; every wife digs roots, catches fish, and carries the household goods when a change of locality is needed: what division of labor exists is only between the sexes. We all know that it is quite otherwise with a civilized nation. The changes which have produced the coherence have done this by producing the division of labor: the two going on *pari passu*. The great parts and the small parts, and the parts within parts, into which a modern society is divisible, are clusters of men made unlike in so far as they discharge the unlike functions required for maintaining the national life. Rural laborers and farmers, manufacturers and their workpeople, wholesale merchants and retailers, etc., etc., constitute differentiated groups, which make a society as a whole extremely various in composition. Not only in its industrial divisions is it various, but also in its governmental divisions, from the components of the legislature down through the numerous kinds and grades of officials, down through the many classes of masters and subordinates, down through the relations of shopkeeper and journeyman, mistress and maid. That is to say, the change which has been taking place is, under one aspect, a change from homogeneity of the parts to heterogeneity of the parts.

A concomitant change has been from a state of vague structure, so far as there is any, to a state of distinct structure. Even the primary differentiation in the lowest human groups is confused and unsettled. The aboriginal chief, merely a superior warrior, is a chief only while war lasts—loses all distinction and power when war ceases; and even when he becomes a settled chief, he is still so little marked off from the rest that he carries on his hut-building, tool-making, fishing, etc., just as the rest do. In such organization as exists nothing is distinguished, everything is confused. Quite otherwise is it in the developed nation. The various occupations, at the same time that they have become multitudinous, have become clearly specialized and sharply limited. Read the London Directory, and while shown how numerous they are, you are shown by the names how distinct they are. This increasing distinctness has been shown from the early stages when all freemen were warriors, through the days when retainers now fought and now tilled their fields, down to the times of standing armies; or again from the recent days when in each rural household, besides the bread-winning occupation, there were carried on spinning, brewing, washing, to the present day when these several supplementary occupations have been deputed to separate classes exclusively devoted to them. It has been shown from the ages when guilds quarreled about the things included in their respective few businesses, down to our age when the many businesses of artisans are fenced round and disputed over if transgressed, as [40] lately by boilermakers and fitters; and is again shown by the ways in which the professions—medical, legal, and other—form themselves into bodies which shut out from practice, if they can, all who do not bear their stamp. And throughout the governmental organization, from its first stage in which the same man played various parts—legislative, executive, judicial, militant, ecclesiastic—to late stages when the powers and functions of the multitudinous classes of officials are clearly prescribed, may be traced this increasing sharpness of division among the component parts of a society. That is to say, there has been a change from the indefinite to the definite. While the social organization has advanced in coherence and heterogeneity, it has also advanced in definiteness.

If, now, Mr. Mallock will turn to *First Principles*, he will there see that under its chief aspect Evolution is said to be a change from a state of indefinite, incoherent homogeneity to a state of definite, coherent heterogeneity. If he reads further on he will find that these several traits of evolution are successively exemplified throughout astronomic changes, geologic changes, the changes displayed by each organism, by the aggregate of all organisms, by the development of the mental powers, by the genesis of societies, and by the various products of social life—language, science, art, etc. If he pursues the inquiry he will see that in the series of treatises (from which astronomy and geology were for brevity's sake omitted) dealing with biology, psychology, and sociology, the purpose has been to elaborate the interpretations sketched out in *First Principles*; and that I have not been concerned in any of them to do more than delineate those changes of structure and function which, according to the definition, constitute Evolution. He will see that in treating of social evolution I have dealt only with the transformation through which the primitive small social germ has passed into the vast highly developed nation. And perhaps he will then see that those which he regards as all-important factors are but incidentally referred to by me because they are but unimportant factors in this process of transformation. The agencies which he emphasizes, and in one sense rightly emphasizes, are not agencies by which the development of structures and functions has been effected; they are only agencies by which social life has been facilitated and exalted, and aids furnished for further social evolution.

Respecting the essential causes of this social transformation, it must suffice to say that it results from certain general traits in human beings, joined with the influences of their varying circumstances.

Every man aims to pass from desire to satisfaction with the least possible hindrance—follows the line of least resistance. Either the shortest path, or the path which presents fewest [41] impediments, is that which he chooses; and the like applies to courses of conduct at large: he does not use great effort to satisfy a want when small effort will do. Given his surroundings and the occupation he chooses, when choice is possible, is that which promises a satisfactory livelihood with the least tax on such powers as he has, bodily and mental—is the easiest to his particular nature, all things considered. What holds of individuals holds of masses of individuals; and hence the inhabitants of a tract offering facilities for a particular occupation fall into that occupation. In § 732 of the *Principles of Sociology* I have given from various countries illustrations of the ways in which local conditions determine the local industries:—instance among ourselves mining districts where there are coal, ironstone, lead, slate; wheat-growing districts and pastoral districts; fruit and hop districts; districts for weavers, stockingers, workers in iron; places for shipbuilding, importing, fishing, etc.: showing that certain sections of the population become turned into organizations for the production of certain commodities, without reference to the directive agency of any man. So in each case is it with the various classes of merchants, shopkeepers, professional men, etc., who in each of these centers minister to those engaged in its special industries: nobody ordering them to come or to go.

Similarly when we pass from production to distribution. As in India at the present time, where a Juggernaut festival is accompanied by a vast fair; as, according to Curtius and Mommsen, in Greece and Rome, the gatherings of people to make sacrifices to the gods were the occasions for trading; so in Christian times, church festivals and saints' days, drawing assemblages of people for worship, led to active exchange of commodities—the names of the fairs proving their origin. This was not arranged by any one: it arose from the common sense of all who wanted to sell some things and buy others. There has been a like history for the rise of markets, and the transition from weekly to bi-weekly, and finally to daily, markets in respect of important things—corn, money, securities. No superior man, political or other, dictated these developments. When barter gave place to exchange by means of a currency, the like happened. One wanting to dispose of surplus goods, meeting those who had no personal need for such goods, took in exchange certain things in universal demand, which he knew he would be able to pass on in like manner—in early stages articles of food, of warmth, of defense, of ornament; and from such articles arose in each case a currency—here dried fish, there tea-bricks, and in other cases skins, bundles of cotton, here standard bars of rock salt, there standard bars of iron, in one place definite lengths of cloth, and in another fine mats, and in many places ornaments and the materials for ornaments: which [42] last, gold and silver, being relatively portable, passed into wide use. These precious metals were at first in quantities actually weighed; then in quantities of professed weight; and finally in quantities bearing the king's stamp as being the most trustworthy. No great man—political, industrial, or other—invented this system. It has everywhere resulted from men's efforts to satisfy their needs in the easiest ways. So was it with the transition from a currency of intrinsic value to one of representative value. When, instead of a direct payment in coin, there came to be used a memorandum of indebtedness to be presently discharged, which could be transferred to others—when, as in Italy, to save the weighing and testing of miscellaneous coins, there arose the practice of depositing specified quantities with a custodian and having from him negotiable receipts—when, as in England, the merchants, after having been robbed by the king of their valuables, left for security in the Tower, sought safer places, and, depositing them in the vaults of goldsmiths, received in return "goldsmiths' notes," which could pass from hand to hand; there was initiated a paper-currency. Goldsmiths developed into bankers; after central banks there arose provincial banks; promises to pay became to a great extent substitutes for actual payments; and presently grew up the supplementary system of checks, extensively serving in place of coin and notes. Finally, bank-clerks in London, instead of presenting to the respective banks the many and various claims upon them, met and exchanged these claims and settled the balance: whence presently came the clearing house. No superior man arranged all this. Each further stage was prompted by the desire to economize labor. From primitive fairs up to the daily transactions of the money market, distribution and exchange have developed without the dictation of any great man, either of Mr. Carlyle's sort or of Mr. Mallock's sort. It has been so throughout all other arrangements subserving national life, even the governmental. Though here at least it seems that the individual will and power play the largest part, yet it is otherwise. I do not merely refer to the fact that without loyalty in citizens a ruler can have no power; and that so the supremacy of a man intrinsically or conventionally great is an outcome of the average nature; but I refer to the fact that governmental evolution is essentially a result of social necessities. On tracing its earliest stages from savage life upwards, it becomes manifest that even a ministry is not the mere invention of a king. It arises everywhere from that augmentation of business which goes along with increase of territory and authority: entailing the necessity for deputing more and more work. Under its special aspect it seems to be wholly a result of the king's private action, but [43] under its general aspect it is seen to be determined by the conditions of his existence. And it is so with governmental institutions at large. Without tracing these further it will suffice to quote the saying of Macintosh—"Constitutions are not made but grow."

Of course inequalities of nature and consequent inequalities of relative position are factors in social changes. Of course, as implied above, any assertion of the approximate equality of human beings, save in the sense that they are beings having sets of faculties common to them all, is absurd; and it is equally absurd to suppose that the unlikenesses which exist are without effects on social life. I have pointed out that in the earliest stages of social evolution, when war is the business of life, the supremacy of a leader or chief, or primitive king, is a fact of cardinal importance; and also that the initiator of ecclesiastical control is necessarily distinguished from others "by knowledge and intellectual capacity." The beginnings of industrial evolution are also

ascribed by me to differences of individual capacity; as instance the following quotations from that part of the *Principles of Sociology* which deals with Industrial Institutions.

> The natural selection of occupations has for its primary cause certain original differences between individuals, partly physical, partly psychical. Let us for brevity's sake call this the physio-psychological cause (§ 730).
>
> That among the fully civilized there are in like manner specializations of function caused by natural aptitudes, needs no showing: professions and crafts are often thus determined ... occupations of relatively skilled kinds having fallen into the hands of the most intelligent (§ 731).
>
> Speaking generally, the man who, among primitive peoples, becomes ruler, is at once a man of power and a man of sagacity: his sagacity being in large measure the cause of his supremacy. We may therefore infer that as his political rule, though chiefly guided by his own interests, is in part guided by the interests of his people, so his industrial rule, though having for its first end to enrich himself, has for its second end the prosperity of industry at large. It is a fair inference that on the average his greater knowledge expresses itself in orders which seem, and sometimes are, beneficial (§ 770).
>
> In its beginnings slavery commonly implies some kind of inferiority (§ 795).
>
> Considered as a form of industrial regulation, slavery has been natural to early stages of conflicts and consolidations (§ 800).
>
> The rise of slavery exhibits in its primary form the differentiation of the regulative part of a society from the operative part (§ 798).

The recognition of these effects of individual differences, especially in early stages, may rightly go along with the assertion that all the large traits of social structure are otherwise determined—that all those great components of a society which carry on the various industries, making the life [44]
of the whole possible, all those specialized classes which have established and maintained the inter-dependence of the producing structures, by facilitating and regulating the exchange of their products, have arisen from the play of aggregate forces, constituted of men's desires directed by their respective sets of circumstances. Mr. Mallock alleges that the great fact of human inequality—the fact that there is a minority "more gifted and efficient than the majority"—is the fundamental fact from which "the main structural characteristics of all civilized societies spring." [10] That he should assert this in presence of all the evidence which the *Principles of Sociology* puts before him, is, to use the weakest word, surprising. If his assertion be true, however, the way of demonstrating its truth lies open before him. In volumes II. and III. of the *Principles of Sociology*, several groups of institutions, presented by every developed society, are dealt with under the heads, Political, Ecclesiastical, Professional, Industrial: seventy-one chapters being included in them. Each chapter treats of some aspect, some division or subdivision, of the phenomena grouped under the general head. Instead of the Industrial Institutions discussed above, suppose that Mr. Mallock takes a group not touched upon—Professional Institutions. The thesis worked out in the part so entitled is that all the professions are differentiated from the priesthood; and the differentiation is tacitly represented as due to the slow operation of those natural causes which lead to specializations of function throughout the whole social aggregate. If Mr. Mallock is right, then of the chapters dealing with the ten professions enumerated, each is wrong by omitting to say anything about the great man, political, industrial, or other, who set up the differentiation or from time to time consciously gave it a more pronounced character—who thought that it would be well that there should be a separate medical class, or a separate teaching class, or a separate artist class, and then carried his thought into effect. Mr. Mallock's course is simply to take each of these chapters and show how, by the recognition of the supplementary factor on which he insists, the conclusions of the chapter are transformed. If he does this he will do more than by merely asserting that my views of social evolution are wrong because the "great fact of human inequality" "is systematically and ostentatiously ignored."

If in his title Mr. Mallock had, instead of "Evolution," written Social Sustentation, the general argument of his book would have been valid. If, further, he had alleged that social sustentation is instrumental to social evolution, and that in the absence of processes facilitating social [45]
sustentation social evolution can not take place, no one could have gainsaid his conclusion. And if he had inferred that whoever improves these processes betters the conditions which favor social evolution, his inference would have been true. But this admission may be made without admitting that the men who directly or indirectly further sustentation, or who improve the quality of the social units, are the agents who determine and direct social evolution. An account of their doings in no way constitutes an account of that social transformation from an indefinite incoherent homogeneity to a definite coherent heterogeneity, in which the evolution of a society essentially consists.

Moreover Mr. Mallock is justified in contending that the great man—discoverer, inventor, teacher, administrator, or other—may equitably receive all the reward which, under the principle of contract, flows to him as the result of his superiority; and that disregard of his claim by the mass of men is alike inequitable and ungrateful. This is the position I have myself taken, as witness the following:—

> Even were an invention of no benefit to society unless thrown open to unbought use, there would still be no just ground for disregarding the inventor's claim; any more than for disregarding the claim of one who labors on his farm for his own benefit and not for public benefit. But as it is, society unavoidably gains immensely more than the inventor gains. Before he can receive any advantage from his new process or apparatus, he must

> confer advantages on his fellow men—must either supply them with a better article at the price usually charged, or the same article at a lower price. If he fails to do this, his invention is a dead letter; if he does it, he makes over to the world at large nearly all the new mine of wealth he has opened. By the side of the profits which came to Watt from his patents, place the profits which his improvements in the steam-engine have since brought to his own nation and to all nations, and it becomes manifest that the inventor's share is infinitesimal compared with the share mankind takes. And yet there are not a few who would appropriate even his infinitesimal share![11]

Had Mr. Mallock recognized the fundamental distinction I have pointed out between social sustentation, life, activity, enlightenment, etc., on the one hand, and the development of social structures on the other, his polemic against socialists and collectivists would have been equally effective, and he would not have entailed upon me an expenditure of time and energy which I can ill spare.—*The Nineteenth Century.*

[4] Nineteenth Century, p. 316.
[5] Aristocracy and Evolution, pp. 52, 53. The italics are his.
[6] Literature, April 2, 1898.
[7] Westminster Review, April, 1857.
[8] Aristocracy and Evolution, pp. 5, 7.
[9] Ibid., pp. 10, 11.
[10] Nineteenth Century, pp. 314, 315.
[11] Justice, pp. 110, 111.

THE TORRENTS OF SWITZERLAND.

[46]

By EDGAR E. DAWSON, M. E.

Mark Twain once said that he was in constant expectation in Switzerland of seeing a farmer fall out of his farm. The farmer has in many cases appreciated his hazardous position when harvesting his crops, and has put on crampoons to prevent a precipitous trip into the valley below. The crampoons prevent the farmer leaving his farm in such an undignified manner, but they do not prevent that same farm leaving its position on the mountain side. To show how, in many cases, the mountain sides are kept intact is the object of this paper. The old simile, "I am as sure of it as of the ground on which I stand," would be as much out of place in some parts of Switzerland as in those parts of the world where earthquakes are endemic. In fact, in these latter places, though the surface may receive a good shaking, it generally returns to somewhat the same neighborhood after its nervous peregrinations are over. Not so with the Swiss mountain side. When part of the mountain takes leave of the rest, it is forever.

Switzerland is often spoken of somewhat derisively as a garden, so perfectly have its pleasure grounds been laid out, and so completely comfortable does one find one's self in the midst of Nature's grandeurs. If its water courses had not been controlled and cared for as are those of a well-conducted park it would be chaos! The constant and vigilant struggle the Swiss have been forced to maintain against the liquid element is much to their credit, for they have generally been victorious. They have spent enormous sums of money in keeping their torrents and rivers within reasonable limits, and are even now, at times, forced to suppress new insurrections on the part of these irresponsible agents. The corrections of the water courses have been necessary for several reasons. In the first place, the erosions on the mountain sides result in deposits which present different inconveniences, of which I shall speak later. In the second place, the erosions are frequently the cause of landslides. The work of regulating the action of the water courses is now done according to accepted rules based on experience and on theories which have been confirmed by facts. Years ago, before the confederation took charge of this matter, it was done often in a haphazard, empirical fashion by the local authorities, with or without the aid of an engineer. But some great disasters in the canton of Grisons awakened the people to what might occur to many of them who had hitherto been more fortunate. At the end of September, 1868, both slopes of the Alps, and particularly the cantons of Valais and Grisons, were visited by floods [47] of enormous magnitude. Such was the devastation caused that an appeal was made to the generosity of the nation at large in behalf of the sufferers. This was responded to with such liberality that a large portion of the sum subscribed was put aside for the purpose of improving the water courses permanently. The fact that collective action was necessary in the attempts to control the turbulent streams became very apparent. This being the case, the state was called upon to take charge of this colossal enterprise. In July, 1871, by federal decree, the confederation declared that the correction and extinction of torrents was a matter of public utility, and worthy of the subsidies of the national Government. At the same time the relative burdens of the cantons and the confederation were settled. The importance of the improvement of the water courses and of the wooding of the regions where they rise was recognized in the Constitution of 1874. There the matter was definitely put under federal control and classed with the allied question of the conservation of the forests. The problem of keeping the waters under control in Switzerland ranges from the marshy lowlands to the summits of the passes. In spite of the varying conditions that this range entails, there are certain general principles that bear on all cases where the water is in movement. As the Swiss supplies his want of coal by harnessing his streams, so he makes the water do a large share of the work of correcting its erring ways and preparing itself to be harnessed. This he does by utilizing its power of carrying or depositing stones and soil, according

as it is held within narrow banks or allowed to roam at will. As this power depends also on the steepness of the slope down which it runs, he uses this latter factor as well.

When he has got the water courses into what he considers good working condition and one that should be permanent, he tries to clinch matters. This is done by so combining the various conditions of cross-section, slope, and quality of soil that the action of the water is automatic—that is, it brings down no more earth and stones than it is capable of carrying below to safer places where the dangers of floods are small. Whenever the force with which the water moves along is stronger than the cohesion of the soil, erosion occurs. This erosion will continue, the channel of the stream becoming ever deeper, until a soil is encountered whose resistance is equal to the erosive action of the water. As the alluvion is carried on, the slope of the stream will become steeper and steeper the higher one goes. This circumstance would be of much greater importance if the gorges and gullies in which most of the streams run were not so well provided with rock. The power of the water to cause erosion is lessened in proportion to the amount of material it is carrying with it, which material is generally the product of previous erosions. [48] Whenever the current needs all its strength to carry the material it has in suspension, together with the solid matter it is pushing along, it will have lost all its power to cause erosion. If the slope is decreased, or if the matter in suspension is increased in any manner, deposits will occur. These deposits render the slope less steep at that point but steeper below, so that the action of the water beyond will make itself felt, and by digging gradually up stream tend to restore the original slope.

In some cases there is very little erosion where the current is much stronger than the cohesive power of the soil, for the reason that the beds of the streams have been almost paved with stones that have been carried along by the propulsive action of the water.

This has in many cases produced an equilibrium between the resistance and the destroying power; in others the equilibrium has been brought about in a different way by the same natural agents. The current of a stream will very often go on causing erosion until arrested by some rocky obstacle that determines a waterfall. These falls cause breaks in the action of the water not only in stopping the erosive action in its upward march, but also in checking the velocity of the water. Then, as basins are often formed just above the falls and where the current is much less swift, matter in suspension is deposited, so that when the stream is swollen it has material to work upon, before starting to make the original slope steeper.

The subject divides itself broadly into two branches—the extinction of torrents and the correction of the water courses in valleys. In the extinction of the torrents various plans are resorted to, which give the current greater propulsive power, but at the same time they render necessary greater protection of the bed. This may be done by incasing it within walls of masonry (though other materials are used in some cases) or shortening meandering portions. In the latter plan the slope is increased, the fall being the same for a shorter distance. Currents that have been making dangerous deposits at certain points and causing dangerous erosions at others are treated by the above systems until the danger has disappeared or the money has given out. When the erosive action of the water is already too great, the material carried and then deposited by the stream is often made use of to consolidate banks that are threatened. Spurs are built out from such banks, and this tends to mend matters not only in forcing the water to take another channel, but also in causing deposits at the foot of the menaced bank.

The destructive effects of the current are arrested when the streams are not important by means of dams made of trunks of trees and wooden stakes, often strengthened roughly with stones. Where the streams are larger, and where the erosive action can not be modified by [49] enlarging the channel, as is the case in many gorges, it is necessary to make an artificial bed for the stream and at times to supplement this by masonry dams. The dams are not permanent in their effects, for as soon as the basin immediately above the dam has been filled with deposits and the original slope of the stream has re-established itself, the products of the erosion pass over the dam. They prove, however, of great utility at times of large freshets by causing deposits which are subsequently carried down in much smaller quantities. This prevents the disasters that would be caused by sudden enormous deposits when the streams are swollen.

The prospect for many a narrow valley would be a sad one indeed if means had not been taken to prevent the lateral erosions so common with the mountain torrents and so productive of landslips. Where the stream has provided itself with a stony bed on which to roll, it often tries to do damage by leaving the stones and attacking the earthy banks. It is in these cases that the danger has proved so insidious; for until disasters actually occurred, in many instances, the undermining effect of the water was not suspected, being entirely hidden from view.

The most economical way of combating such cases is by making use of those points that by their formation arrest the erosive action. This is done by re-enforcing them in such manner as to produce a series of natural steps. The upward march of the excavating action of the water is stopped at least partially and temporarily at each step. Such a method is of great advantage when it is necessary to delay a more costly correction for financial reasons.

The experience gained since a connected system was begun in the management of the water courses has been of incalculable value, and many have been the landslips arrested and prevented by seeking their causes in the hidden erosive action of a small stream. In still another manner does the water threaten the mountain sides, and that is by permeating the soil (which is thus rendered much heavier), until it reaches a bed of rock or other layer that it can not penetrate. There it forms a layer of slippery mud on which the soil above slides bodily down. The method pursued in such cases is sometimes that of a ditch dug to the impermeable layer, sometimes that of a drain. In both cases there may or may not be small feeding ditches. Another plan which appears very contradictory of what has just been said is also employed. This consists in preventing, by means of horizontal trenches, the water from flowing off on the surface in the regions above the timber line. The water is forced to percolate through the soil and so reaches

the wooded portions, where it would permeate anyhow, much more gradually than otherwise. The soil thus escapes the enormous increase of pressure due to the sudden absorption of great [50] quantities of water, and consequently is less in danger of leaving its fastenings.

One of the most difficult of the problems that these torrents give rise to is that of their control where they suddenly enter a valley, and where the slope is consequently greatly decreased. The decrease of current entailed causes the deposit of stones and material at the mouth of the gorge, and the water then spreads itself over the valley. This occurs more or less regularly with certain torrents that are usually dry and where it is impracticable to prevent the erosions above. It then becomes necessary to build a stone canal from the mouth of the gorge to the principal water course of the valley. As this must be built on the alluvion (which presents the surface of a cone), it is often higher than the rest of the valley, and one may find other small canals for the draining of the valley passing under the larger one and meeting the principal stream below. A similar action to that of the torrent on entering the valley is that of a stream with a rapid current emptying into one whose current is slower. Here the deposits will at times force the smaller stream to seek another channel, and it frequently occurs that the correction moves the mouth of the stream a considerable distance.

The manner in which the streams in the valleys are made to aid in their own correction is most interesting. Whereas in the mountains it is usually desirable to decrease the erosive action of the water, in the valleys the contrary is the case, as the deposits in the lowlands are as dangerous to life and property as was their abstraction above. The great desideratum to be attained is to have the mountain streams arrive in the valleys in a purely liquid condition, and to give the valley streams the power to carry to the lakes any material they may be so unfortunate as to have taken in charge. To accomplish this latter purpose, the sinuosities of the streams are often reduced to straight lines, an increase of slope being thus secured. The new channels are made of a cross-section to enable the water to carry on its alluvion and silt. Where great freshets occur it is necessary to guarantee the artificial beds against the enormous increase of the water's destructive action.

The usual plan is that of having the cross-section of the stream with a deep depression in the center. This depression is of dimensions to insure a proper flow under ordinary conditions. When the stream becomes swollen it overflows the borders of this depression and spreads over a much larger area until the banks proper are encountered. This sudden increase of cross-section reduces the velocity of the water and consequently its destructive power. When the water of a [51] stream is turned from its old channel into the new one that has been prepared for it, the operation is generally very gradually performed, so as to enable the water to fill up the old bed as much as possible by depositing its silt.

A plan pursued with much success is that of building out from the high bank of a stream (which it is desired to confine into a narrower channel) insubmersible spurs, stopping at the points where the new bank is to be situated. The water flowing in between these spurs deposits its dirt and gravel, and gradually builds up the new bank. In many cases the ends of the spurs are connected by low artificial banks of masonry over which the water flows. These banks retain and protect the deposits, and, when the latter have attained a sufficient depth, the artificial banks are raised to their permanent height. Still another method pursued with the same object in view is that of starting up stream and building the banks to their permanent height until a point is reached where it is desired to "fill." Here the artificial banks are left temporarily very low. The water overflows them, and the reduction of its velocity entails the deposit of its silt. When this has continued as long as necessary or practicable, the walls are raised to their permanent height along the section and the same process is repeated below. This gradual process is also very advantageous from a financial point of view. When the engineer finally reaches the mouth of the stream at one of the lakes, we should expect to find his difficulties at an end, as the lakes are usually so deep that the alluvion makes little impression on them, and their areas are such that floods are not much to be feared. But he is confronted here with a new difficulty, that of anchoring or securing the foundation of his artificial river bank. The soil is generally alluvial over a large area, and is very damp. He generally has to terminate the masonry before he reaches the less stable alluvial soil and continue the structure by means of wooden material, which retains its position much better under such circumstances and is more cheaply replaced. It would be natural to imagine that man's control of the water problem stops at this point. But not so with the Swiss; he even controls its exit from some of the lakes. This is notably the case at Geneva, where by means of ingenious dams the lake is maintained at what is deemed a proper level. When it is remembered that this lake is fifty miles long by ten broad, an idea is gained of the amount of water controlled. Every few years the level is lowered for a given period, so that repairs may be made to the walls and structures along the shores.

THE EVOLUTION OF COLONIES. [52]

By JAMES COLLIER.

V.—POLITICAL EVOLUTION.

The law that the evolution of a colony repeats the evolution of the parent state would here be logically applied to the history of the relations between colonies and the mother country. These would be shown to have followed a similar course, though with new developments, to those of the mother country with *her* suzerain; and they would be carried further back and deeper down to those universal animal processes of lactation and rearing which they continue and which explain

them. The gradual settlement of a new country would next be exhibited as a repetition (with necessary modifications) of the settlement of the mother country, because guided by the same general laws—that it dispossesses an earlier race, which had followed quadrupeds and birds, which had followed trees, shrubs, and grasses, which again had sown themselves along geographical lines. Chapters on both topics are unavoidably omitted. The law has now to be applied to the political, industrial, and social evolution of colonies. In so wide a subject only *aperçus* are possible.

There are traces in several colonies of a state anterior to the establishment of a settled government. According to the unloving Hobbes, such a state is necessarily one of war, and it is sometimes that; according to the humane Rousseau, it is one of peace, and, to the credit of human nature, it is oftener that. There were English settlers in Pennsylvania before the Swedes arrived. The first immigrants to Plymouth found predecessors on the coast who owed no allegiance. Seventy years after the foundation of North Carolina the inhabitants still led the lives of freemen in the woods. Prior to 1702 New Jersey was considered one of those provinces "where no regular government had been established." The Tasmanian farmers who colonized Victoria lived for some time without any form of government, and lived peacefully. Pastoralists were found on the Canterbury plains before the advent of the Pilgrims, and were content. When the Pilgrims got into collision with the central government, they said bitterly that they would do better with none. Where it is otherwise the circumstances are exceptional. Gold and silver fields everywhere are at first, and often to the last, scenes of wild disorder, where a man's safety depends on his ability to defend himself. Escaped Australian convicts, runaway sailors, adventurers, and natives made up a community which turned the natural paradise of the Bay of Islands into an earthly hell. Parts of Texas in very recent days were the seat of anarchy. Government soon arrives on the spot in the shape of the Texas Rangers, the Draconian gold-fields [53] mounted police, or a royal governor. Or an organized body of immigrants absorbs previous settlers and evolves from within itself all the agencies of government. On one or other of these two types all colonial societies have been built up. The patriarchal theory of Filmer is realized in those colonies—the great majority—where the government is clothed with power delegated by the sovereign of the mother country. The socialist theory of Locke is embodied in the New England colonies; in the Carolina "Association" of 1719; in the resolutions of the Liberal Association of Canada in 1841, which issued in the compact between the crown and the Canadian people; in the New Zealand whalers in 1840, governed by their own laws; in the New Zealand Company's settlements (with a social contract previously drawn up by the passengers, as by those of the Mayflower); and in the colonies of Otago and Canterbury, and New Australia in Paraguay. Two intermediate groups have a transitional existence. Many colonies have been founded by commercial companies whose collective history might be written in two lines—inception of vast enterprises, partial commercial success, great collateral benefits, ruinous loss of capital, surrender of charter to the crown. A set of colonies peculiar to the United States were established by one or more proprietaries, from whose voluntary concessions the form of government was derived, but most of these merged, after a series of conflicts, in the popular group. They were respectively bastard royal and bastard charter colonies.

From the origin of a colony is deducible its whole political and social structure. Colonies of royal foundation, by a kind of moral pangenesis, tend to reproduce all parts of the mother country that are suitable to the new environment—its inequalities of *rank*, governors who are the image of the sovereign, an executive, legislative, and judicature that are the delegation of his authority. But these institutions must grow; they can not be made. The attempt to create an aristocracy in Carolina, and the proposal to manufacture one in New South Wales, necessarily failed. Yet in both countries one grew or is growing up. In the South there was an untitled aristocracy, with the aristocratic temper, exclusive institutions, and four distinct classes (the descendants of the lords of the manor, villeins or tenants, bond-servants, and slaves, who had a brief existence in Virginia, Carolina, and Maryland)—planters, overseers, mean whites, and negro slaves; the fall of Richmond saw the happy ending of all that. In the British colonies, as in England, there is an increasing passion for titles, and of about sixty grades in the Byzantine hierarchy of the English monarchy at least eleven have been transplanted to colonial soil. But it is on one condition, abroad as at home—that honor shall be divorced from power. In England the [54] nobility is being edged out of office, and on Lord Salisbury's grave might be written, "The last of the nobles"—the last who governed his country. In her colonies one premier after another resolutely refuses the forbidden dignity that would banish him from the ministerial Eden. The same point has been reached in the United States from the opposite side. Most of the charter and some of the proprietary colonies developed into republican societies, with political equality as their badge, a popular legislature, an elected judiciary, and a half-elected executive. Side by side with this democracy of power there has grown up in the great cities—Philadelphia, Boston, New York—an aristocracy of blood, culture, or dollars. This aristocracy of fashion—as in France and England, so in the United States and (on a small scale) in Australia—consoles itself for lifelong exclusion from public affairs by addicting itself to literature, art, philanthropy, and such like. But these are only its recreations. Its chief use is to exist, to exhibit the civilization of a people at its flower, to give pleasure to others and to itself. The proportion of this element to the rest of the population will measure the age of the community.

The core of the *executive* is the governor. The governor of the monarchical colonies is the deputy of the sovereign, and the story of his authority is the story in brief of the royal prerogative. The governors of the Spanish colonies arrogated and abused a power far more despotic than a Spanish king's. The French Governor of Illinois ruled with absolute sway. The first Governor of New South Wales exercised unparalleled powers. He could inflict five hundred lashes and impose a five-hundred-pound fine; could sentence to death, execute, or pardon. He regulated trade. He fixed prices, wages, and customs duties. All the labor in the colony was at his

disposal. He could bestow grants of land. He appointed to all offices of honor or emolument. The administration of justice was exclusively in his hands. The colonists were his subjects. He was practically irresponsible. Thus an Anglo-Saxon community can take on the characters of an Oriental satrapy. It can also become a military despotism. For some years after the departure of one governor and the deposition of another the government of the colony was in the hands, or under the feet, of the officers of the New South Wales Corps, who ruled it as the Sultan rules Turkey. The stage of pure absolutism, which is necessitated in a colony, as in the mother country, by the existence of a small band of immigrants in the midst of a hostile indigenous population, or of a small number of free settlers among a convict populace, is succeeded by that of limited absolutism. The authority of the governor is checked by the appointment of a council. Most of the early North American crown colonies were at this stage. It answers to England under the later [55] Tudors, and, as there, left ample scope for oppression. Occasionally it blossomed or withered into prodigies of tyranny on a small scale, as in the too celebrated Andros. Sir James Craig, so lately as the beginning of the nineteenth century, treated his Canadian Parliament as superciliously as a Stuart. In New Zealand there were continual complaints that a certain governor had more absolute power than a sovereign. In South Australia and South Africa the same governor ruled like an emperor, his council not thwarting but aggrandizing his authority. This second preconstitutional stage is often unduly prolonged in colonies, as it commonly is in the mother country, on the pretext of an enemy on the frontier or of troubles with the natives, but really because of the forceful character of a governor who is unwilling to lay down the dignity he may not have been overwilling to take up. Its persistence in the North American colonies can only be explained on Haeckel's principle that the development of ancestral species is followed in the development of the embryo. Despotism in the Old World was the parent of despotism in the New. There is no other reason why colonies ripe for self-government, like Massachusetts, New York, and Virginia, should have been oppressed by such men as Andros, Cornbury, and Harvey. The stage is ended by the granting of a constitution or by a successful rebellion. The governor's personal force will then be the measure of his power. The sagacious and resolute Lord Elgin asserted that he had twice the authority in constitutional Canada that he had enjoyed in Jamaica. Such a governor is the colonial analogue of Queen Victoria, who, in consequence of her association with the Prince Consort, the length of her reign, and her strong character, has prolonged monarchical influence. But the day of such sovereigns is passing; the day of such governors is past. The office is by no means shorn of its prerogatives. The governor, like the sovereign, selects his prime minister, and the act may have serious consequences; the appeal of the minister for election as leader by his party shows the blending of the popular with the monarchical strain, but it is little more than formal. As George III in 1783, and William IV in 1834, arbitrarily dismissed the Whigs, a Governor of Newfoundland in 1861 dismissed his ministry; in 1858 the Governor of New South Wales had resolved to dismiss his; and it is not many months since Mr. Rhodes was cashiered. Like the sovereign, the governor sometimes refuses to grant a dissolution. Like the Governor General of Canada last year, or the Governor of New Zealand a few years ago, he may refuse to appoint senators—successfully in the one case or only to be bowled over by the Colonial Office in the other. Beyond these real but rarely exercised prerogatives he has little else to do than sign his ministers' documents. He ought to interfere in [56] certain cabinet crises, but dares not. His power, like that of the sovereign, is reduced to a shadow. The premier of the colony is now its working king.

As the governor's authority wanes, his dignity waxes. After 1632 a viceroy of high rank was sent to New Spain. In 1867 Disraeli, half genius and half charlatan, commenced a policy of ostentation by announcing that only those would in future be appointed colonial governors who had been "born in the purple," or were peers, and notwithstanding two or three Liberal reactions the policy has been confirmed, in regard to all the more important colonies, by the demands of the colonists. On arriving in his dominions the new ruler has a royal reception. He becomes the head of the ceremonial system in the colony, and if he ceases to govern he reigns (according to Bagehot's theory of the monarchy) by impressing the popular imagination. And as loyalty to the Queen is passing into loyalty to the imperial tradition, so is loyalty to her representative being transmuted into the pride of imperial connection.

The governor completes the parallel with sovereignty by undergoing all its vicissitudes. As monarchs have abdicated, been imprisoned, banished, restored, tried, and beheaded, colonial governors have resigned, been imprisoned, expelled, recalled, restored, impeached, dismissed, and hanged, and in both sets of cases for similar reasons. They have resigned because of ill usage at the hands of their ministers, because things were done in their absence of which they disapproved, or because they were entrapped into approving of their ministers' wrongdoing. La Bourdonnais was sent to the Bastille, Andros was imprisoned for tyranny in Massachusetts, and in North Carolina it was the "common practice" to resist and imprison their governors. Depositions were frequent in the North American colonies. An oppressive Governor of Virginia was banished to England, but sent back; a Governor of New South Wales was deposed for rectitude by a military mutiny and shipped to Tasmania; a Governor of New Zealand was placed on board a ship for England because he had excited the ill will of a powerful company, and had indiscreetly realized the dream of free traders by making the colony a free port. As Pericles dreaded being ostracized, early Governors of New South Wales feared being placed under arrest. Recall is the sentence that governors of British colonies had most to shun in the days when they were still irresponsible. The first four Governors of Australia, and possibly the sixth, were lied out of office. One was recalled because of the financial embarrassments of his colony and his own devotion to science; another, on the better grounds of tyranny and red tape. A Governor of the Cape of Good Hope was recalled because he was unpopular. Another governor of that colony was [57] recalled for incorrigible insubordination, and again, when he had been pardoned and sent to a more distant colony, for hopeless incompatibility. How so serious a step may be contrived by a

mere clerk in the Colonial Office may be read in the autobiography of Sir Henry Taylor, who procured the recall of an obnoxious governor by submitting to a compliant Secretary of State a dispatch recalling him. An outbreak of public indignation, like that against Governor Eyre, may be needed to bring about the same result. Dupleix and Frontenac fell before the machinations of their enemies, and the former was allowed to die in misery. Hastings was impeached. Articles equivalent to impeachment were drawn up against a Governor of New South Wales, who, like Clive, suffered the indignity of having his administration scrutinized by a committee of the House of Commons. Lastly, as a single English king was brought to the block, so has a single governor, and he the creature of an insurrection, expiated his rebellion on the scaffold.

The election of governors recalls the election of Frankish kings, but really repeats that of the governors of commercial companies; how powerful such elected functionaries may become is shown by the chairman of an English railway company and the American boss. Leaders like Smith or Winthrop, Cargill of Otago, or Godley of Canterbury, who give to young colonies cohesion and the power to survive, or carry them through perils, are their rulers by indefeasible sovereignty; in form they may, as in Massachusetts, be only the presidents of the company out of which the colony has sprung. Re-elected for twenty years, like Winthrop, or thirteen, like Endicott, they may confer on the office a duration equal to that of inheritance, and may show an independence greater than a hereditary or an appointed officer can safely assume. Creators of colonies, like Baltimore, Penn, and Oglethorpe, repeat a type that must be rare in history, if indeed they do not originate the noblest of all types of ruler, and are kings by a diviner right than that of any known sovereign.

The governor being the brain (or the active portion of the brain) of the body politic, the *administration* is his limbs, and expands from him with such improvements as new circumstances permit and such modifications as they require, in the same manner as it had done from the sovereign in the mother country. Not that each colony passes through all the stages through which the latter pass; that depends on the date at which the colony was given off. Massachusetts and Virginia alone of the North American colonies, New South Wales and Tasmania alone of the Australasian, described most of them; in the younger colonies the earlier ones were dropped. Thus (to mention a single point) the office of Colonial Secretary (who was originally the [58] governor's secretary, as the Secretary for Ireland, till the other day, was only the Lord Lieutenant's secretary) differentiates into several ministries, as the department of Secretary of State had differentiated in England. An anomaly is worth noting. In the United States, where the whole people is the fountain of power, the ministers are the servants of the President, appointed and dismissed by him. In England, while they are still in theory her Majesty's ministers, and the Prime Minister is nominally selected by the sovereign, by a remarkable transformation they have become the servants of the legislature—that is, of the people. The two countries have exchanged institutions, as Hamlet and Laertes exchanged rapiers. The explanation is historical. The United States parted from the development of Britain at a time when the executive was, far more than now, independent of the legislature and dependent on the sovereign. The framers of the Constitution of the United States, looking at the British Constitution from without, and ignoring the subtle checks and balances that gave the lie to Montesquieu's too rigid trichotomy, petrified a still developing system, and dug a gulf between the executive and the legislature. But in England, with the growing weakness of the crown and the growing strength of the legislature, the ministers have gone over to the popular side. The younger British colonies were founded at a time when this development was already far advanced, and they have repeated the evolution. A curious consequence ensues. While in a monarchical country and its colonies a manifestation of public opinion can in a week bring the most powerful ministry to its knees, the President and ministers of a popularly governed country pursue their irresponsible course in apparent indifference to either pulpit or press.

A similar cleavage divides the *legislative* structure. The governor of crown colonies, like the sovereign, is at first the sole, and through his ministers to the last the chief, legislator; the legislature is created by concessions wrung from him, and its history is the record of successive limitations of his authority. In charter colonies the legislature is the creation of the people, and the laws are made by its deputies. A single tolerably perfect example of each type is chosen. The early history of New South Wales is one of the best preserved specimens in the museum of political paleontology. During its earliest years the governor was as absolute as the first Norman sovereigns. William Rufus might ask: "You Taillebois, what have you to propose in this arduous matter?... Potdevin, what is your opinion of the measure?" And Philip, hunter or king, might as unceremoniously solicit the advice of the chaplain or the commander of the forces, but they were under no obligation to take it; and the earliest laws, like the capitularies of Charlemagne, were [59] public orders or proclamations. Under the sixth governor, when civilian officials had arrived, his authority received its first limitation: a small council was instituted, consisting of the chief justice, the attorney general, and the archdeacon of Sydney. A few years later the council was enlarged by the inclusion of new officials, and an equal number of unofficial citizens, who were, however, nominated by the crown. So far, we are still in the twelfth English century. In 1828 began fourteen years of agitation for an elective council, and with 1842 we arrive at the colonial Magna Charta. The concession had hardly been made when, with the influx of fresh settlers, another agitation for all the rights of self-government was begun. It was complicated with the convict question, as the politics of the United States was long complicated with the slavery question, but was not settled with, though it may have been accelerated by, the settlement of that in 1848. Eight years later full self-government was granted, largely through the agency of one man. As a Wentworth had aided in subverting the liberties of Englishmen, a second Wentworth redeemed the honor of his name by proving the Shaftesbury of a second revolution, and procuring freedom for their Australian descendants. Subsequent developments repeat the English reforms of 1832, 1867, and 1881. Thus the colony described in less than a century the

evolution which it had taken the mother country fourteen hundred years to accomplish. Younger colonies, omitting the earlier stages, ran the same distance in far shorter periods.

They are not only repeating, they are anticipating, the history of the parent state. Female suffrage has been conceded in two Australasian colonies, and it is inevitable in the rest. The domination of a socialist democracy is far advanced in the two former. The referendum, or direct appeal to the people on specific issues, is on the eve of general enactment. Ministries elected by the legislature are possibly in the near future. Thus legislative bodies which sprang from the crown are more democratic than those that sprang from the people. Withal, the former retain an anomalous vestige of their origin. While the business of legislation in Congress is necessarily conducted by members who have no official connection with the executive, as it was originally in the English Parliament, the British and colonial ministries claim an ever-increasing monopoly of legislation on all questions of any magnitude. It has long been recognized as impossible for a private member to carry through the House of Commons a measure of any consequence, and a colonial ministry arrests the progress of a successful bill by intimating that the subject of it can only be legislated upon by the Government.

The free involution of a legislature from below is naturally more rapid than its reluctant [60] devolution from above. The swift development of the Massachusetts Company into the Massachusetts Legislature has been ably traced by Professor Fiske, who is a sociologist as well as a historian. The attempt to transact public business at a primary meeting of all the freemen in the colony, assembling four times a year, repeats the old Witenagemot, and failed for the same reason as that died out—because, from the expansion of the population, the assemblage was impracticable. It needed only four years for the freemen to acquire the right of sending deputies to the General Court, and only fifteen to bring about a permanent division into two Houses. Other early colonies passed through the same stages; colonies of later foundation took up the development at the bicameral stage. It is the history of a land and colonization company of those days, or of a railway company in ours. The directors become a Senate and the body of shareholders the popular House; the statutes of the company are its constitution and the by-laws its legislation. The origin of charter legislatures in a company explains a parallel anomaly to that in crown legislatures. While the representative Houses in British colonial legislatures have followed the House of Commons in gathering all power into their own hands, in states descended from the charter companies the House of Representatives has been losing, while the Senate has gained authority. In both cases the apparent anomaly is the outcrop of a deeper law. The ministry in the one case and the senate in the other are each the embodiment of that continuous social germ-plasm to which the popular will of the hour stands in the same relation as the individual life does to the physiological germ-plasm; and, as the latter is the true substance of the body, the social germ-plasm is the substance of society, incarnating its permanent interests, and therefore justly overriding the cries, the whims, the passions of the hour.

The same dichotomy is visible in the colonial *judicature*. The *paterfamilias*, the village elder, the tribal chief, the king, possess and personally exercise an undelegated jurisdiction. Fully twenty years ago a sociological worker surprised a historian of some pretensions, who was conversant with the mere events of his special period, by informing him that the practice of English kings to preside in their own courts of justice came as far down as that very period—the reign of James I. This prerogative was transmitted with the other attributes of royalty to the governors of crown colonies, who "generally acted as judges, sitting in the highest court." A New Jersey Cincinnatus revived primitive simplicities by hearing causes seated on a tree stump in his fields. The successive delegations of this power repeat the necessary concessions that created [61] the English judiciary. Side by side with the royal prerogative grew up a popular jurisdiction which developed into the jury; and it would be worth while to compare the acquisition of this constitutional right (for example, in Connecticut and New South Wales) with its history in England. Out of this element, and also as a corollary from the election of a governor who was chief judge, came the practice of electing judges in the North American colonies. It was by no means confined to the charter colonies. Nowhere was the determination toward an elective judiciary more noticeable than in Pennsylvania, whose proprietary was its feudal sovereign. It may be historically explained from the corrupt and servile judicature of the age when these colonies were founded. The attachment to the old system in contemporary British colonies may also be explained from the very different point in the history of the mother country when they were given off, when the talent, the purity, and independence of the bench had become the pride of Englishmen, and the judges were Baconian in everything but the taking of bribes. The English and (naturally in a far less degree) the colonial courts still show traces of their royal origin in the antiquated wig and gown, the arrogance of the judges, their haughty point of honor—"contempt of court," and their aristocratic bias. These are counterbalanced by the increasing strength of the popular element. A hopeful bill was a few years ago introduced into a colonial legislature restraining judges from commenting on evidence. A mere act of Parliament would have as much effect on lawyers' loquacity as Mrs. Partington's mop had on the Atlantic. It is, nevertheless, in the direction of restricting the powers of the judges that the more radical colonies are moving. In one southern community certain causes may be tried by a judge with a jury of four, who will probably rise into assessors, and in another that important step is possibly on the point of being taken. The courageous Premier of South Australia, who lately defied the entire English medical profession, has now taken in hand his own not less formidable guild. He proposes that "in proceedings under certain acts the bench is to consist of a judge of the Supreme Court with two lay assessors, one appointed by each party to the suit"; and counselors are peremptorily excluded from such proceedings. In certain other cases litigants may submit statements of their differences to judges who will adjudicate without the intervention of counsel. Thus the same middle point may be reached from opposite termini. A series of levelings down may bring judicatures of royal origin to the same stage as popular jurisdictions have reached by a gradual

leveling up. The courts will then unite the majesty of the law, whose "voice is the harmony of the world," with an impartiality and inexpensiveness that will insure to every citizen the enjoyment of [62] the most elementary of all rights—the right to justice.

Side by side with the process of differentiation within colonies rose up an integration of colonies with one another, which also repeats the history of the mother country. The same principles of authority and consent, again in unequal proportions, are blended here. It was by conquest that the seven old English kingdoms were welded into a united England, Strathclyde incorporated, Ireland annexed. By force disguised as bribery, aided by the patriotic or interested efforts of a few nobles and placemen and in opposition to the will of the inhabitants, Scotland and Ireland were joined to England. Some four or five groups of British colonies have reduplicated, or are now reduplicating, a parallel development. In North America it was preceded and accompanied by altercations among the different colonies. Boundary disputes repeat old English intertribal struggles. Tariff wars are now waged, and commercial reciprocity treaties contracted, between contemporary colonies. New Haven and Connecticut, which consisted of towns federated by consent, were united by force. Voluntary alliances against the Indians or to conquer Canada, or involuntary unions under despotic rulers, associated larger or smaller North American groups from Maine to Maryland. The loose confederation of 1781 was too voluntary to last. The final federation that superseded it had a large element of latent force mixed with consent. It was hardly less a conquest of the North by the South than that of the Heptarchy by Wessex. The Constitution is a monument of Southern ascendency. So it was that, for seventy years off and on, the United States was governed by a Southern oligarchy, whether under the hegemony of Virginia or of South Carolina. The dominion of Canada means (even under a French premier) the dominion of Ontario, with Quebec bribed, and Newfoundland not bribed enough, to enter. In 1876 the ten New Zealand provinces were amalgamated under a central Government which for many years remained that of the earlier-settled North Island. A federation of the Australian colonies planned seven years ago under the auspices of protectionist Victoria, is likely to succeed under the leadership of free-trading New South Wales. Mr. Rhodes is advising the federation of the British colonies of South Africa; forty years ago a federation of all the South African states was designed by Sir George Grey, then high commissioner, but with little patriotism and still less wisdom, for at that time it necessarily implied the dominance of the Dutch element. In 1846 that far-seeing statesman had projected a union of the South Sea Islands with New Zealand. Only four years ago the same aged prophet of federation, with an eloquence [63] inspired by the theme, outlined to a Liberal audience a scheme for federating the English-speaking peoples. These are dreams; but the dreams of to-day are the realities of to-morrow, and every step taken toward the realization of them is itself a gain.

ARCHITECTURAL FORMS IN NATURE.

By F. S. DELLENBAUGH.

"Semblance of castle and arch and shrine
Towered aloft in the clear sunshine."

The world is old, yet the world is new. It is old in our sight because it has endured for a time that from our puny standpoint seems long, but which, gauged by the standard of eternity, would barely be represented by a single tick on the dial that knows no beginning and no end. It is a work still in process; when it is done the human element will not be here to admire or condemn it. When in the long ages of its development parts of the solid crust have been pushed above the waters, the elements have combined to pull them down and sink them again under the seas. It is a battle between the waters and the dry land, and when during the refreshing shower we see the rivulet at our feet brown with mud, we see the victory of the rain; we see the price the earth is paying to this subtle foe. This warfare goes on day by day, year by year, age by age, and will go on as long as a dry rock rears its head above the deep. The rains and frosts and winds, acting on the exposed surface with unceasing energy, have in many localities produced strange contours and striking resemblances to objects familiar in our daily life, especially to buildings and other structures due to the hand of man. These are often on a giant scale. But, in addition to the quality of size, these natural forms possess as well the ever-important element of beauty, without which bigness is [64] vulgarity. Nature is never vulgar. Whether we look upon the roadside violet that wilts under the touch, or whether we stand wondering at Niagara, or strain to see the tiptop rock of the Grand Cañon, we may always discern a radiant beauty, which pervades the world to its foundations, and is poured out upon us unmeasured and unpriced.

Fig. 1.—Completed Bridge.
NATURAL BRIDGE VIRGINIA

So these architectural forms that result from the perennial battle between the dry land and the sea, no matter what their size, are charming in majesty, in proportion, in harmony of color, and in variety and grace of outline. Our imaginations are

FIG. 2.—COMPLETED ARCH.
NATURAL ARCH ARIZONA

constantly in search of resemblances, and it is not strange, therefore, that every land presents to human curiosity numerous specimens, though it must be admitted that the mind is sometimes taxed to discover the likeness. On the other hand, some are so evident as to have acquired a world-wide celebrity. The Natural Bridge of Virginia (Fig. 1) is not only a resemblance, it is a reality. In the Rocky Mountain region are numerous other bridges formed thus naturally. In the Cañon of Desolation, Green River, Utah, far above the water are many natural arches in the thinner salients of the monster cliffs. These perforations are often two thousand feet above the river, looking like enormous windows opening on some other world. In one a pine tree that must have been at least a hundred feet high was growing, and its top was many feet below the crown of the arch. Wherever this particular formation is exposed, these arches or bridges occur in all stages of development. The sandstone of this formation has the peculiarity of fracturing conchoidally, and when the face of a cliff contains one of these fractures (due to weathering) and is not thick, some crevice is sure to [65] open a path to the enemy, which is soon widened to a highway for the frost and rain, and a cascade in shower-time pours down, picking up sand as it goes to help in the attack. The weathering becomes more rapid, the arch opens up, and in time a natural bridge (Fig. 2) spans the air where once there was but solid stone. The process continuing, the bridge will disappear, a vacancy will take its place, and far off in the river bottom, or still farther in the sea, will rest the disintegrated material that once made part of the continuous cliff. Where the cliff is too thick to be perforated (Fig. 3), the arch breaks back into a deep cavern whose roof falls and falls till the blue sky takes its place. Thus has a natural bridge, like a flower, its birth, its growth, perfection, and decay. Wind erosion also plays a part, but the chief work is due to water.

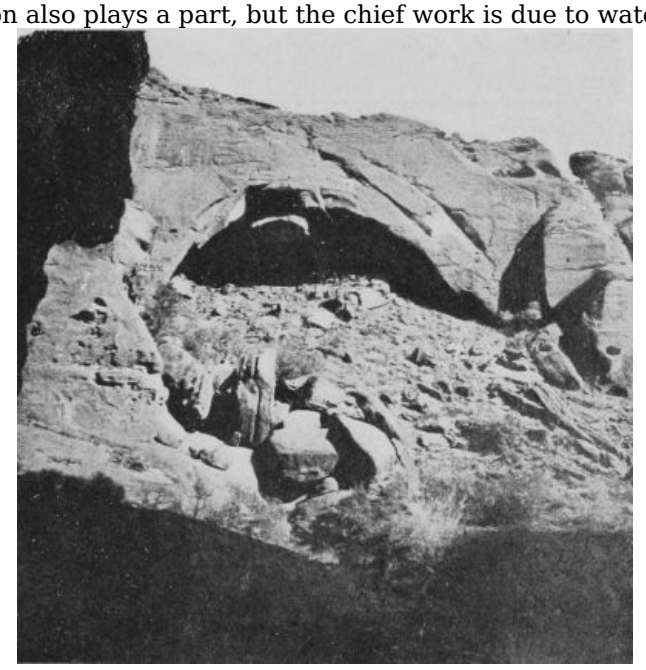


FIG. 3.—MIDDLE STAGE OF A BRIDGE OR ARCH.

Besides bridges there are numberless other forms. Who has not seen Castle or Pulpit Rocks, or Devil's Slides, or Palisades, etc.? But it is in the West, perhaps, that the most remarkable rain carvings and wind carvings occur, and especially in that part called the Southwest, that "land as old as time is old," that strange, weird land of red rocks, of tall, long cliff lines like mountain ranges split asunder to span the desert in their nakedness; that land of labyrinthine cañons, where the bloom of morning lingers to kiss the gloom of night; land of isolated buttes that frown [66] in lofty silence on the lower world like monuments belonging to some cemetery of giants; land of *mesas*, plateaus, pinnacles, and peaks.

FIG. 4.—GARDEN OF THE GODS.
STEEPLE ROCK COLORADO

The massive red-and-yellow buttes at Green River, Wyoming, are familiar to passengers on the Union Pacific Railway, and have been beautifully rendered on canvas by Thomas Moran. Visitors to Colorado Springs will not forget the superb "Steeple" and "Cathedral" rocks in the Garden of the Gods (Fig. 4), whose gorgeous vermilion is thrust vertically into the Colorado blue; and many there are who have seen the wonders of the Yellowstone and the Yosemite. In all these places there are architectural forms that have justly received the admiring tribute of thousands, yet in more remote regions are forms quite as remarkable that have seldom been seen by the eyes of white men.

While riding northward across the Navajo Indian Reservation from Fort Defiance, I well remember seeing, at a distance of a mile or so, which may have "lent enchantment to the view," an immense arch in red sandstone, and, more interesting still, one of the most perfect suggestions of a building I have ever seen. To go closer at the time was not practicable, nor even to stop for a more deliberate study, but they were in sight from the slow-moving cavalcade for a considerable time, and I have always remembered them as about the most perfect architectural forms I have seen in all the West. [67]

Pinnacles and multitudinous other forms were also there, and a close inspection would doubtless have discovered many quite as near perfection as those which attracted us from afar.

In other places in this same locality huge volcanic masses had been pushed mysteriously, in remote geological time, here and there through the strata of sandstones, and the layers of water-made rocks having been subsequently cut away by the rains, the harder fire-made rocks offering more resistance were left behind in tall spires, towers, and various fantastic shapes. To one of them, revealing from the mountains above it a central mass with winglike dikes spreading out on each side, the Navajos have applied the name of *Tsebetai*, "The Stone Bird," and by this name it is now known to all who enter the barren and peculiar country. Gazing down upon it one day from the crest of the Tunicha Plateau, I was instantly impressed by the felicity of the Indian title, for there it lay upon the plain exactly like a great buzzard petrified with wings outstretched for flight.

FIG. 5.—THE CAPTAINS.
ARIZONA

As a rule, it is not the volcanic rocks that furnish the close images of bird, beast, or building. The sedimentary or water-made rocks yield the greatest number and the closest resemblances. Even in towers and pinnacles the water-made rocks, though softer, come out ahead, frequently sending up their splendid shafts to hundreds of feet, or to a full thousand, like the "Captains" in De Chelly Cañon, Arizona (Fig. 5). Minarets and spires from one hundred to three or four hundred feet high might be counted by thousands in the cliff and cañon country.

In far-away Greenland Dr. Kane came upon the red sandstone, "dreamy semblance of a castle flanked with triple towers, completely isolated and defined," which he named the "Three Brothers Turrets" (Fig. 6). Not far from this he found a still more singular and impressive shaft, whose poetical symmetry caused him to name it "Tennyson's Monument" (Fig. 7). This he describes thus: "A single cliff of greenstone, marked by the slaty limestone that once incased it, rears itself from a crumbled base of sandstones, like the boldly chiseled rampart of an ancient city. At its northern extremity, on the brink of a deep ravine which has worn its way among the ruins, there stands a solitary column or minaret tower, as sharply finished as if it had been cast for the Place Vendôme. Yet the length of the shaft alone is four hundred and eighty feet, and it rises on a plinth or pedestal itself two hundred and eighty." [68]

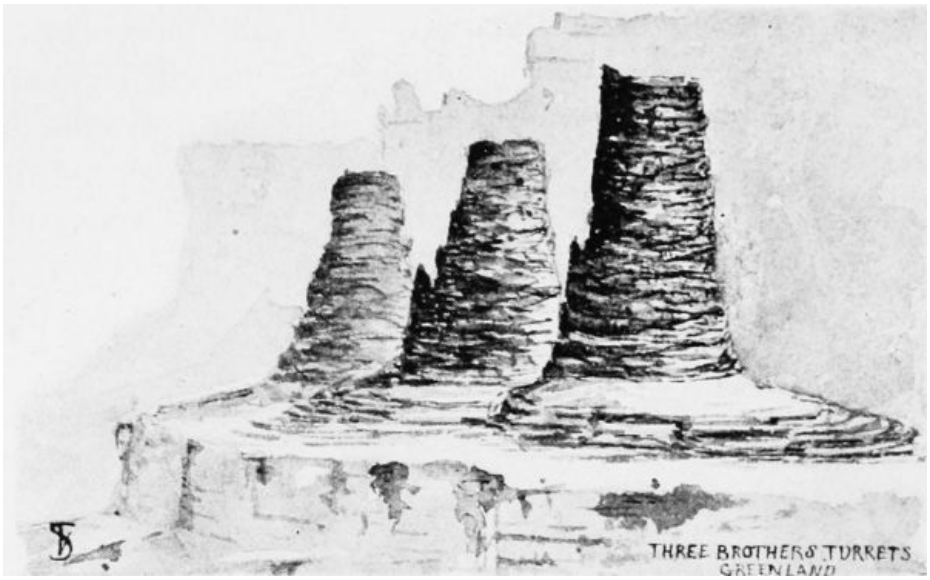


FIG. 6.—THREE BROTHERS TURRETS.
GREENLAND

In some of the cañons of the Great Walled River, the Colorado of the West, turrets, pinnacles, and even natural arches stud the walls with countless imitations of architectural forms, every bend of the stream offering some fresh novelty. In parts of Marble Cañon the high walls are eroded into endless alcoves, caves, towers, weather-beaten castles, and a thousand and one weird or fantastic forms. One night, just below our camp, was a perfect semblance of a ruined castle. Around the indentations which answered for crumbling windows clung carelessly bunches of mosses and ferns, while at one side from a mass of emerald verdure, rendered greener and sweeter by contrast with the miles on miles of barren red cliff up and down, gushed forth a clear spring whose waters, churned to silver, dashed through the vines into the deep river a hundred feet below.

In the Cañon of Desolation, twenty-four hundred feet above the surface of the river, surrounded by pine trees, is a formation that seemed from below so exact a counterpart of a pioneer log cabin that it was difficult to believe it was only a deception. The beetling wall which it surmounted was named "Log Cabin Cliff."

FIG. 7.—TENNYSON'S MONUMENT.
GREENLAND

Another class of resemblances are those called "domes." The Domes of the Yosemite are a well-known example, but the Five Domes of the Virgin River in southern Utah are perhaps quite as wonderful, while having the advantage of more inviting color. The region surrounding them is one of the most remarkable scenic spots on the continent, and in time will become as celebrated as the Yosemite or the Yellowstone. It has fewer freaks and curiosities, perhaps, but probably more real beauty. Not far from the Five Domes are the Temples of the Virgin (Fig. 8), similar to the domes, but more rugged at the top. These are veritable temples of the gods, solid as the rock-ribbed earth itself.

[69]

FIG. 8.—TEMPLES OF THE VIRGIN.
UTAH

There are also in some places domes hollowed out. In Glen Cañon of the Colorado, a little below the mouth of the San Juan, is a dome of this character carved out of the homogeneous sandstone by the action of a pretty brook, which in fair weather is a mere rivulet, but in rain time is an angry flood, sweeping down on its tide immense quantities of sand. This little stream enters at the back of the cavern through a very deep, narrow cleft, not more than a foot or two wide, and after a plunge of some thirty feet or more into a clear pool trickles on out to the river, which flows past the entrance. The chamber is about two hundred feet high, with a narrow crevice twisting on up to the top of the cliffs, about a thousand feet, while the area of the sandy floor is about two hundred by five hundred. Its mouth is barred by a little grove of box-elder trees. When the storm is abroad the innocent brook grows to a giant in an hour, because of the rain accumulating on the barren, rock-surfaced country as on the roof of a house, and, gathering the load of sand in its impetuous clutch, it hurls it against the bounding walls, thus doing its part in the war of the waters against the land. I have counted dozens of these cascades leaping over the cañon walls during heavy rainstorms. An exploring party once camped within the dome mentioned, and, thinking it rendered well their songs, they named it "Music Temple." Some carved their names on the soft sandstone wall, and three of these a short time after were sent by the Indians to the Great Dome of all.

The extensive Pink Cliffs, forming the escarpment of the southern edge of the Great Basin, are of the colonnade type, and for many miles their exquisite color and massive columnar façades

[70]

crown the high country ten thousand feet or more above the sea, visible far to southward, and with the underlying Gray Cliffs and the still lower down Vermilion Cliffs (which find their beginning in Glen Cañon of the Colorado, and trace their serpentine line leagues to the west to meet the Temples of the Virgin) form one of the most magnificent panoramas to be found anywhere in the world. Detached and isolated portions of these Pink Cliffs, surrounded by the upper members of the Gray, produce sometimes novel effects. I recall one sunny morning when I found myself suddenly in a silent grassy glade, green and gray all round, with before me what can be likened only to an immense pipe organ, its delicate pink columnar pipes standing full two hundred feet high against a somber background of pines where Æolus could be heard sighing for the lost chord.

Major Dutton, in his Geology of the High Plateaus of Utah, says of these Pink Cliffs: "The resemblances to strict architectural forms are often startling. The upper tier of the vast amphitheater is one mighty ruined colonnade. Standing obelisks, prostrate columns, shattered capitals, panels, niches, buttresses, repetitions of symmetrical forms, all bring vividly before the mind suggestions of the work of giant hands, a race of genii once rearing temples of rock, but now chained up in a spell of enchantment, while their structures are falling in ruins through centuries of decay. Along the southern and southeastern flank of the Paunsagant (plateau) these ruins stretch mile after mile. But the crowning work is Table Cliff in the background. Standing eleven thousand feet above sea level and projected against the deep blue of the western sky, it presents the aspect of a vast Acropolis crowned with a Parthenon. It is hard to dispel the fancy that this is a work of some intelligence and design akin to that of humanity, but far grander. Such glorious tints, such keen contrasts of light and shade, such profusion of sculptured forms, can never be forgotten by him who has once beheld it."

Thus everywhere the imagination is roused to the comparison of the natural and the artificial; with little effort it discovers classic outlines in these rain-carved forms. And occasionally there is something uncanny about them. In eastern Utah, some miles from the point where White River joins the Green, and close by the former stream, lies a whole group of natural edifices, to which General Hughes applied the name of Goblin City. Remote and lonely at the time of our visit, in the midst of a hostile country, the numerous small houselike buttes, resting like a real town in the bottom of the rugged, desolate gorge, seemed about to pour out an angry host, to stop our further entrance into their weird and forbidding land. The broken cliffs through which we had descended to the "City" presented detached rocks here and there looking like petrified guardsmen who might only be revived by the Prince's kissing the Sleeping Beauty, somewhere perhaps to be found in this goblin realm. [71]

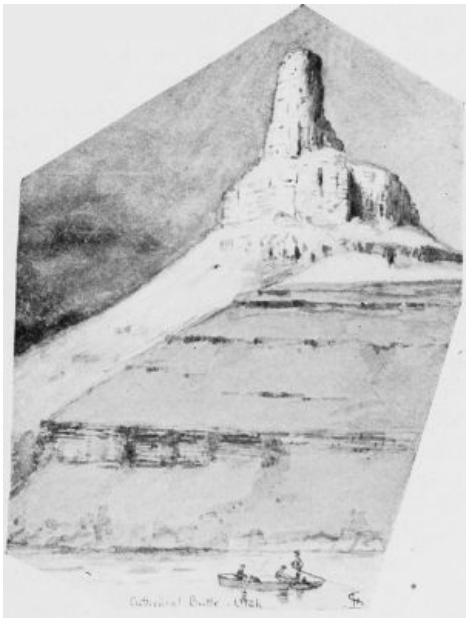


FIG. 9.—GUNNISON'S BUTTE; 2,700 feet above river. UTAH

Gunnison's Butte, on Green River, not far from the point where the brave captain crossed the stream in 1853, is a fine example of what may be called the cathedral type (Fig. 9). Rising supreme in colossal dignity twenty-seven hundred feet above the river bank, in its tender color, in its splendid lines, it is without a rival. On its southwestern part, toward the base, the numerous abutments and little slopes crowning them are of a pure delicate blue, rivaling the tint of a summer sky. Extending far to westward, these Azure Cliffs, which begin with Gunnison's Butte, present one of the most remarkable and beautiful touches of color the rocks have ever unfolded. Near the mouth of the San Rafael, Dellenbaugh's Butte (Fig. 10) exhibits a different type, likened by the explorers of the region to an art gallery, because of its broad roof and simplicity of outline. Four hundred feet high, its chocolate-brown mass rests beside Green River, silent, serene, as if waiting for the jury to finish arranging the exhibit and open the doors to the public.

FIG. 10.—THE ART GALLERY. DELLENBAUGH'S BUTTE UTAH

Monument Rocks near Colorado Springs are well known for their fantastic shapes, but another set of similar monuments in southern Colorado are not so familiar, and have been formed in a different way. Those near Colorado Springs are due to a hard spot in the rocks acting as a kind of roof for the portions below, but in the other case the resistance has been offered by fragments of basalt rolling down to a plain from a neighboring hilltop, and assuming protection over the area upon which they happened to rest. Thus they soon found themselves topping numerous adopted monuments twenty or thirty feet high (Fig. 11). [72]

One of the most out-of-the-way regions left within our boundaries is that lying around the junction of the Grand and Green Rivers in eastern Utah. These two rivers, flowing at this point in cañons about twelve hundred feet deep, come together in a cañon thirteen hundred feet deep to form the Colorado. You climb out from the junction by a

narrow crevice, and on top find yourself on a barren, much-cut-up plateau. The surface is verdureless, consisting for the most part of bare rock split by numerous crevices. You are in the midst of "The Land of Standing Rock," as the Indians call it. Powell, in referring to this locality, says: "We must not conceive of piles of bowlders or heaps of fragments, but a whole land of naked rock, with giant forms carved on it; cathedral-shaped buttes towering hundreds or thousands of feet; cliffs that can not be scaled, and cañon walls that shrink the river into insignificance; with vast hollow domes, and tall pinnacles and shafts set on the verge overhead." Near and far in all directions the eye encounters pinnacle after pinnacle, butte after butte, cliff after cliff, like a stone forest, impassable, impenetrable, except to the trained mountaineer. Some of the shapes here are most peculiar. One which I call [73] the Synagogue (Fig. 12), as no other name, so far as I know, has ever been applied, is representative. Its lines are strikingly like those of the temple of Khandaria in Khwahrao, Central India. It has a round main structure, showing several deep lines of horizontal molding, and is of a deep reddish-brown color. The "roof" is a light pinkish red, as I remember it, and rounds up to a central cupola of the lower color. Springing from the front is a beautiful minaret, carrying the darker color to the apex.

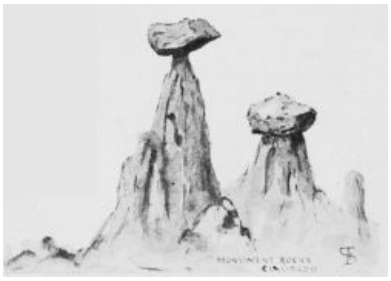


FIG. 11.—BASALT TOPPING EARTH.
MONUMENT ROCKS COLORADO

FIG. 12.—THE SYNAGOGUE.
UTAH

Though strange rock structures abound in all this region, it is in the specially arid portions that they are most common. The strata being unprotected by vegetation, the wearing away is more rapid, and follows more eccentric lines. The higher and drier a locality, there—provided there is some rainfall—will be found the most extraordinary rain carvings. The lack of abundant rain prevents the growth of vegetation and the altitude permits the rain torrents to carry loads of sand, and the more sand and velocity the greater the scouring. In some of these intermittent stream courses the sand and bowlders scoop out deep holes like huge pots—a variety, in fact, of the hole known in geology as "pothole" (Fig. 13). These are very deep and sometimes provide a thirsty traveler with a draught of clear water that has lingered from the last shower. In some places these "pockets" or "tanks" supply the only water to be had, and it is a glad sight when one sees a pocket before him. Each formation has its own peculiarities of erosion, or as Dutton aptly puts it, "its own school of natural architecture." Given, then, a particular formation exposed to the atmosphere, it can be foretold just what its natural architectural forms will be, whether domes, minarets, pinnacles, arches, towers, or what.

[74]

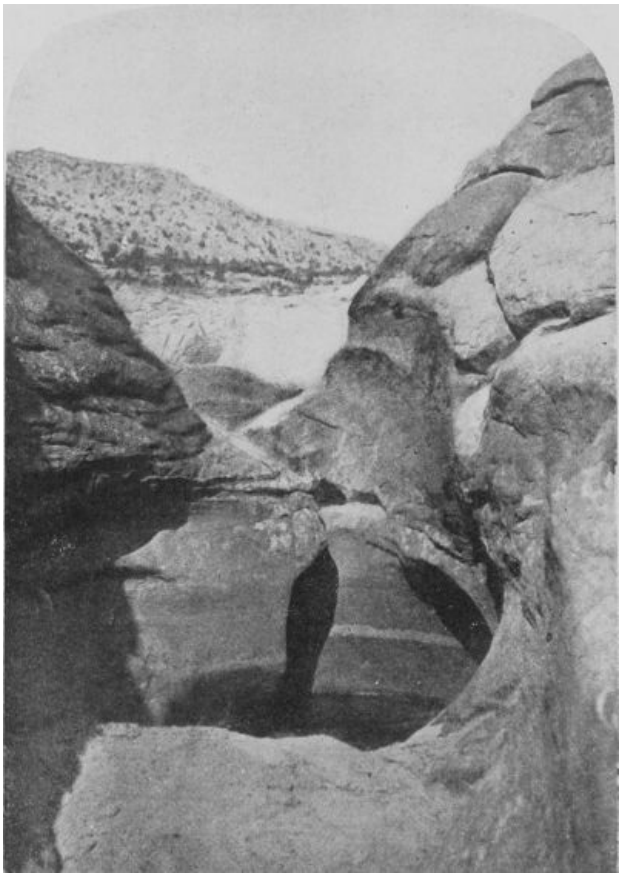


FIG. 13.—POTHOLES IN INTERMITTENT STREAM COURSE.

Architectural forms are not confined to the United States, nor to the American continent. The Giant's Causeway in Ireland is a familiar example of what they have in those parts, while under the Arabian sky the conditions resemble those in our arid Southwest, and there we find many fantastic rain carvings. Among these is the Sphinx of El Guerrah, carved by the rain-sculptor doubtless expressly to furnish answers to our "whys and wherefores" concerning this "wondrous architecture of the world."

AMONG the applications proposed for the newly liquefied gases is their use as aids in balloon navigation. An aëronaut having a few bottles of liquefied hydrogen or illuminating gas has the means of increasing the inflation of his balloon when necessary, and need not fear to waste a little gas when he wishes to diminish its levity. Prof. L. Errera, of Brussels, has suggested an apparatus which he calls the *ceinture de natation*, or natation belt, by which these objects can be conveniently accomplished.

THE HERDS OF THE YELLOW ANT.

[75]

BY JAMES WEIR, JR., M. D.

AS far as my observations go, and they extend through a period of twenty years, the aphides which live on grapevines, and which are the peculiar cows of the common yellow ant (*Lasius flavus*) of our gardens, show many curious phases in their life history. Especially is this true of the manner in which they perpetuate their species.

If a colony of aphides be kept under observation during the summer, it will be noticed that several kinds of individuals arise within it. By far the largest number of the herd will be made up of the wingless agamic form—that is, of females which reproduce without mating. In the species under consideration the young (*during the summer*) are born alive, and do not come from eggs.

So rapid is the increase of these insects that overproduction would soon kill off the colony by starvation were it not held in check by the peculiar anatomical and physiological metamorphoses which make their appearance in the offspring from time to time. Every now and then young ones are born which, in the course of time, evolve two pairs of wings; these winged individuals (which are also females and agamic) abandon the colony and produce elsewhere, in turn, wingless and *single-winged* individuals. In autumn both males and females are born; these mate and the females lay eggs.

These creatures secrete a honeylike fluid which exudes from two tubelike teats on the back of the sixth abdominal segment. Ants are passionately fond of this honey-milk and jealously guard and protect the herds of aphidian cows which produce it. They can be seen at all hours of the day, busily engaged in milking their queer kine. They will gently stroke the aphides with their antennæ, thus inducing a free flow of the nectar from the abdominal tubules. Calves effect a like

result by nudging their mothers with their heads; the cows "give down" their milk when thus assaulted by the calves.

Ichneumon Fly laying Eggs on Aphides.

In autumn, as soon as ovipositing has begun, the ants gather the aphis eggs as fast as they are laid and carry them into their nests. Here they remain, carefully guarded and protected by the ants, until they hatch out in the spring, when the young agamic females are carried out by their foster mothers and placed upon the tender grape shoots or buds. This year the ants brought out the young aphides, which formed the herds kept under observation this summer, on the 18th of March. On the 19th they carried them back into the nest; this occurred in the forenoon, when the sun was shining and the air was warm and balmy. About 12 M. it began to storm, and became [76] quite cold; that night there was a hard frost. The ants evidently knew that this change in the weather was about to occur; therefore they removed their property to a warm and sheltered place. I have often watched the ants in autumn when the aphides were ovipositing; the former would caress the latter, and seemingly would endeavor to stimulate and cheer them during the operation. As soon, however, as the eggs were deposited, the ants would seize and carry them into the nest; the aphis mother was left, without any compunctions whatever, to die during the first frost! Her life work had ended, and the economy of Nature needed her no longer.

Ants are always on the lookout for the new colonies which are continually being started by the winged females. As soon as one of these new herds is found by an ant, she returns to the nest and notifies her companions. One or two ants then accompany her to her newly found treasure, which in future is always, night and day, under their watchful care. As the herd increases in numbers, additional herdsmen, or rather dairymaids, are called into service.

Associated with this species are commonly to be found other species of aphides, notably the one which secretes, or rather excretes, a white powdery substance which is to be seen on their backs in soft, plumose masses. On microscopic examination this substance is found to be fairly teeming with microbia. These microbes, at the first glance, seem to be of different species; maturer judgment, however, declares them to be but metamorphic forms of the same individual.

A "white" aphis can be seen in the photograph at the base of the upper leaf stem. With a small pocket lens the details of this creature's structure can be easily made out. There are several of these aphides on the vine, but the one mentioned is the largest and the most conspicuous. They are much larger than the nectar-producers, are oval in shape, and distinctly flattened. In fact, in general outline they are strikingly like that *bête noire* of all good housekeepers—the *Cimex lectularius*. The ants frequently congregate about these little creatures and appear to be paying [77] them some kind of court. When I cut the vine for photographic purposes, six or eight ants were standing about the large individual mentioned above; they soon became aware that some dire calamity had happened, or was about to happen, either to their beloved herd or to themselves, and, becoming frightened, soon abandoned cattle and pasture and fled away in panic terror. I had hoped to photograph them *in situ*, but found this to be impossible with the instruments at my disposal.

The ants do not "milk" these white aphides, neither do they eat the excrementitious substance on their backs. The white individuals, however, seem to be factors in the social economy of the herd, for the ants move them, on occasions, along with the herd to other pastures. Once I saw an ant pick up a white aphis and carry it to a leaf some little distance away from the colony; she then returned, picked up a gravid nectar-producing aphis, and carried her to the spot where she had left the white individual. In a few days a fine herd of "milkers" was to be seen grazing in the new field. I judge from this that these white aphides are in some way useful to, if not absolutely necessary for, the welfare of the herd.

The winged females have both compound eyes and *ocelli*, or primitive eyes, yet they seek the under surface of the leaf, thus seeming to prefer the more subdued light to be found there. The young are always deposited on the under surface of the leaves; in a few days, however, they either migrate of their own accord to the more succulent stems or are carried thither by the ants, which never cease to watch over and care for them.

In order to test this guardianship, I have frequently wounded the vine below a colony of aphides, thus cutting off, to a certain extent, the flow of sap. The ants would soon discover this and would at once begin to move the herd to another vine. The aphis is provided with boring and suction organs somewhat similar to those of the mosquito. In point of fact, it is interesting to note that the ancestors of the mosquito, in all probability, lived wholly on the juices of plants; hence, in this respect, the resemblance is more real than apparent. Aphides, also, like mosquitoes, have the curious habit of elevating their bodies, "standing on their heads," after they have become [78] gorged with food; this can be observed in the drawings.

The cow of the yellow ant should not be confounded with her harmful cousin, *Phylloxera vastatrix*, the deadliest enemy of the grape. Fortunately for us, this last-mentioned aphis does not abound in the United States; in France and other European countries, however, phylloxera has occasioned the loss of millions of dollars.

Notwithstanding the fact that the ants are exceedingly zealous in guarding their property, many of the aphides fall victims to the assaults of their enemies. The most cunning, insidious, and crafty of their foes are the

Cocoon, Larva, Eggs, and Adult of Aphis-Lion (*Chrysopha*). Slightly modified from Comstock.

ichneumon flies, three varieties of which are continually, during the summer months and in autumn, endeavoring to cradle their young in the bodies of the aphides.

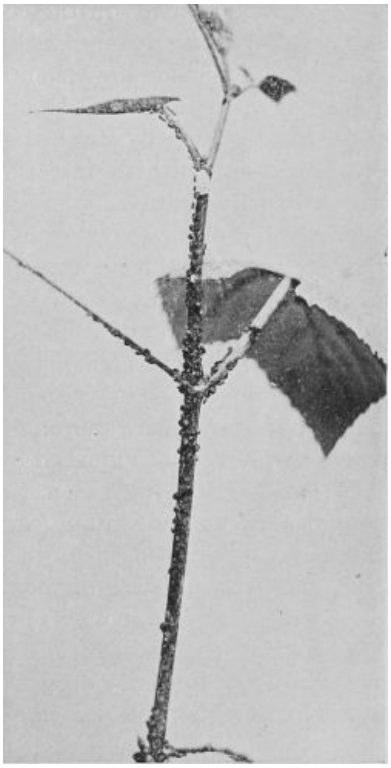
One of these flies, which can be seen in the drawing, is quite large; I am inclined to believe, therefore, that their larvæ do not pupate in the bodies of their hosts, but undergo further metamorphoses elsewhere. Another of these flies is very small, hardly larger, in fact, than the insect which it selects as a living cradle for its young. The ichneumon shows rare intelligence, inasmuch as she invariably deposits her eggs on the young members—the calves, as it were—of the herd; she seems to know that the older aphides would die before the ichneumon grubs arrived at a suitable age for pupation; hence she selects the young ones. She runs here and there about the colony until she finds a young aphis; then, curving her abdomen between her legs, she will quickly lay an egg on the body of the unconscious insect. When the egg hatches the larva feeds on the body of its host (carefully avoiding the vital organs, however) until the time arrives for it to undergo further metamorphoses. The animated cradle and cupboard eventually dies, but not until its queer baby has arrived at an age at which it has no further use for it.

An Aphis-Lion.

The ants are fully aware of the fact that the ichneumon is a deadly enemy of their cows; hence, when one of these flies is seen hovering over the herd, they at once become alert and endeavor to chase her away whenever she alights. She manages, however, to elude them every now and then, and to lodge her fatal eggs on some of the tender young aphides. [79]

Another implacable foe of these creatures is the larva of a neuropterous insect which in its perfect or mature form resembles the dragon fly. It is technically known as an aphis-lion, and differs very widely in habits from the common and well-known ant-lions. The last-mentioned grubs dig pits, at the bottoms of which they lie in wait for and seize their prey whenever it falls therein; the aphidian lion is, on the contrary, a bold and skillful hunter, and takes its prey wherever it may find it. It is an ugly, heavy, slothful-looking grub, yet it is remarkably agile. When darting upon its quarry (and it hunts the winged aphides only), its thick, clumsy-looking legs move with such rapidity that they can scarcely be seen. Its movements as well as its shape are decidedly lacertilian; in fact, when it is seen coursing over the grape leaves in pursuit of its prey, it reminds one irresistibly of the brilliant little lizards which are to be observed running here and there over stone walls, fences, and sunny woodland paths. This creature stalks its prey like the lycosids or hunting spiders, and fairly bounds upon it when it arrives within grasping distance. Its catlike movements when creeping up on its quarry are wonderful to behold, and indicate a very high degree of intelligence.

In color it is jet black; in fact, in certain lights it glistens like a jet jewel. It is about half an inch long and one sixteenth of an inch broad. On the margins of its body, from its head to its tail, are rows of thorn-like spines. Its masticatory organs, as well as its viscera, are much more highly developed than are those of ant-lions. It is a brave little creature, and only succumbs to the ants (which make war on it wherever they find it, thus showing that they are fully aware of the fact that it is inimical to their herds) when life ceases. During the last twenty years I have frequently observed this larva, and have endeavored to follow it in its metamorphoses. I have succeeded only once, however, in carrying it through to its *imago* or perfect form. It is not described in any of my lists, and may be, therefore, a new species. There is another aphis-lion which in very many respects closely resembles the one just described. It is pictured by Professor Comstock, a modification of whose drawing is here produced. He writes of this creature as follows: [80]



"When the aphis-lion is full grown, it rolls itself up into a tiny ball and weaves around itself a glistening, white cocoon, which looks like a seed pearl." (This can be seen in the sketch near the base of the upper leaf.) "It may be supposed that while the aphis-lion is secluded in this pearly cell it repents its greedy, murderous ways, and changes in spirit; at least the body changes greatly, for, after a time, a circular lid is made in the cocoon, and out of it there emerges a beautiful, dainty creature, with delicate-veined, green wings, a pale-green body, slender brown antennæ, and a pair of large eyes that shine like melted gold. It is sometimes called golden-eyes, and sometimes a laced-

wing fly, from its appearance."

This beautiful little insect evinces marvelous forethought in the matter of perpetuating her kind. She knows that her young are predaceous, devouring anything in the shape of an insect or an egg that they can secure; she is aware of the fact that, if she were to deposit her eggs, side by side, on a leaf, the first young aphis-lion hatched out would devour all of the remaining eggs. In order to guard against this, she spins a delicate but stiff stalk of hard silk, upon the tip of which she deposits an egg. By the side of this stalk she rears another, and another, and another, tipping each with an egg, until finally, when she has finished ovipositing, there appears a miniature grove of delicate silken stems, each one of which bears aloft on its summit a round and shining egg. When the first-born of this brood makes its appearance, it crawls down the stem to the surface of the leaf, and goes in search of food, utterly unconscious of the rich and toothsome feast just above its head on the tips of the other stalks!

Lubbock concludes, from certain experiments, that the yellow ant will not voluntarily drop from an elevation. Now, observations and experiments made by myself teach me that these ants (*Lasius flavus*) *will* drop from elevations when they wish to attain a certain object.

On one occasion one of the herds of aphides under observation was discovered by a wandering black ant (*Lasius niger*), which reported her discovery to her comrades. At once a marauding expedition was inaugurated by these cattle thieves, which fiercely attacked the yellow guardians of the herd. The black rievers swarmed up the grapevine, but were met by the brave yellow [81] warriors, which valiantly withstood their attack. Finally, the yellow ants were in danger of being overwhelmed by numbers, when I suddenly perceived that they were being re-enforced. Closer examination revealed the fact that they were crawling up a neighboring vine and then dropping from an overhanging leaf on to the leaf on the stem of which the aphides were feeding. They could not reach the herd by way of the original path on account of the intervening army of black ants, hence their shrewd and most intelligent use of the neighboring vine and overhanging leaf. I am glad to report that the yellow ants were victorious, and that they completely routed the would-be robbers.

When alarmed, the yellow ant will draw in its legs and drop to the ground; moreover, this is characteristic of all vine- and tree-climbing ants, Lubbock to the contrary notwithstanding. It stands to reason that past experiences must have taught them that they received no injury from involuntary tumbles; that they have evolved the habit of voluntarily throwing themselves from an elevation in order to attain certain objects does not seem to me, therefore, at all wonderful or extraordinary.

TWO GIFTS TO FRENCH SCIENCE.

BY M. HENRI DE PARVILLE.

M. ANTOINE THOMSON D'ABBADIE, of the Academy of Sciences and Bureau of Longitudes, France, who died in Paris, March 20, 1897, was born in Dublin, January 3, 1810, of a family of the Basses-Pyrénées temporarily residing in Ireland, but which returned to France in 1815. The d'Abbadies are said to have been descended from the lay monks instituted by Charlemagne to defend the frontier against the incursions of the Saracens. The name d'Abbadie was not originally a proper name, but the title of a function (*abbatia abbadia*), and designated those soldiers who lived in the abbeys of the Basque country, lance in hand. Hence the name, which is well diffused, whether spelled with two *b*s or one.

While still very young Antoine d'Abbadie manifested an unusual curiosity concerning the unknown around him. "What is there at the end of the road?" he asked his nurse. "A river," she replied. "And what is beyond the river?" "A mountain." "And what then?" "I don't know; I never was there." "Well," said he, "I will go and see." He was the same as he grew up, always wanting to know. He visited Brazil upon a mission for the Academy of Sciences, and on his return joined his brother at Alexandria.

Unknown Ethiopia attracted his attention, and he engaged with his brother Arnould in [82] archæological researches. Archæology proved unfruitful, and the two brothers took up geodesy. For eleven years Antoine d'Abbadie traveled though Ethiopia, living the life of the natives, and making himself master of the five Abyssinian dialects. The exploration was difficult and sown with dangers. Antoine d'Abbadie covered the country from Massouah, on the shore of the Red Sea, to the interior of the land of Kaffa, which he was the first to visit, with a triangulation that involved the fixing of five thousand positions at five hundred and twenty-five successive stations. The distance between Massouah and Mount Wocho in southern Kaffa is about one thousand kilometres, a little more than the crossing of France along the meridian of Paris, and the trigonometric network reached two hundred and fifty kilometres in breadth. Antoine d'Abbadie remained in Gallaland from 1837 to 1848. The labors of the two brothers, too numerous to cite here, concerned also ethnography and linguistics. Both were nominated Chevaliers of the Legion of Honor on the same day, September 27, 1850. The doors of the Academy of Sciences were opened to Antoine d'Abbadie August 27, 1867, and he was named a member of the Bureau des Longitudes in 1878. He was in charge of the observation of the transit of Venus in Santo Domingo in 1882.

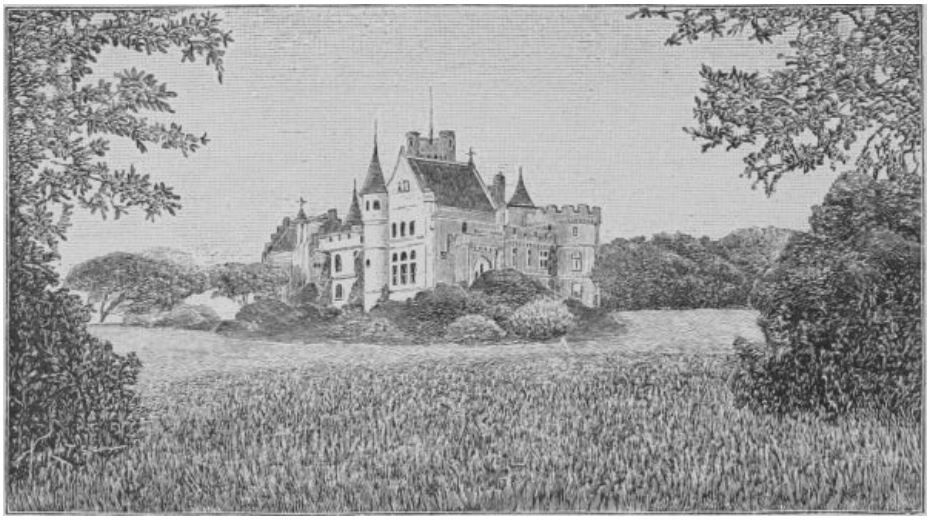


FIG. 1.—CHÂTEAU D'ABBADIE. General view. (A gift to the French Academy of Sciences.)

Instead of devoting himself to a specialty, as is done now to excess, d'Abbadie pursued the scientific movement in its various forms, and was at once an astronomer, geodesian, archæologist, ethnographer, numismatist, and interested in other fields. With his noble character he made himself esteemed and loved during his whole working life by all so fortunate as to make [83] his acquaintance. In an interview I had with him a few weeks before his death, when his disease had already gained a strong hold upon him and he was nearly speechless, he expressed himself freely concerning the future, although he uttered every word with difficulty, and it was easy to see that it caused him pain. The topic was science, and he wanted to talk about it.

When he was president of the Academy of Sciences, a few years ago, he sacrificed himself to be equal to the honor that had been conferred upon him. Speaking was already becoming very difficult to his tired vocal organs. He made extreme efforts during the whole year to fulfill his duty as president, and was punctual at the Monday sessions to the end.

In 1896, feeling the advance of age, he determined to make a splendid present to the Academy of Sciences. The Duc d'Aumale had given Chantilly to the Institute. M. Antoine d'Abbadie gave the Academy of Sciences his magnificent Château d'Abbadie, near Hendaye, in the Basses-Pyrénées, on the coast of the Bay of Biscay. The academy will enter upon the possession of this property, of three hundred and ten hectares of land surrounding it, and of a capital producing a revenue of forty thousand francs (eight thousand dollars) after the death of Madame d'Abbadie. Only a single condition is imposed on the gift. Having carried on his astronomical work at Abbadia and begun there to catalogue the stars and study the variations of gravity, he asked in exchange for his incomparable gift that the academy should complete in fifty years a catalogue of five hundred thousand stars. The bureau of the academy dispatched its president, M. Cornu, and its perpetual secretary, M. Bertrand, to Abbadia as its representatives to express its gratitude to M. and Madame d'Abbadie. The faith of the academy was pledged to continue the work begun by M. d'Abbadie, and a commemorative medal was given him bearing on one side a portrait of Arago, and on the other a minute of the gift and the thanks of the company.

The Château of Abbadia will therefore be devoted to the determination of the stars that are not yet catalogued. Probably, as was the donor's thought, the religious orders or some of the secular priests will perform this colossal labor. The chaplain of the château has already given his service to the work. In any case, those who may live in the château will have no cause to complain of their home. Abbadia is a very interesting structure, built from plans by Viollet-le-Duc, modified and carried out by the architect Duthoit, with suggestions of the fourteenth and sixteenth centuries. The observatory adjoins the château, which it antedates thirty years in building, and has a meridian telescope and the essential astronomical instruments. In the deep cellar of the [84] observatory M. d'Abbadie made more than two thousand seismic observations with the pendulum.

The château stands in an admirable situation, and presents a very fine external aspect. We give a general view of it and a picture of the main entrance. The interior decoration is very beautiful.

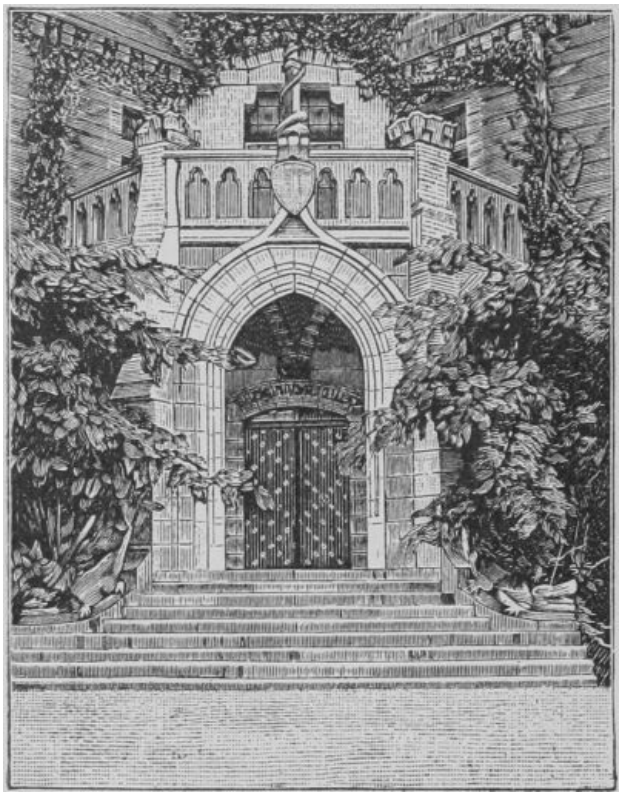


FIG. 2.—PRINCIPAL ENTRANCE TO THE CHÂTEAU D'ABBADIE.

Those who have had the privilege of visiting Abbadia have remarked that a stone is missing from the balcony of one of the windows; this stone, according to the wishes of the donor, is never to be put in place. A history is connected with its absence. M. d'Abbadie, in the course of a journey in America, contracted a strong friendship with Prince Louis Napoleon, who was then in the United States. The prince once said to him, "If I ever come into power, whatever you may ask of me is granted in advance." The prince became Emperor of the French. Napoleon III had a good memory. He met his former companion one day, and said to him in an offhand way: "I promised when we were in America to give you whatever you would ask for; have you forgotten it?" M. d'Abbadie replied: "I have built myself a château near Hendaye, where I hope to spend the rest of my days. If you will be so kind as to go a few kilometres out of the way for me during your coming visit to Biarritz, I shall consider myself highly honored if you will lay the last stone of my house." Napoleon smiled and promised. But that was in 1870, and Napoleon III never returned to Biarritz. That is the reason a stone is missing at Abbadia.

An account is also appropriate here of that other gift to French science and letters of the Château of Chantilly, made to the Institute of France in 1886, by the late Duc d'Aumale, whose tragic death in consequence of the terrible disaster at the Bazaar de Charité, Paris, occurred near in time to that of M. d'Abbadie. The duke was conspicuous as a soldier, as a man of letters, the author of the History of the Princes of Condé, and as a great bibliophile; as a member of the [85]
French Academy (1871), taking the place of Montalembert; of the Academy of Moral and Political Sciences, and of the Academy of Fine Arts; and as a patriot, though a banished prince. The gift was made three months after the decree was issued banishing the Orleans princes from France, and after the duke had expostulated with M. Grévy in vain against the step. The deed reads: "Wishing to preserve to France the domain of Chantilly in its integrity, with its woods, lawns, waters, buildings, and all that they contain—trophies, pictures, books, objects of art, and the whole of what forms, as it were, a complete and various monument of French art in all its branches, and of the history of my country in its epochs of glory—I have resolved to commit the trust to a body which has done me the honor of calling me into its ranks by a double title, and which, without being independent of the inevitable transformations of societies, escapes the spirit of faction and all too abrupt shocks, maintaining its independence through political fluctuations. Consequently, I give to the Institute of France, which shall dispose of it according to conditions to be hereafter determined, the domain of Chantilly as it shall exist on the day of my death, with the library and the other artistic and historical collections which I have formed in it, the household furniture, statues, trophies of arms, etc." The sole condition attached to the gift was that nothing should be changed at Chantilly. The chapel, where the heart of Condé is deposited, should be retained, devoted to worship, with special masses to be said at stated times, [86]
and the splendid collections of the château should together be called the Condé Museum. In 1889 the Government authorized the duke to return to France. He refused to accept the permission as a matter of favor, but only as one of right. He returned, however, and took his seat in the academy in May of that year.—*Translated for the Popular Science Monthly from articles in La Nature.*

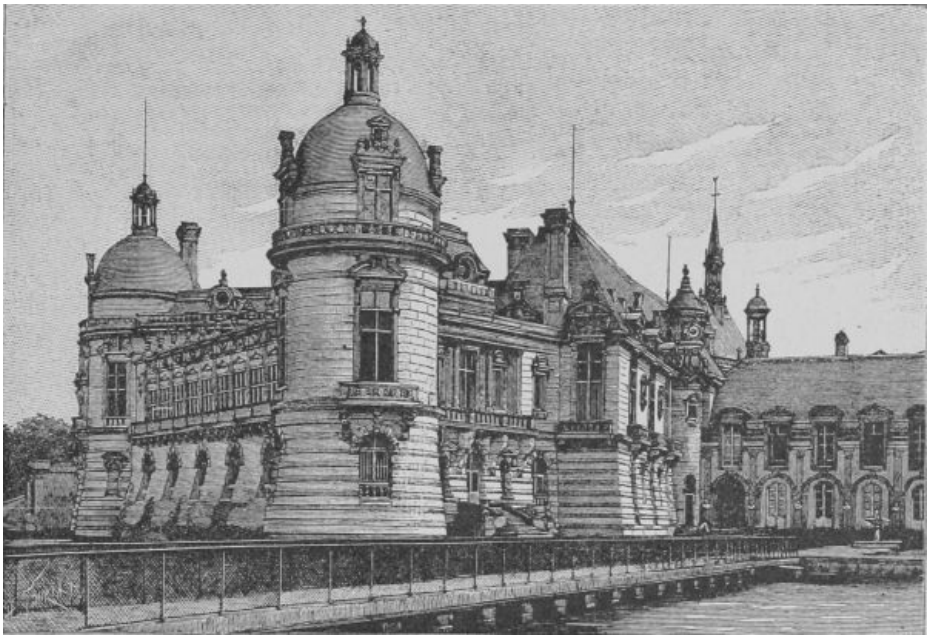


FIG. 3.—THE CHÂTEAU OF CHANTILLY.
(Presented by the late Duc d'Aumale to the Institute of France.)

THE MONGOOSE IN JAMAICA.

BY C. W. WILLIS,
MEMBER OF THE INSTITUTE OF JAMAICA.

ABOUT fifteen or twenty years ago the mongoose (*Herpestes griseus*) was imported from India by the colonial government and introduced into the island of Jamaica, in the West Indies, for the ostensible purpose of destroying the large, gray, white-bellied rat which played havoc with the growing cane on the sugar plantations.

The mongoose belongs to the *Viverridæ*, or civet-cat family, which is closely allied to the *Felidæ*, one of the most widely diversified among the carnivora. But the mongoose differs materially from the civet cats, for it belongs properly to the subfamily *Herpestinæ*, or ichneumons, having toes slender and straight, and separate from one another; the scent glands, so highly developed in the civet cat, being either small or entirely absent. Most of the ichneumons are natives of Africa, but several are Indian, and one form (*H. ichneumon*) extends to southern Spain.

H. griseus is the true mongoose of India, and is the animal imported into Jamaica. In its native habitat it devours snakes, rats, lizards, and other creatures not in favor with humanity. Its color is gray, darker on the head and legs; its feet are blackish, and the end of the tail is tipped with black. Beneath the longer gray- or white-ringed hairs there is a fine, short, reddish under fur. The body of the full-grown animal is about twenty-one inches in length, and the tail eighteen inches.

Like Pharaoh's rat in Egypt, to which it is allied, the mongoose is highly valued in India, and is often kept tame about the houses for the services that it renders in destroying snakes and other plagues. It is especially famous for its prowess in destroying the deadly cobra, a feat performed by force of its superior boldness and activity.

That the little animal has fairly achieved the object for which it was imported can not be gainsaid, but that it would ever become the universal pest which it is at the present day, and has [87] been for several years, was never anticipated. So long as it kept to the cane-growing plantations, and ate the planter's poultry and all young and available animal life, all went well; but with its rapid and prolific powers of reproduction and its vagabond and roaming disposition, in a very short time it was found to be in every part of the island, from the seashore to the tops of the loftiest mountains, the highest peak of which is seventy-three hundred feet above the sea level.

THE MONGOOSE (*Herpestes griseus*) IN JAMAICA.

Though it has not exterminated the cane rats, it has lessened their numbers, and saved the sugar planters a vast sum of money. But it has nearly exterminated the ground laying and feeding birds. It devours poultry and eggs of all kinds, on the ground and in trees, including those of the land turtle, so that the latter, once very numerous and highly esteemed as an article of food by the native epicures, is now seldom found. Here may be mentioned an interesting fact, that the mongoose, in no way a tree-climbing animal in its native India, has become such in Jamaica, as its voracious appetite lessened the numbers of ground feeding and laying birds, and compelled it to take to the trees in order to enlarge its food supply.

The mongoose kills young pigs that roam, half wild, over the island; also lambs and kids. It eats fruits of all kinds, fish, wild fowl, snakes, lizards, and crabs; and the once plentiful edible lizards and land crabs are now rarely seen. All young and tender life, both animal and vegetable, is included in its daily *menu*. When the mongoose has cleared off all the animal life, it turns its attention to the "ground provisions," and here it shows the varieties of its tastes and the strength of its jaws. It will grovel with its paws until yams, cocos, sweet potatoes, cassava both bitter and sweet, and other ground food tubers are laid bare. [88]

Of fruit, the mongoose has a partiality for bananas, the mango, and others, as well as for some of the tree vegetables, such as the delicious akee (*Cupania edulis*), and the avocado, or alligator pear. It will, likewise, when the irrigating canals are drained for cleansing, seize fish and make off with them. Not the least harm it has done has been the destruction of insectivorous birds and lizards, and the consequent increase of another nuisance, the tick. This is a subject which the Jamaica Government is bound to take up in the near future, and there will be found only one remedy—the introduction, propagation, and protection of insect-eating birds, for the question of adopting some plan for the wholesale destruction of the mongoose has thus far proved fruitless.

The mongoose breeds six times a year, and each time there are from five to ten young ones. The animal lives in the hollows of trees, dry walls, and other similar places. Its activity is wonderful, and it very seldom misses its quarry, which, when secured, the mongoose proceeds to mutilate in the groin, first of all drinking the warm blood, then devouring the liver and heart.

In Jamaica there was a very beautiful indigenous snake (*Chilobothrus inornatus*), a friend of the agriculturist, commonly called the yellow or banana snake, which grew to a length of six or seven feet. It is practically extinct, for during the last five or six years it has been nearly impossible to find a specimen. This bloodthirsty little animal has also nearly exterminated another ally of the cultivator, a certain ground lizard (*Anolis corsalis*), which is now very rarely seen.

In its general appearance, except in point of size, it being much larger, it may be stated that the mongoose very closely resembles the common gray squirrel of the northern United States, although the latter does not have feet and tail tipped with black.

COMPARING the flint implements of palæolithic and neolithic age, Prof. T. McKenny Huse exhibited at the British Archæological Institute a series of flints to illustrate his view that in their earlier stages of manufacture the palæolithic and neolithic implements passed through the very same steps—that is, a block of flint was first rough dressed by both palæolithic and neolithic people into the same general form. The neolithic man merely proceeded further on the same lines, afterward finding out the way to grind the edge, and at last the whole implement. With few exceptions, the author said, neolithic flints were found on the surface or in artificial excavations; whereas, as a rule, palæolithic implements were found in deposits that seemed to be due to the sweeping down into hollows or river terraces of surface soils in or on which the implements and other stones lay.

THE CAUSE OF RAIN.[12] [89]

By J. E. PLUMANDON,
METEOROLOGIST AT THE OBSERVATORY OF THE PUY-DE-DÔME.

A great many theories have been invented to explain the formation of rain, some of which are remarkable chiefly for their absurdity or their complexity. Even most of the scientific theories depend too largely on hypotheses and are not sufficiently supported by facts. There are, however, some which are as a whole established on authentic observations, and, although they are still incomplete, they do not, like some of the speculations, contradict facts that are observed every day. For more than thirty years I have studied professionally and because I had a taste for it all the atmospheric phenomena which came before me. Several times I have been so fortunate as to witness, at Clermont, or on the top of the Puy-de-Dôme, the genesis or development of heavy showers, and have fancied that I have detected some of the details or secrets of their formation. In a pamphlet on this subject, which I published in 1885, I expounded the ideas which a large number of observations on fog, drizzle, mist, rain, snow, sleet, and hail had suggested to me; and by means of some of these ideas, the resultant of facts observed hundreds of times, I hope to be able to explain the formation of rain.

First, I must say that heat, and especially moisture, do not vary in the lower part of the atmosphere in the way it was long thought. At extreme altitudes the temperature of the air is very low, but the cold does not increase regularly as we rise, and the same is the case with the moisture. In high ascensions, or while sailing almost horizontal courses, aëronauts traverse atmospheric regions alternately warm and cold, dry and moist. Such anomalies present themselves even near the surface. There are between eighty and a hundred days every year in which a higher temperature is registered for a greater or less length of time on the Puy-de-Dôme than at Clermont. Sometimes the difference is very great. Thus, on the 26th of December, 1879, the temperature was -16° C. at Clermont, while on the summit of the Puy-de-Dôme the thermometer marked +5° C., showing a difference of 21° in favor of the top of the mountain. Differences of temperature of this kind occur everywhere. The moisture of the air varies in the same way through the atmosphere. In ascending or descending a few hundred metres, the hygrometer may be observed to pass from dryness to saturation. At the altitude of the Puy-de-Dôme extreme moisture may succeed almost absolute dryness in a few instants, in a clear sky [90] and without any change of wind.

The parts of the atmosphere included within the same limits of temperature or humidity therefore rarely form concentric or parallel layers. They constitute regions interlacing zones which the clouds, thick or scattered in groups, often mark to our eyes, showing us those which are saturated with the vapor of water. The distribution of these zones in space depends chiefly on the heat action of the sun, and upon preceding and present movements of the atmosphere. Now, if a certain increase of heat is adequate to melt a piece of ice and to transform the water of the fusion into vapor, in like manner a corresponding cooling may suffice to cause the vapor to return to the state of a liquid and then to that of ice. The processes in the atmosphere are not different, and all showers, results of the more or less extensive condensation of the vapor of water, may arise from the cooling of that vapor or of the water which it produces.

A certain volume of atmospheric air is capable of holding in suspension a quantity of water proportioned to the elevation of its temperature. But, for each determined temperature, there is a maximum which can not be exceeded without the excess of vapor returning to the liquid state. If, therefore, an atmospheric region is saturated with vapor, and its temperature falls, that region will give rain. Immense and superabundant causes for the cooling necessary to provoke rain exist in such an atmosphere as we have described. The cooling may take effect in three principal ways: first, by the radiation of different regions between one another and toward interplanetary space, the temperature of which is extremely low, as has been indicated by measurements made in high balloon ascensions; second, by the expansion which air rising in the atmosphere undergoes in being rarefied; and, third, by the mingling of masses of warm or moist air with cold or dry.

Cooling by mixture is the sufficient cause in the majority of cases; and this may be effected from above, by descent of the air from the upper regions; from below, by ascent, with the assistance of rising currents created by solar radiations; or, finally, in any and every direction under the influence of the winds and the general movements of the atmosphere. Furthermore, the cooling need not be very great in order to provoke rain under certain conditions of temperature and humidity of frequent occurrence.

Rain clouds very frequently descend a little below the altitude of the Puy-de-Dôme. It is, therefore, not difficult, in order to determine the degree of cooling necessary for the formation of rain, to take advantage of observations that have been made there. The hygrometer sometimes [91] remains near saturation without there being precipitation of vapor; and, supposing that the temperature is near 3° or 4° C., which is about the mean temperature of the year, it will require a cooling of only one or two degrees centigrade at most for the air to be unable to hold all its vapor and for the excess of it to be transformed into rain. This is confirmed by experiment and observation.

I will mention a remarkable example illustrating this point. Not rarely, when the west wind is blowing violently on the top of the Puy-de-Dôme, an east wind, blowing opposite to it, prevails at Clermont. Then an eddy is formed behind the plateau and the chain of puys that runs from north to south, a little west of Clermont. This eddy gradually becomes a vast whirlwind with a horizontal axis, several leagues long, a few kilometres wide, and seven hundred or eight hundred metres high. It commonly gives rise to an abundant and continuous formation of black clouds, which appear in an instant along its length, following its intersection with the upper current. The phenomenon is frequent, and is sometimes produced under very interesting conditions, as on a certain day when the temperature at Clermont was five degrees above zero, centigrade, while the hygrometer indicated that the air contained seven tenths of the quantity of vapor required for

saturation. Under such conditions the temperature on the Puy-de-Dôme would have only had to be a very little above the freezing point for the vapor of the horizontal eddy to be transformed into rain on meeting the upper current coming from the west. Now, on the top of the mountain the thermometer marked 4°C. below the freezing point. Hence, every time the lower east wind increased a little, this having the effect of carrying the vapor and the air of the lower regions a little higher, the black clouds could be seen developing with a recrudescence of intensity. A few instants afterward a torrential rain fell at Clermont.

In some cases—and such frequently occur in summer—the mingling of strata of air of different temperatures is effected by ascending currents. The sky is clear; the moist air in contact with the soil is warmed under the action of the sun, rises, and more or less quickly reaches a much colder stratum. Light mists are formed; they may frequently be seen rising and spreading out over the warmer or moister spots. On the flanks of the Puy-de-Dôme one may often find himself among ascending currents of this sort which succeed one another intermittingly when the air is calm, after a rain; they rise with a velocity of four or five metres at least per second.

These fogs finally become stationary in a region of the same density with themselves. There they accumulate and form a cloud or a group of clouds that go on developing. When penetrated by the rays of the sun, which they almost wholly absorb, these clouds are warmed up again in the [92] interior, and budding protuberances are seen, which are especially developed on the upper parts of the cloud. These protuberances are formed and grow so rapidly as to almost suggest the presence of a steam generator within every cloud. The external parts of the cloud, however, cool very soon by radiation, evaporation, or dissolution, but especially by their contact with the cold air, into which they continue going. Hence, when the vapors emitted by the cloud reach its periphery, they are cooled at once as if in a condenser; they then take on a rapid movement of descent, which is easily distinguished, and suffer condensation in their lower parts. As the surface of the cloud in contact with the cold air around it is considerable in proportion to that which receives the influence of the solar rays, the warm ascending currents slacken speed and are extinguished, because the cloudy mass, drawn on by the higher currents, removes from the place where it is formed, or because it stops the rays of the sun and prevents their reaching the ground. There results a more and more complete condensation, and the watery vapor is at last transformed into drops of rain. The condensation into rain is accelerated and augmented when the mass of cloud rises with great rapidity, especially when it enters abruptly into very cold atmospheric strata. A sudden mixture of the cloud with the air around it takes place then, and sudden and abundant rains result like those which are produced at the instant of thunderstorms.

The formation and mixture of masses of air of different temperatures are effected by ascending currents in zones of restricted extent, but sometimes very numerous. Local showers and thunderstorms are produced in this way. The phenomenon becomes much more important and at the same time extends over vast regions, when it is brought about by the aid of the wind and the larger movements of the atmosphere, and general rains result.

Babinet, in his Studies on the Sciences of Observation, explains the formation of rain by supposing that when the wind meets an obstacle, it ascends; the moving air cools in rarefying, and deposits its excess of vapor over saturation. This fact, when it occurs, should indeed contribute to the condensation of the vapor contained in the air; but it does not afford an adequate explanation of all rains; for, first, how can it rain on the vast oceans which present no obstacles to cause the air to ascend? It is necessary to suppose that internal movements of the atmosphere intervene in the production of rain.

Monk, Mason, de Saussure, and many others fix the prime condition for the formation of rain in the superposition of two beds of cloud. This assertion, although it is still repeated in a number of treatises on physics, is inexact. A single stratum of cloud—yes, a solitary cloud—has been seen, [93] on the Puy-de-Dôme, to produce rain and lightning, with thunder.

Frequently, under the influence of the centers of perturbation which often exist south of the Alps, a vast sea of clouds, the upper face of which does not exceed an altitude varying from seven hundred to twelve hundred metres, covers all central France, and probably other countries. Only the high table-lands and mountains rise above this stratum of clouds over which the sun shines in a perfectly clear sky. Yet rain is found in such strata of clouds, however homogeneous they may be, and it rains in the regions they cover. I have long been able to affirm this fact, important because it destroys old errors elaborated in the isolation of the study, and to support it with authentic proof.

We may witness the formation of rain when we rise into the usual region of the clouds, either in balloon ascents or by climbing mountains.

The phenomenon may be observed under five aspects: First, we may find ourselves in a fog of greater or less thickness, the hygrometer indicating that the air is nearly saturated with vapor, without one being able to detect the fall of the smallest liquid particle, and without exterior objects being moistened. Second, while we can not observe the fall of a single liquid drop, however small, everything enveloped in the cloud will be rapidly moistened. We are in the atmospheric stratum where the rain is beginning to form. Inhabitants of mountainous regions say at such times that there is a wet fog. At the top of the Puy-de-Dôme, when this condition lasts for a day, we can collect three, four, or five millimetres of water. Third, we may remark, in the fog, the fall of exceedingly fine droplets, which we can hardly distinguish—it is drizzling. Fourth, the rain is falling, while we are still in the fog; and, fifth, the rain is falling and we are below the fog —that is, below the clouds.

These five aspects may be present in the same cloud, when we will find them in the order given in successive strata, one beneath another; so that, entering such a cloud from the upper part, we may traverse, in regular order, "dry" fog, wet fog, fog with drizzle, fog with rain, and, as we leave the cloud at the bottom, rain without fog. Mr. Glaisher, the English scientific aëronaut, thus records his experience in an ascension he made July 1, 1863: "We let ourselves drop at eight

hundred metres, and went into a fog which was dry for the first thirty metres, but shortly afterward became moist. As we descended, the fog seemed to become more charged with water, and seemed very dark beneath us; at five hundred or six hundred metres we heard the sound of the rain striking the trees, so violent was the fall."

Rain drops, in fact, grow as they fall, whether by continuance of condensation, or by union with [94] other drops. They should, therefore, be larger when they issue from the cloud in proportion as the region where drizzle is formed is higher above the base of the cloud. There is, however, a limit to the size they can attain, for the velocity of their fall increases with their mass, and they are divided by the resistance of the air.

The five aspects under which we have regarded the formation of rain are evidently five phases distinguished by our senses in the progressive transformation which the vapor of water undergoes in passing to the liquid state. It also sometimes happens that the condensation of the vapor in a cloud can only reach the first or second stage of the transformation without extending to the other stages. At other times it stops at the third phase, that of drizzling, which may then, as rain does, cross atmospheric regions below the cloud, and reach the ground, provided the base of the cloud is not too high and the air passed through is not too dry. In short, we may conclude that the formation of rain is due simply to variations in the temperature and moisture of the air. There is, however, another element, the intervention of which is indispensable, if not to reduce the vapor to water, at least to cause that water to fall in rain, or under the form of drops. This element is the atmospheric dust.

We designate generally as atmospheric dust all the corpuscles which the atmospheric envelope of the earth holds in suspension; but distinctions should be made. Some dust occurs in the air fortuitously and for the moment, such as troubles us in dry weather when the wind is blowing. This is coarse, and so evident that we say "It is dusty," and soon falls by its weight to the ground. There is other dust which remains in the air almost permanently. It becomes visible to the eye when illuminated against a dark background, as when a sunbeam comes into a dark room. Other dust may be studied under a microscope of low power; and still other, and the largest proportion of that in the atmosphere, is so fine that it can not be distinguished, even with the most powerful instruments.

This extremely fine and light dust is disseminated to heights that may exceed fifteen or twenty or more miles. Cyclones, volcanic eruptions, and immense prairie fires are the principal causes of its production and expansion in the atmosphere. Mr. Aitken, a Scotch meteorologist, has made some remarkable experiments to demonstrate the existence of this dust. For that purpose he employed a very ingenious method, which permitted him to count all the particles, even those which could not be seen with a microscope. The principle of his method is as follows: If we fill a receiver with air that has been deprived of all its dust by passing it through a liquid, and saturate [95] it with vapor, and then by cooling cause the vapor to condense, the resultant water is deposited directly. If the receiver is filled with air not cleared of its dust, the cooling of the mixture of air and vapor provokes first the formation of a fog that marks the presence of dust, because each particle of dust becomes a nucleus, a center of condensation, for the vapor. Finally, if the cooling is carried far enough, the water formed falls in very fine droplets, each one of which incloses a dust particle. Mr. Aitken has succeeded in counting these droplets, by introducing only a very small volume of dusty air into the receiver and finally filling it with absolutely pure air. He has thus found that the external air contains on the average 32,000 particles of dust per cubic centimetre after a rain of considerable duration, and 130,000 particles in fine weather. There are 1,860,000 particles in the same volume of air in the middle of a room, and 5,420,000 particles near the ceiling. The figures look fanciful, but they are exact, for they have been corroborated by numerous consistent experiments and agree with the determinations that have been made by other methods.

As to the formation of rain, it should be observed that absolutely pure air can not give either fog or drops of water when it is supersaturated with vapor. If there were no dust in the atmosphere we should have no clouds or rain. The sky would always be clear, and the sun would shine uninterruptedly as long as it was above the horizon. There would be no dawn or twilight, and day and night would succeed one another instantly, without transition. Atmospheric water would be deposited only when in contact with things, as in Aitken's experiments, very much as dew is deposited.

The causes of the formation of rain are evidently the same everywhere. The secondary conditions change only according to climates; but they vary so much that rains are distributed very unequally over the earth. According to Desanis, the quantity of vapor contained in a column of air as high as the atmosphere would give, in France, a layer of water about four centimetres thick. Few rain storms would furnish so much; but there are storms sometimes that give much more. On August 17, 1888, seven centimetres of water fell at Clermont in five hours; and September 12, 1875, the pluviometer measured ten centimetres for the whole day. Still more copious rains fall in some tropical countries; at Purneah, in India, eighty-nine centimetres have fallen in twenty-four hours.

Mr. John Murray has calculated, from the charts of Elias Loomis, that the quantity of rain falling every year over the whole earth would form a bed of water averaging nine hundred and seventy millimetres in depth.

When we consider the annual quantities of rain in particular regions or localities, we find the [96] numbers exceedingly variable, and some of them surprising. Clermont receives 630 millimetres, and the mean of the fall in Europe is about the same. About one metre falls on the western coast of Iceland, two metres in Norway, 2.80 metres in Scotland, 4.60 metres at Vera Cruz, 5.20 metres at Buitenzorg, in the Dutch East Indies, 7.10 metres at Maranhão, Brazil, and 12.50 metres at Cherrapunji, in British India. On the other hand, it rarely rains in some regions of the globe north and south of the equator; as in the center of the Sahara and of Arabia, the plateau of eastern

Persia and Beluchistan, the desert of Kalahari, and the desert of Atacama. The plains or pampas of the eastern slopes of the Andes, in about 23° south latitude, are likewise subject to extreme droughts, in one of which, lasting three years, three million head of cattle perished.—*Translated for the Popular Science Monthly from Ciel et Terre.*

[12] An address before the Society of Horticulture and Viticulture at Clermont-Ferrand.

DREAM AND REALITY.

By M. CAMILLE MELINAND.

There is a very striking resemblance between dreams and waking perceptions. We see in dreams objects, persons, and events identical with those of the waking state. The belief in their reality is as complete as in that of what we see when awake; the emotions are as deep and vivid. Pleasures have a delicious savor, and pains are even more intense than those of the reality—as, for instance, those of nightmare, and the distresses to which we give ourselves up in full. In all cases these dream troubles seem as real as those of life, and are taken by us quite as seriously; and the existence of everything we see and feel is as evident as in life.

Still we oppose the dream to the reality. The waking world is our true, our only world; the world of the dream seems to us purely interior and chimerical. The incoherence and absurdity of our dreams surprise and amuse us, and we are amazed to find that we have been able to believe, while asleep, in such foolish things. In short, dreaming is synonymous to us with illusion, phantasmagoria, and falsehood. The clearest of the prevailing theories about dreams rest upon the postulate that waking perceptions are the true ones, and the visions of the dream are false. They have answers to the three questions we are used to ask concerning dreams—Where do they come from? why are they incoherent? and why do we take their visions for realities? They explain dreams as former sensations reviving within us under different combinations, and as therefore simply confused reflexes of the reality. Dreams may, however, sometimes be produced by a [97] present impression suffered by one of our senses, half awakened—a contact, the way we are lying, and the condition of the organic functions being thus the causes or occasions of dreams. The incoherence of dreams seems no more mysterious in these theories, and is explained as the result of two causes—the slumber of the "reflecting" faculties, judgment, reason, the will, the exercise of choice and control; and, secondly, the unrestricted reign of imagination and the association of ideas. Our faith in the reality of the things dreamed is accounted for by the mechanical play of the images, the law being set up that every image that is not opposed by stronger images appears to us a real object. The problem, therefore, resolves itself: the senses being asleep, the images that arise within us are not contradicted by normal sensations, and that is why we take them for realities. Further, our reflective faculties, being likewise dormant, can not contradict the images, in the absence of sensations, reasonings, or recollections. Hence a credence, as absolute as unreasonable. We purpose to show that there is something artificial and prejudiced in the classical theory of opposition between dreams and waking, which assigns illusion, confusion, and incoherence to the former, and solid and permanent reality to the latter, and that the difference between them is not so clean cut.

Most persons in talking of this subject say that they are sure of the reality of things when awake because their different senses concur in attesting it. They see a tree, and satisfy themselves that it is a tree by going up and touching it. They smell a rose, and go find the rose, look at it and handle it; while in dreams we are not able to apply these supplementary tests. The distinction is imaginary, for our senses likewise seem to support one another in dreams. We dream not only that we see an object, but also that we feel and hear it. When I dream of meeting a friend, I believe that I see him and shake hands with him and hear him speak. There is, therefore, a complete identity of the two conditions as to this point, and the thing that appears to me in a dream is a "bundle of sensations," visual, tactile, auditive, muscular, and often olfactory, just as it appears to me when awake.

We are told of another difference. When awake, we find others agreeing with us in recognizing the reality of things. I see a tree, and so do those with me; I show it to them, and they look at it; I feel of it, and they touch it; I hear the rustling of the leaves, and so do they. Our perceptions in practical life are thus tested by comparison with those of others, whereas in our dreams we have our solitary and fanciful visions all within ourselves, with none to participate in our perceptions of them.

This supposed contrast is no more real than the former one. What is true is that when we are [98] once awake we change our point of view, and our vision of the night then seems to have been wholly interior, solitary, and subjective. But, notwithstanding the common illusion, *while we are dreaming* affairs pass, to us, exactly as when we are awake. It is true that in the waking state we find ourselves mingled with other men, who perceive the same objects that we do. Do we not sometimes dream that we are one of an audience looking at a play? that we are talking with a friend, and exchange views with him? and that we understand one another perfectly? There is, therefore, in this aspect, not a difference but identity between the dream and the waking. The interior condition, the sensation, the credence, are identical. The dreaming man believes, sees, and feels himself in intercourse with his fellows, just as the man awake believes, sees, and feels it. When we wake, we discover our mistake, but what of that? It does not prevent us from believing completely in it while we are asleep. And this is the point; for, after all, am I sure that I shall not awake some day from what I now call my waking life? And who knows whether I shall

not then judge that I have been dreaming a solitary dream? It may be added that the agreement of witnesses is not a decisive sign by which to distinguish the reality from the dream. There are collective hallucinations.

We come now to a more important difference, which includes the principle and has a characteristic apparently essentially distinguishing the dream—its looseness, disorder, inconstancy, and incoherence. In the dream visions succeed one another without connection; no law determines their order; an unrestricted fancy reigns among them, and the normal is broken up in them at every point. We are transported instantaneously from one country to another. We pass without transition from childhood to age, and causes have the strangest effects. The most essential laws of thought are constantly violated. There are facts without any causes, metamorphoses, magical disappearances. Even the absurd is realized, and the "principle of contradiction" does not seem to be any more respected than the others. We are at the same time in two places; we pronounce words, we hold conversations of which we can not when we wake recover the thread, so strange is their logic, so fugitive the sense, and so fanciful the combination. A practiced psychologist, M. Delbœuf, succeeded in taking down in the morning the last phrase of a book which he had been reading in a dream, and which had seemed then remarkably lucid. Here it is: "The man raised by the woman and separated by aberrations pushes facts disengaged by the analysis of the tertiary nature into the way of progress."

Is this distinction, then—that the dream is incoherent and the real rational—any more just than [99]
the others? It is doubtful if it is. There are rare dreams in which everything proceeds in a regular and natural way; and, on the other hand, reality is not always exempt from capriciousness and improbability. But to me the capital objection to the distinction is that it is illusory, and the contrast between the disorder of dreams and the coherence of the real is only apparent. The dream, it is true, appears disordered to us, but that is when we are awake. An essential point which we always ignore is that *while we are dreaming* everything seems simple and normal and regular to us. We are not at all astonished at what happens. We find it all right to be in two countries at the same time, and we understand very well how one person can be changed into another. The conversations we have—those which are utterly unthinkable when we are awake—usually appear to us marvelously lucid, and we admire the ease, the *verve*, and the luminous continuity of our words. We enjoy that moving with so much suppleness and precision among ideas; our demonstrations are infinitely convincing; and it is perhaps in the dream that we have the most perfect sense of evidence.

Everything, then, that passes in the dream is—to the dreamer—as natural as events in the waking condition. When awake, events seem, without exception, natural and regular; they also seem natural and regular in the dream. It is true that we find them absurd when we wake, but what of that? They are absurd only by comparison, as looked at from the point of view of the waking man, who is no longer the same that he was when dreaming. Who can tell if we shall not awake some day from what we now call our waking condition, and that we shall not then find the events absurd that we now consider rational and real? Who can tell that we shall not be stupefied at having been so firmly attached to invisible phantoms and disordered combinations?

In setting up a fourth distinction it is said that real life forms a continuous whole, while dreams are not connected with one another. The series of my days forms a single life, which holds together. I resume to-day my life of yesterday, and shall resume to-morrow my life of to-day. While I am asleep, the course of it is only suspended. I begin again in the morning at the very point where I stopped in the evening. I find myself in the same medium, occupied with the same thoughts, subject to the same cares, involved in the same routine of events, the same storm of passions. The same thread runs through it all. On the other hand, it is said, our dreams do not form a consecutive existence. The dream of one night has no connection with the dream of the previous night. On going to sleep to-night I have no assurance that I shall find the landscapes or [100]
the personages or the circumstances of my last dream. The most diabolical nightmare may succeed a most delightful romance. In short, not only is the form of the same dream incoherent, but our successive dreams are incoherent as to one another. This was what struck Pascal when he wrote: "If we dreamed the same dreams every night, we should be affected by them as we are by things we see every day; and if an artisan was sure to dream every night, for twelve hours, that he was a king, I believe he would be nearly as happy as a king who dreamed every night, for twelve hours, that he was an artisan.... But because dreams are all different, and the same one is so diversified, what we see in one affects us much less than what we see when awake, because of the continuity of the waking life, which is not so continuous and even, however, but that it changes, too, though less abruptly, if only rarely, as when we travel; and then we say, 'It seems like a dream to me,' for life is a somewhat less inconstant dream."

What are we to say to this distinction? I do not believe it is necessary to take it seriously, any more than the others. When is it that we pass judgment on the discontinuity and incoherence between our successive dreams? Not while we are dreaming them. When I am dreaming, I seem to be pursuing a life that has always been the same. I have no sort of an impression that the present dream has been preceded by different dreams having no connection with it. I have, on the contrary, exactly as I have when awake, the impression of an indefinite and single series of events, of an unrolling of them without arrest and without break. There is, therefore, on this point, no difference, but another resemblance between the dream and the reality, and the same impression of continuity and unity prevails in both. It is true that the aspect changes in waking, and our several dreams then appear detached from one another. But what of that? Are we sure that we shall not awake some day from what we now call the waking state, and find then that that state, continuous in appearance, was in reality composed of a series of separate, incoherent, and incongruous fragments?

Thus we are all the time coming upon the same illusion. We judge of the dream, not by what it is, but by what it seems to have been after we have waked. Instead of observing the impressions

of the dreaming man while he is dreaming, we take notice of what he thinks about them after he has waked up. This is to falsify the comparison of the normal and dream life by regarding the normal life while we are in it, and the dream life when we have come out of it. The several other difficulties on which psychologists have insisted are capable of solution by the application of the same principle: the seeming suspension of the will; the want of correspondence of the moral [101] standards of the dream with those of the waking condition; the confusion of temporal duration and sequence; and the transformations of personality and character, concerning which I would ask, however, if the eccentricities betrayed are not rather in the nature of more complete exposure. I have sometimes been surprised at the psychological revelations of dreams; faults and weaknesses that we do not avow when in the normal condition reveal themselves then with inexorable frankness; we yield to temptations that we evaded when awake, though inclined to them; to wickednesses which we kept closely shut up within us; reveal antipathies which we had dissimulated. Base desires break out, latent loves declare themselves, and things take place which, as in a play, bring the farthest depths of our hearts into the light; and when we wake we say: "That is true; it is just what I should have done under like circumstances. I had never thought of it, and I am not proud of it, but it is so."

There is this real distinction between the dream and the waking state: that when awake I know there is another condition, while in the dream I take no thought of the waking state. Awake, I know that I have been living the fantastic dream life, and have come out of it into a real life completely distinct from the other. I am in a first state, and know there is a second. But when I am dreaming I have no thought of another state that I have come out of and must return to; I do not feel that there is another existence, radically separated from this one; and I never compare the visions of my dreams with my waking world, for I know nothing of it. I have the impression of having always lived the life I am in, which seems natural; and even if I ask whether I am not dreaming, it is a merely verbal expression, with no accompanying sense of the meaning of it. Another distinction, and the only absolutely clear one, is that while we always wake from the dream, we never wake from the reality. This is why we believe in the reality and not in the dream.

These two differences are differences in degree, but they do not necessarily indicate differences in nature. Similar facts are frequent among hypnotics. We may plunge them into a condition of somnambulism which we will call a second state; and then, from that, magnetize them over again into another somnambulism, which we call the third state. Now the curious fact comes to pass that the subject in the third state recollects the second state, but when in the second state again, knows nothing of having been in the third state. "Lucie 3," says M. Pierre Janet, "recollected her normal life perfectly; she also recollected previous somnambulisms, and all that Lucie 2 had said.... It was a long and hard task to awaken this subject after she had [102] passed a few minutes in the syncope already described. She then returned to ordinary somnambulism, but Lucie 2 could not tell me a word of what had happened to Lucie 3, and supposed she had been asleep and said nothing." Thus we have the same difference between two successive stages of somnambulism as between the dream and the waking state. But as the stages 2 and 3 are evidently of the same nature, so we have a right to suppose that the dream and the waking, whose phenomena as to each other are similar, are likewise of the same nature.

In the ordinary experience of mankind we do not awake from our normal condition; but is it proved that there is never any awakening, any third state into which we may pass? The supposition of some such state into which we pass by death is one of the fundamentals of nearly all religions; and in this sense we might contemplate the possibility of an awakening in which we shall be astonished at having given ourselves up go completely to the world of sense, at having taken a passing state for the definite one, an ephemeral world for the sole and absolute world, a provisional existence for the real one.

Even among men as we find them, we see some making an approach to a third state, if not living in it. What is science but the revelation of a new world, different from the visible one? When we see light and colors, they tell us of an invisible ether with particles vibrating with almost incalculable rapidity; when we hear faint or loud sounds, sharp or grave, they tell of the more or less ample and rapid vibrations of matter. When we perceive a multiple or varied reality, it shows us the single phenomenon of motion. These formulas do not, however, signify, as some mistake, that light, color, and sound do not exist, but that there is something else; and that if we could gain new senses, a new universe would open out to us. This means, simply, that the scientific man is already half waked up from his ordinary life, and has half entered a new world.

Metaphysics is a waking up of this kind. A metaphysician who really believes his doctrines, like Plato or Spinoza, is already living in a new world and contemplating the supposed reality in which we are still immersed as a matter of indifference away off in the dim twilight. To him, what we regard as reality is only appearance, while the eternal rain of atoms or the play of immaterial forces, or whatever he supposes the world to be made of, is the true reality.

Religion is another such awakening, and to the devout man this life is only a provisional one, a trial, the prelude to the true life; and while he may regard the world of sense as real too, he looks forward to the superior reality, which it is the privilege of the elect to contemplate; and it is some [103] feeling of this kind that has sustained martyrs and has incited men of all ages and all faiths to suffer and endure, and die for what they believe.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

A PRACTICAL DUTCH CHARITY.

Holland, Scotland, and Switzerland, quite unlike physically, have in their institutions many points of similarity, and the impulses and character of their people are almost identical. In religious matters the resemblance is also striking, even though the creed professed be known by different names.

In Scotland the struggle for existence demands something more assertive than the doctrine of *laissez faire*; the terrible sweep of the avalanche in Switzerland, without any apparent cause for its starting, suggests an acceptance of the belief that "it is, because it must be"; while Holland, in its incessant war with the sea, is continually bidding defiance to natural laws, and protesting against their unrestrained action.

Calvinism found its strongest adherents in the two countries first named, and the faith of Luther answering to the active instincts of the Batavian race was at once adopted by it. In Holland as well as in Switzerland man is ever reminded of life's realities by the watchful care necessary for his very existence, and the material obstacles which must be conquered at every step. Patriotism never becomes dormant because the face of the land shows in its scars its history, and love for home grows with each reckoning of the cost of its retention. The possessions of one day are in many instances no guarantee of the wealth of the next, and the hand now extended in giving assistance may on the morrow be held out to receive. Thus we find the charitable instincts always awake, and societies for the relief of the needy thoroughly organized.

The conditions under which Holland began its geographic formation and the processes afterward employed to hold or enlarge her boundaries, together with the social unrest of the time, caused thoughtful men to put in operation every agency that could direct the innate desire to do good and to give direction to the forces within the kingdom, as well as those which came from without. In Holland, therefore, we find numerous societies for the relief of suffering humanity, and people ever ready to give due attention to the complaints and necessities of the laboring classes. No other country offers such an excellent field for the study of charitable [104]
institutions. The Dutch are eminently practical; they made an early beginning in the work of alleviating distress, and this relief, from the nature of things, as pointed out, is not spasmodic as in other countries where nothing short of famine, earthquakes, or floods can awaken the people to a realization of the duty they owe to mankind. Here the call for aid may come at any time, so that those charitably inclined must be ever ready to respond, and the organizations for relief can never become lax or inefficient.

Then, too, the population of the Netherlands is very homogeneous, and the leaders in all good works are not only administering to their own people, but are unbiased by prior experiences under other auspices. Consequently, this country furnishes institutions organized under normal conditions, with an entire absence of external influences, and where the helped and the helpers are of the same race.

England, France, and Germany have sent commissions to Holland to study its organized charity, its school system, workingmen's societies, and like institutions. These countries have but little in common, even though their forms of government are, or have been, outwardly similar, while on the other hand we have always found in the Dutchman "a friend and a brother," and an example well worthy of following. And since it is only after examining remedies for evils found without complications, that we can prescribe for abnormal conditions, the study of Dutch institutions is the best possible preparation for arriving at the means for meeting the necessities in our own country.

In Holland the general awakening to the demands of the people came in the eighteenth century, when the social life was lacking in strength, when the rich were largely given over to extravagance, while the poor were neglected, uneducated, and exposed to want. Everything seemed to separate the two classes—nothing emphasized their interdependence. The citizen class was restive under these oppressive conditions, and needed only the successful example of some neighboring people to start the revolution within their own country.

There was in the Netherlands at this time at least one thoughtful man who foresaw the approaching social revolution and realized the danger which threatened his native land if unaccustomed rights and powers should become the possession of those who heretofore had felt the power of others. This man was Jan Nieuwenhuizen, the founder of the Society of General Welfare. It is impossible to estimate the good which has been accomplished by this organization. It instituted free schools, and gave to the state the scheme on which the present public-school system rests; it established savings banks, and the Postal Savings Bank—now the model of the world—was glad to copy after them; it conducts a sort of neighborhood loaning banks, and it is [105]
likely that its plans will be incorporated in the agricultural banks now under consideration. Through its instrumentality people of different classes are brought together in periodical meetings, when the lower can learn by observation from the higher, and lose much of the prejudice and envy which is so often felt, while the higher will become more tolerant toward the lower as they realize the burdens which the latter carry, and appreciate the obstacles which mar their progress, thus leveling many of the artificial class distinctions.

What this society has done for Holland, "Ons Huis" is trying to accomplish in Amsterdam; and though the latter is occupying a more limited field, its energies are more concentrated and its methods are such as to warrant its characterization as a practical charity.

The founder of "Our House," Mr. Janssen, fully realized that outright giving while blessing the giver is of questionable value to the recipient, and alms once accepted suggested in the ease with which it was obtained that a second be asked for, and the feeling of dependence soon calls into existence the belief that the uncontracted debt of a living must be collected. We therefore find a charitable organization in which everything must be purchased, but at cost so slight as to be within the reach of all, yet being a charge, no benefit is esteemed for naught because it was

obtained for nothing.

We find this unique society in a sort of "people's palace" in the very center of Amsterdam's working population. The building, which is the gift of Mr. Janssen, is on Rozen Street, Nos. 12, 14, and 16, extending through to Rozen Gracht, and contains a board room, reading room, library, gymnasium, lecture room, assembly rooms, large hall, kitchen, quarters for the janitor's family, and a restaurant.

The purpose is declared to be "to promote the moral and material development of the people—poor as well as rich—both in giving and receiving by inducing those who are blessed with knowledge or money to assist their fellow-beings whose lives are monotonous and devoid of comforts and pleasures." The very name—"Our House"—is intended to show that within its walls all enjoy equal rights, that the less learned are the younger members of the family whom the less ignorant will gladly instruct, and that the purposes and aims of all classes should be the same. Both sexes have equal privileges, and the religious and political views of those who attend the meetings or enjoy the benefits offered are never inquired into. The adherents of all faiths are treated with equal deference, and the only condition imposed is the observance of such principles of etiquette as should find favor in every home.

Since the day of rest of the various religious sects is not the same, all days are regarded as of [106] equal importance, but, to meet the objections of the Protestant clergy that the exercises here kept people away from the church services, it has been decided not to open the building on Sundays until noon. But as the hours of employment of many persons are so long that their evenings are not free, the reading room is open on this day after the hour named, and certain instructive lectures are given during the afternoon. At these the average attendance is about five hundred. A strong effort was made to have the building closed during the whole of Sunday, however. The argument was made that as long as beer gardens and places of amusement were open on this day, the people should not be restricted on the only holiday of the week to those places where money is spent for trifling pleasures. The large number of persons who spend Sunday afternoon in the reading room proves that the opportunity to make good use of their time is fully appreciated.

Before giving in detail the plan of work in hand, it should be said that the director has secured the assistance of about one hundred and fifty men and women who are willing to contribute their time to the furthering of the purposes as outlined. They are divided into fourteen groups, or committees, each looking after a single interest. The means as at present constituted for attaining the ends in view may be classified as follows:

1. Reading room for men and women not under eighteen years of age; open daily.

2. Wednesday evening lectures on literature, history, physics, pedagogy, political economy, and travel. These lectures are open for debate.

3. Courses of lectures on different topics for men and women separately, or for both together. These discussions are marked by an intimate tone.

4. Sunday evening meetings: musical or theatrical performances, magic-lantern pictures, tableaux, etc. These are given in the large hall, which accommodates five hundred and twenty-five persons.

5. Legal advice.

6. Clubs for boys, girls, men, and women. Friendly intercourse. Discussions on scientific subjects. Chess club. Travel club.

7. Lessons in Dutch, French, English, and German, bookkeeping, reading and writing for adults, needlework, mending, making and cutting of one's own clothes, cooking, drilling for boys and girls, fencing, acting, chorus singing.

The reading room is provided with a large number of daily and weekly papers, magazines, and technical journals, together with such books as could be purchased or obtained as donations. The user of the reading room pays ten cents a quarter, with the privilege of bringing one friend a [107] week as a guest. Every conceivable device is employed to induce visitors to make use of the books; for example, the lecturers frequently choose a literary topic, and refer to the books in the library, or one of the members of certain manual-training classes read aloud while the others work. Then some of the social evenings are given up to the discussion of a new or popular author, and persons skilled in reading aloud are asked to read or recite choice extracts. To accommodate those who feel that three months' subscription is for too long a period, the regular admission fee of two Dutch cents—equivalent to eight tenths of a cent of our money—gives the right to make use of the library during the visit. It now looks as though the impulse to secure a shortening of the work day would come from this organization in its desire to secure for its beneficiaries a longer time in which to profit by the use of the books and special opportunities for study here placed at the disposal of the workingmen. The reading room is looked after by a committee of twenty, some of whom are always present to give aid and advice to the readers, to answer such questions as may arise, and to keep the books and papers in place.

The lectures conducted in Our House are of a twofold character—individual discourses and a series of discussions of a given topic. Every Wednesday evening between November and April is provided with a speaker by the lecture committee, who treats in a popular manner a subject of his own choice, and allows the auditors at the close of his talk to ask questions regarding the topic in hand. The average number of persons attending these lectures last winter was about three hundred, and the charge for a single admission is two cents, with a considerable reduction when four or six tickets are purchased for one family. In the course lecture the most popular topic so far has been natural science, especially botany, physics, and chemistry. In this connection it is interesting to note that the luxuriant flora of the East Indies, with which the Dutch became acquainted long ago, gave an impetus in Holland to the study of botany. The people of all classes are fond of plants and flowers, and it is not surprising to learn that twenty persons followed a course of instruction in botany. A prominent physician of Amsterdam gave a

course of ten lectures upon "The First Aid to the Injured," and eighty men and women profited by the practical discussion of this subject. The cost of these lectures is four cents apiece.

Somewhat related to the above are the concerts, Sunday evening meetings, and performances of various kinds which are given under the auspices of the appropriate committees. Perhaps one of the most profitable evenings of the winter is when manufacturers and employers are invited to [108] meet those of the working class who may wish to be present to discuss in an informal manner questions of common interest. Under the genial leadership of Mr. Janssen and the director, much of the restraint usual on such occasions is thrown aside and the employer and employee sit side by side, and each listens to the undreamed opinions and experiences of the other. At one of these meetings the question of a shorter work day was discussed from the standpoint of the employer, the laborer, and the humanitarian. The investigations of our own Bureau of Labor were quoted to show the benefits resulting from a shortening of the day of work, and it is more than likely that the outcome of the discussion will be an intention on the part of the manufacturer to curtail the hours of work just as soon as possible, while the laborers, in learning of obstacles of which they were ignorant, will await more patiently the action desired.

The classes or individual pupils contribute their services to the committee in charge of entertainments. This committee sees to it that three Sunday evenings of each month are provided for, either from the ranks of home talent or with the aid of outside artists. In the concerts some of the best performers of the land have gladly taken part, and the music of the greatest composers has been heard here. As in all other cases, there is a charge for admission—four cents for one and six cents for man and wife. A feature here in vogue might well be copied. In arranging the selections for a concert the effort is made to always include at least one popular piece, or a song of national, artistic, or patriotic interest; then on the programme the words of this song are printed. The audience may be asked to join in the chorus, but even if this is not practical the people can catch the air, and with the words before them in later days they can make melody in their homes. If we recall the class of people for whom these provisions are made, and keep in mind the limited avenues of enjoyment open to them, we will appreciate the boon of such a considerate act.

It might be tedious to enumerate the various classes here conducted, and give even in brief an outline of the methods, experiences, and results. Each lesson costs from two to four cents, and the pupils—many of whom have reached middle life—show a commendable zeal in prosecuting their studies. However, two topics deserve mention—the lessons in mending and in cooking. Since it is the poorer people who are to be benefited by the work of Our House, lessons in economy are needed, if not demanded, and the earlier opportunities for acquiring these lessons have been meager. The authorities have therefore wisely decided to so instruct the housewives of these people that their clothing may look well even if mended and the family meals be palatable [109] though simple. It is believed that the result of such teaching will make many homes more attractive, and keep the men from seeking outside of the house conditions which they should find within.

The clubs also serve as valuable adjuncts to the work in hand. They are usually groups of persons of the same sex and near the same age who meet under the guidance of some experienced man or woman for social intercourse, for practice in debate, playing of chess, the reading of some standard author, or the discussion of places and peoples. In all of these meetings, as well as under all circumstances, the people in attendance are taught polite behavior by example rather than precept, and every precaution is taken to avoid any reflection or invidious comparisons that might tend to keep away the people whom Our House is intended to benefit.

A word might be said about the travel club. Early in each autumn a proposition is made that during the following summer a trip will be taken to such and such places, usually naming one near by, within the kingdom, and another farther away, as Brussels or the upper Rhine. Persons desiring to visit either of the places named unite in forming a club. They meet at stated times to listen to accounts of the place selected, its historical associations, and the points of interest *en route*, and also to pay into the treasury an amount agreed upon. For example, last summer one club, upon the saving of a cent a week by each member, was able to go to Haarlem and spend the day in seeing the city and the many places of interest in the neighborhood. In another, each member contributed ten cents a week, and the club was able to make a two days' trip to Brussels. By this simple means persons otherwise unable to go beyond the confines of their native city have the opportunity to get at least a glimpse of the outside world, and under such conditions and with such special preparations as to obtain from the trip the maximum interest and profit.

The only thing that is free in Our House is legal advice and the writing of legal documents. In Amsterdam, as elsewhere, the poorer people have too frequently an exaggerated idea as to their rights, and rush into "law" for fatuous protection. Such persons are liable to fall into the hands of unprincipled lawyers who help to nurse the fancied wrong and encourage a suit for damages, or put up an idle defense for the sole purpose of winning a fee. To protect this class by giving them the most unselfish advice possible, a number of the best lawyers of the city have cheerfully offered their services, and every Thursday evening from eight to twelve o'clock one or two stand ready to give gratuitously the best advice they can upon such legal points as may be presented. That this service is appreciated may be seen in the fact that from ten to twenty persons profit by [110] this privilege every evening. On this evening persons are present for the purpose of writing letters for those unable to write, and also to draw up legal documents for such as need them.

Mr. Adma van Scheltema—a name closely identified with every good work in Amsterdam—has organized in Our House art loan exhibits. For one half of the days during which the exhibit is open there is no charge for admission, while a slight fee is exacted on the other days. From these exhibitions much pleasure as well as instruction has been derived, and, located in a section which sends but few visitors to the art museums, one can realize that they perform a good work, as missionaries in cultivating the people's taste.

Such is, in short, an account of a practical charity—a charity, in truth, not because something is furnished for nothing, but that so much is given in return for so little. During the past year more than three thousand persons were registered as enjoyers of the privileges offered. Mr. Janssen gave the building and in one sense endowed the work; Mr. Tours gives his time, wisdom, and energy in directing its affairs; they both ask the wiser men and women of the city to give a few hours of each month or year. They have not asked in vain, and the cheerful responses give promise of the coming of the time when the only answer to the question, "Am I my brother's keeper?" will be an energetic "Yes."

SKETCH OF FRANK WIGGLESWORTH CLARKE.

FRANK WIGGLESWORTH CLARKE.

THE great advance which chemical science has made in the United States during the past thirty years has been brought about by the joint operation of several factors, of which we may mention the formation and the influence of chemical societies seeking to further its development, the intelligent labors of individual investigators cultivating special fields, and the systematic pursuit of experimental work with reference to certain definite results. In this shaping of chemical research in such a way as to make it most efficient, the work and influence of Frank Wigglesworth Clarke have been prominent and important. His own labors have been industriously and unselfishly pursued with an eye to the advancement of the science, and their value has been generally recognized. It seems as if he had taken to himself a hint thrown out in one of his earlier scientific papers, and, giving up the transient glory of brilliant experiments, had devoted himself to setting the science as far forward as possible in single branches.

Professor CLARKE was born in Boston, March 14, 1847, and was graduated from the Lawrence Scientific School of Harvard University in 1867. Two years later, in 1869, he was appointed instructor in chemistry in Cornell University, the first assistant ever appointed at that institution. His next position was that of professor of chemistry and physics in Howard University, Washington, in 1873 and 1874. In the latter year he became professor of chemistry and physics in the University of Cincinnati, in a position which he held till 1883, when he became chief chemist to the United States Geological Survey and honorary curator of minerals in the United States National Museum, where he still remains. [111]

Professor Clarke, having become a member of the American Association for the Advancement of Science in 1869, assisted, in 1875-'76, in the organization of its section on chemistry, a branch which had theretofore been but little represented in the Proceedings of the association. Prof. S. W. Johnson was elected chairman of the new section for the meeting in 1876 at Detroit, and Professor Clarke was commissioned to make the necessary efforts to insure a full attendance of chemists and others interested in the applications of chemistry. In 1888 he presided over the section; and he has ever been active in building it up, and in the development of the American Chemical Society.

Professor Clarke has published about seventy-five scientific papers in various journals, and many popular articles, especially in Appletons' Journal and the Popular Science Monthly. His first scientific paper, A New Process in Mineral Analysis, was published in the American Journal of Science for March, 1869. Other important papers have related to analytical methods, to the constitution of the tartrates of antimony, and to topics on chemical mineralogy, including

especially the constitution of the silicates.

Many of his popular articles relate to educational affairs, and present forcible arguments for a fuller recognition of science in the course of instruction, and cogent demonstrations of the need of better teaching of science and better qualified teachers. When occasion has arisen, he has fearlessly exposed and denounced humbug in education. In a paper on The Higher Education, published in the seventh volume of the Popular Science Monthly, having defined the purpose of true education as being "to develop the mind; to strengthen the thinking faculties in every possible direction; to render the acquisition of new knowledge easier and surer; to increase the student's resources; and to render him better fitted for dealing with the useful affairs of the world," he sets forth the advantages of science over the ancient and even the modern languages for the accomplishment of it. Science, he reasons, furnishes as good an instrument for cultivating [112] the memory, and has the additional advantage of strengthening the perceptive powers too, for in it the eye, the ear, and all the instruments of the senses are trained to observe facts accurately, as they are not trained to so great a degree in language study. It again takes the lead in the cultivation of the pure reason; for it gives grand laws and generalizations already deduced or in process of deduction. "The discovery of these natural laws may be counted among the greatest achievements of the human mind. To follow out the processes by which they were discovered gives the mind its most rigid training, and elevates the tone of thought in many other respects. The intellect becomes self-reliant and yet conscious of its own weak points." Also, in æsthetic development, scientific education is put foremost. "The true student of Nature and her phenomena ever sees order and symmetry coming out of chaos, and finds the rarest beauty hidden where to the unaided eye naught but ugliness exists.... Can any student, who looks upon the universe with vision thus unobscured, fail to find in his studies the truest æsthetic culture?" But it had been alleged that the scientific courses had been tried in many American colleges and found less fruitful than the classical. In answer to this the author considered the character of most American colleges, the qualifications of many professed teachers and the methods of study, and showed that these, as they actually were, were not competent for the conveyance of genuine scientific instruction.

By the multiplication of competing colleges putting sectarian interests in the foremost place, the means were divided up and frittered away, which, concentrated in one institution, would hardly be enough to enable it to do really effective work. "Each college acts as a drag on all the others. Libraries, cabinets, and faculties are uselessly duplicated. Naturally, one result of this state of affairs is a lowering of educational standards.... Since, on account of this foolish division of forces, most of these colleges are inadequately endowed, they are compelled to work short-handed. One professor has frequently several branches to teach.... In the majority of cases there is a chair of Latin, a chair of Greek, and then—a chair of 'Natural Science.' Each linguistic professor is to some degree a specialist; while the one who teaches science is perforce compelled to be a smatterer. He is expected to teach half a dozen dissimilar branches, each one being a life work by itself. He is to be omniscient on about a thousand dollars a year."

That the character of these institutions, as well as their poverty, was detrimental to the advancement of scientific education was more fully shown in another article on American Colleges *vs.* American Science, in the ninth volume of the Monthly. The colleges were described [113] as being to a large extent denominational institutions, "equipped and endowed with, due reference to the perpetuation of sound faith, and incidentally to the encouragement of what is supposed to be learning.... The very fact that a college has been established for theological purposes, or for ecclesiastical aggrandizement, is adverse to good scientific research.... Every year professors are chosen, not on account of scientific ability, but for reasons of a theological or sectarian character. If two men, one a Baptist and the other a Unitarian, were candidates for the same professorship in a Baptist university, the former, even if very much inferior to his rival, would almost certainly be elected.... Theological soundness in such an institution far outranks scientific ability. If Laplace had lived in America, no college would have tolerated him for an instant. Almost any decayed minister, seeking an asylum, would have beaten him in the race for a professorship."

These conditions were shown to have necessarily a bad effect upon American science, and to be not likely to arouse or encourage the scientific spirit. The student "becomes accustomed to regard the sciences as comparatively unimportant," and "graduates in complete ignorance both of the methods and of the aims of science, having learned only a few disconnected facts concerning the great world about him."

Improvement in these conditions, the author argued, must come partly from within and partly from without. The colleges must reform their ways, and, not being likely to do it spontaneously, must be helped—by pressure of public sentiment and, later, of legislation. This suggestion proved to be introductory to that of a very important line of work, for the furtherance of which Professor Clarke seems never to have been able to labor too earnestly and industriously.

"But how," he says, "should public sentiment be properly shaped and made available for service? How is the natural, though slow, growth to be fostered and directed? Mainly by the efforts, organized and individual, of scientific men. Personally, every worker in science should strive to awaken in the community about him a comprehension of the value and purposes of his particular branch. In other words, the real investigators ought to do more toward popularizing their discoveries instead of leaving that task to amateurs or charlatans. At present, unfortunately, too many able scientific men depreciate popular work and hold aloof from it. They do nothing themselves to interest the public, and then lament the fact that the public does not become interested. Yet just here is where the beginning must be made. With a wider public interest in science will come deeper public appreciation, and this will develop the tendencies necessary for [114] the improvement of our colleges and schools. Until the people see and recognize the difference between true investigators and mere collectors of specimens, between original workers and text-

book authors, little real progress will be made."

While these pictures were correct, when made, of a very large number of American colleges, a vast improvement has taken place since the articles were written in the quality of instruction given; but there yet remain too many institutions to which they are still not inapplicable.

This was not the beginning of Professor Clarke's efforts to show men of science that the true interests of their cause lay in their making their knowledge easily accessible to the public. In the first volume of the Monthly he had an article on Scientific Dabblers, the purpose of which, as he defined it, was, after calling attention to the silly character of much that was called "popular science," to urge upon true scientific men the importance of rendering real knowledge more accessible to the masses. There is a demand for science, he said, "or the trash which is written would not be read. It works into nearly all departments of common life, and is, in one way or another, of interest to almost every one. Yet, as I have already said, the current popular lectures upon scientific topics are frothy and worthless; the theologian often misrepresents science for partisan purposes; and the newspapers, with all the good they may do, are too frequently conducted by those ignorant of all science. The people ask for knowledge, and unwittingly get much chaff with their wheat.... Therefore it seems to be time that true students of science should seek to popularize their learning.... Men of science constantly lament that the Government does not extend more aid to scientific research. The Government is a popular one, and the people must be trained before its help can be expected. Therefore it is for the interest of the teachers, as well as for the good of the people, that scientific truths should be popularly put forward in simple, untechnical language, and made accessible to all."

Later, in his chairman's address before the Chemical Subsection of the American Association, in 1878, he had this subject in mind, and mentioned it as part of the work of the section "to attract public attention to the subjects that interest us, and to do what we can to secure for chemistry a wider appreciation and greater means for development.... If the general public," he said later in his address, "is not interested in chemistry, it is because we as chemists have neglected a part of our duty. We have but to speak, in order to command the public ear."

Another side of scientific advancement to which Professor Clarke's working life has proved him [115]
much attached is presented in this address at the American Association meeting of 1878, and more minutely as to the particular point we have in mind in an article on Laboratory Endowment, in the tenth volume of the Popular Science Monthly. In the association address he insisted strongly upon the physical side of chemical research, stated briefly as the study of the phenomena which occur during the reactions in chemical experiments, or of the transformations of energy, and upon the importance of the co-ordination of studies separately pursued to the systematic and permanent advancement of the science; for which purpose he considered endowed laboratories for research extremely desirable. In such laboratories adequate corps of thorough specialists should co-operate in those investigations which individuals could not undertake; every worker should be assigned to definite, positive duties, the accurate and careful performance of which would eventually be sure to advance exact knowledge. The work would be hard routine, and the real value of the institution would be independent of everything sensational, and would rest upon considerations of the most severely practical kind. As an example of such work he mentioned the study of the connection between the composition of a substance and its physical properties. Supposing this taken up systematically by a well-organized body of investigators, the first step would be to determine, carefully and with the utmost rigor, the physical properties of the elements. Each one of these substances would have to be isolated in quantity and in a chemically pure condition, such as has never been attained as to some—a labor which would of itself involve a great amount of research. Then would come the measurement of physical relations, thermal, electrical, optical, magnetic, mechanical, and so on; and the determination of all their "constants" under widely varied conditions, notably of pressure and temperature; labors which would in many cases involve the comparative testing of various methods of research, and often the invention of new experimental processes. The number of elements and of their compounds which should be taken up in some regular order, series by series, would afford almost illimitable fields of research to large numbers of students; all of whom, if laboring under some plan of systematic co-operation, might contribute directly and efficiently to the perfection of the science. "One chemist might undertake to furnish certain of the elements in a perfectly pure condition; another might carefully determine under varying circumstances their densities and rates of expansion; a third could work up their latent and specific heats; a fourth their electrical relations, and so on. Failure to attain grand results would be impossible. Doubtless the labor would prove irksome and monotonous, but the reward would [116]
be sure. In five years, more would be done toward rendering chemistry an exact science than can be accomplished in a century by means of chemical investigations at present most in vogue." Chemists engaging in work of this kind would have to make sacrifices, for it would offer little promise of sensational reputations to be gained through dazzling discoveries, and would have to look to the ultimate glory of the science for their chief reward.

Professor Clarke has not omitted to practice what he thus preached; and while he has not failed to win honors in other fields of the science, has made it the chief work of his scientific life to advance toward solution one of the physical problems of chemistry indicated above. He has taken as his special field of research the "constants," and of these, the one which is perhaps the most fundamental of all, the revision of the atomic weights—not by experiments of his own so much as by comparison and criticism of the work of all who have undertaken the task, eliminating errors and finding from the sum of the whole what is the nearest deducible approach to accuracy. In 1872 he sent to the Smithsonian Institution a compilation entitled A Table of Specific Gravities, Boiling Points, and Melting Points for Solids and Liquids. This was accepted by Prof. Joseph Henry, who made it the first publication of a projected series to be called The Constants of Nature. To this series Professor Clarke has since contributed Tables of Specific Heats, of

Expansions, and a Recalculation of the Atomic Weights. A new edition of the Specific Gravities was issued in 1886, and a second edition of the Atomic Weights in 1897. For the past five years Professor Clarke has contributed an annual report on atomic-weight determinations to the Journal of the American Chemical Society, giving each year a consistent table of values brought thoroughly down to date. These tables are now used in all parts of the world as standards for reference.

As chemist of the United States Geological Survey, Professor Clarke has published ten official bulletins of work done in the laboratory under his charge, of which Bulletin 125, The Constitution of the Silicates, and Bulletin 148, Analyses of Rocks and Analytical Methods, by F. W. Clarke and W. F. Hillebrand jointly, are the most important. Other works are: Weights, Measures, and Money of All Nations, 1875; The Elements of Chemistry, a school text-book, 1884; and a Report on the Teaching of Chemistry and Physics in the United States, published by the United States Bureau of Education in 1881.

A paper published by him in the Popular Science Monthly for January, 1873 (Volume II), on [117] Evolution and the Spectroscope, showed that the evolution of the planets from nebulæ was possibly accompanied by an evolution of the chemical elements. This was nearly a year in advance of Lockyer's first paper suggesting the same general view. The discussion of this subject was taken up again in the eighth volume of the Monthly (February, 1876), in an article, Are the Elements Elementary? in which the author, after showing how subtle connections significant of unity run through them all, inquired: "If the elements are all in essence one, how could their many forms originate save by a process of evolution upward? How could their numerous relations with each other, and their regular serial arrangements into groups, be better explained? In this, as in other problems, the hypothesis of evolution is the simplest, most natural, and best in accordance with facts. Toward it all the lines of argument presented in this article converge. Atomic weights, specific volumes, and spectra, all unite in telling the same story, that our many elements have been derived from simpler stock." These views were admitted to be speculative but not baseless. "Science is constantly reaching forward from the known to the unknown, partly by careful experiment and partly by the prophetic vision of thought." Then, speculation upon such questions "is not altogether unprofitable. The time spent in conjectures and surmises is not wholly wasted, for it is impossible to follow up any of the lines of thought thus opened without reaching some valuable suggestions which may pave the way to new discoveries. New truth, in one direction or another, is sure to be reached in the long run. So, then, we may proceed to theorize in the most barefaced manner without entirely quitting the legitimate domain of science." An article on The Present Status of Mineralogy, in the thirty-second volume of the Monthly, presents the mutual bearings of that study and chemistry and geology.

Professor Clarke contributed the chapter Element to the last edition of Watts's Dictionary of Chemistry. He was made president of the Washington Chemical Society in 1885, and of the Philosophical Society of Washington in 1896. He organized and had charge of Government exhibits, on behalf of the Department of the Interior, at the expositions of Cincinnati, Chicago, Atlanta, Nashville, and Omaha. He is a corresponding member of the British Association, of the Edinburgh Geological Society, and of the New York Academy of Sciences.

Correspondence. [118]

THE MOON AND THE WEATHER.

Editor Popular Science Monthly:

Dear Sir: Scientific investigators in meteorology have again and again declared they have not been able to discover by accurate and long-continued observation that the moon has any effect whatever upon terrestrial weather; yet the farmers have, for unreckoned years, undoubtingly ascribed certain kinds of weather—changes, especially—to the moon; and, despite the dictum of the scientists, they have persisted in their confidence in the pale orb as a weather-breeder, and as a disposer, in a large degree, of the wet and dry features of the months.

Now comes Mr. H. H. Clayton, meteorologist at the Blue Hill Meteorological Observatory, and shows by diagram and dates that the *electrical* condition of the atmosphere varies in close accord with the position of the moon in her orbit.

That electricity performs various offices in the atmosphere, notably among the particles of vapor, is well known; but just how and to what extent atmospheric phenomena result from electrical action has not yet been clearly demonstrated. However, we have now a scientific basis for the assumption that the moon has an influence on the weather.

An interesting summary of present knowledge concerning the atmosphere is contained in Studies of the Upper Atmosphere, by A. Lawrence Rotch, director of the Blue Hill institution. The diagram of comparative altitudes, which forms the last illustration of my article on kite-flying, in the May number of this magazine, is from the frontispiece of Mr. Rotch's pamphlet just mentioned, for which credit was inadvertently omitted.

George J. Varney.

57 Cornhill, Boston, *August 19, 1898*.

Editor's Table

THE GOAL IN EDUCATION.

MANY of our readers, we are sure, must have been impressed by the articles on The Philosophy of Manual Training lately contributed by Professor Henderson to the pages of this magazine. The thought underlying them is one to which we have ourselves often endeavored to give expression, namely, that the end of education is wholly misconceived unless we consider it as aiming to bring the individual into right relations, at as many points as possible, with the world in which he lives, and to place him in as full possession as possible of the varied powers and capacities of his nature. It is because he regards manual training as the most effective instrument for awakening the intellect in the first place, and then for establishing a proper balance between the mental and bodily activities, that Professor Henderson has advocated it with so much earnestness. All that he has said on the subject seems to us deserving of the closest attention.

In the old system of education language was regarded as the supreme and sufficient instrument of mental development; and in the great public schools of England this idea enjoyed the very highest degree of prestige and authority. By language in these establishments, the two classical languages of Greek and Latin were meant, the English language receiving very scant attention, and English literature none. If any one was so far in advance of the times as to express a doubt whether a knowledge of Greek and Latin was the only preparation needed for life, he was pointed [119] to the brilliant men who had come from the forms and the playgrounds of Eton and Winchester and Harrow; and the discussion was considered closed. The fact is that the radical insufficiency of the system was masked to a great extent by the circumstance that it was mainly applied to a ruling class, who early in life obtained a more practical training in public affairs. Pitt was educated, as has been remarked, by that great statesman, his father, the Earl of Chatham, and Peel by a great manufacturer who took a keen interest in politics. Robert Walpole, leaving the university at an early age, had the society of his father, a most practical-minded country squire, whose original ambition had been to make him the greatest grazier in the kingdom. Many similar cases could be cited in which early introduction to society and to practical life made up for the deficiencies of scholastic training, and reflected, or seemed to reflect, on that training a much greater credit than it deserved.

It may be admitted, however, that as a preparation for a political or forensic career an old-fashioned classical education was not wholly without efficacy. It was systematic and orderly; it was rigid in its requirements; it presented difficulties which had to be overcome, and afforded the means for unmasking looseness and inaccuracy of thought; finally, it called into constant activity, though in a narrow field, the discriminative, and analytical faculties. Its weakness lay in this, that it did not reveal the nature of things, but promoted a dangerous habit of "moving about in worlds not realized," and of giving to words an importance which should only be conceded to verified and comprehended facts.

Nowadays we mix, or try to mix, a modicum of scientific knowledge with the education we impart. This is so far good. It affords a training in observation and verification, and opens up to the young sources of interest of which they may increasingly avail themselves in later years. Moreover, as the scientific instruction generally embraces more or less of physiology and hygiene, it places them on their guard against the formation of injurious habits, and shows them the conditions on which health depends. These are advantages which, so far as they go, it is impossible to appreciate too highly.

It takes more, however, than the admixture of a little physical science in a school curriculum to make, in a wide sense, the education that is required for life. What is further required is a proper adjustment of the mind toward life with its varied activities and its infinite possibilities of good and evil. When we see men of fine literary gifts growing more cynical as they advance in years, and treating the world to stronger and stronger doses of pessimism in their writings, we are compelled to believe that their adjustment to life must have been wrong. When we see men of science who year by year appear to have less and less in common with their fellow-creatures, and whose studies only develop on the intellectual side an ever-increasing passion for the infinitely minute and the vastly unimportant, and, on the moral, a morbid sensitiveness to all kinds of personal questions, we find it difficult to think that they were properly oriented at the start. It may not be given to every one to "see life steadily and see it whole"; but it ought to be possible for a well-trained mind to see it with an eye of calm, tolerant, and sympathetic contemplation. No education is complete which leaves out such knowledge of the world, and of the relation which the individual sustains to it, as shall at least tend to give a right purpose and direction to the [120] individual life. "The world is very evil," is a pious utterance; but it is equally pious for each of us to ask how much of evil is lurking in ourselves. We conceive of a scientific education in the full sense as one which, while it imparts true ideas in regard to the physical history of the globe and the chemical elements that compose it, aims no less at unfolding the true constitution of society, the springs of human action, the strength and weakness of human character, the possibilities of good and evil that reside in every individual, the misery that waits on wrongdoing, and the happiness that flows from just and pure deeds. There is a way, we are persuaded, of presenting the world of humanity to the minds of the young which would tend to create in most—in the vast majority—a strong desire to take a helpful part in the work of their age and generation, and not to concentrate all their efforts on the business of self-advancement. It is merely a question of seeing the facts in a broadly human, which is after all the only true, light.

Let us have in education literature and analytical studies and science with its grand constructions and sanifying discipline—all the useful elements—but let the true goal of education

be kept ever in view, which is, not to enable this individual or that to shoot to a pre-eminence over his fellows, but to place the individual in right relations with his fellows, to give to each a career of useful activity, and to prevent that dreary disappointment with life and all its works which overtakes so many in their declining years. Life has its burdens, but it is not vanity; and the normal action of human beings on one another should be to give to each separate existence a higher value and deeper sources of happiness.

A DOUBTFUL APPENDIX TO SCIENCE.

It was perhaps to be expected that Sir William Crookes, as president of the British Association, would, whatever else he touched upon in his presidential address, say something in regard to the special views which have now for many years been associated with his name. In point of fact he did do so. Beginning with a survey of the world's resources in the matter of wheat production, and an inquiry as to how the fertility of the soil may in future be kept up, he passed to the constitution of matter and molecular action as illustrated by the phenomena of Röntgen rays, and finally referred to "experiments tending to show that, outside our scientific knowledge, there exists a force exercised by intelligence differing from the ordinary intelligence common to mortals." These experiments were made, we are told, more than thirty years ago. It does not appear that any substantial or indubitable addition has been made to the evidence which these experiments afforded, or were supposed to afford; but Professor Crookes "thinks" he can "see a little further now." "I have glimpses," he says, "of something like coherence among the strange, elusive phenomena." That undoubtedly is a good thing to get glimpses of; but there is perhaps room for question whether the extreme interest of the professor in the "strange elusive phenomena" has not led him to make a little more of the "glimpses" than strict scientific method would warrant.

It is really only necessary to read the concluding portion of Professor Crookes's address to see that he is dealing not with science but with crude imaginations. He says that "confirmation of [121] telepathic phenomena is afforded by many converging experiments," but especially by "the subconscious workings of the mind when these are brought into conscious survey." There is really no meaning in this. How can any "survey" be other than conscious? And what is there in the subconscious workings of the mind adapted to prove that impressions can be made upon the mind otherwise than through the recognized channels of sense? "The patient experimentation of the Society for Psychical Research is probing subliminal processes and learning lessons of alternating personalities and abnormal states." There is no objection in the world to all that; but it would take more than an alternating personality or an abnormal state to enable a mind to gather knowledge from another mind without the intermediation of intelligible signs. A sick man may act in a very singular way, but his sickness does not enable him to transcend the ordinary powers of humanity.

The eminent professor speaks of the cures wrought by suggestion (hypnotism); but seeing that the suggestions are made by intelligible signs, verbal or other, we find no support here for the telepathic hypothesis. We really gather from the professor's remarks that while a great many persons—some of high intelligence and of recognized position in the scientific or philosophical world—have been pottering away at this matter of telepathy and other phases of spiritualism for a great many years, things are to all intents and purposes just as they were before all these laborious researches began. This is not just the way the professor puts it; his words are: "A formidable range of phenomena must be scientifically sifted before we effectually grasp a faculty so strange, so bewildering, and for ages so inscrutable as the direct action of mind on mind." Sometimes the reason why a thing is inscrutable is because it isn't so; and that, we suspect, is the explanation in the present case. One hypothesis which the professor puts forward is simple to the last degree. It is that the molecular action of the brain, when thoughts are passing through it, is taken up by the ether and communicated to another brain in which it awakens similar thoughts. But the question we ask at once is why this wireless telegraphy between brain and brain is not going on all the time, and why we are all not driven crazy by the everlasting intrusion of other people's thoughts? If this is the process, why should neighboring brains be skipped, and the effect be produced upon one particular brain hundreds, perhaps thousands, of miles away?

"It is henceforth open to science," says Sir William Crookes, "to transcend all we now think we know of matter, and to gain glimpses of a profounder scheme of cosmic law." We really do not know when it was *not* open to science to do this *if it could*; and we do not see that the telepathists and other denominations of spiritualists have in any appreciable manner improved the situation as regards the probability of the thing being done. They have contributed floods of talk and tons upon tons of printed matter, and have worked thousands of people into variously grewsome conditions of mind; but if any one can point to a single distinct advance in scientific theory due to their peculiar methods, we can only say that we do not know what it is. Professor Crookes has been one of the foremost scientific workers of his day; and we find it hard to believe that he can be under any illusion as to the futility of the efforts of the spiritualist school. At the same time he [122] is entitled to the utmost freedom of thought and utterance; and if he believes there is still hope of important gains to humanity from the side of spiritualism, he is justified in holding his position; and while we may think he is sadly misled, we must accord him the respect due to eminent talents and unquestioned sincerity.

THE CAUSE OF SPAIN'S DECADENCE.

Until account is taken of the effect of war on the thoughts, feelings, and institutions of men, no

headway can be made toward a rational explanation of the decadence of Spain. Since the outbreak of hostilities with that country, which has made the topic a favorite one with newspaper and magazine writers, every other explanation has been vouchsafed; but all of them, including the favorite one about the mental and industrial paralysis produced by the Spanish Inquisition, mistake effects for causes. Not one of them, so far as we have seen, has touched the root of the matter and pointed out that Spain has simply gone the way of every other nation that has devoted itself, not to the pursuits of peace, but to the destruction of life and property.

Like all other despotisms, Spanish despotism has been the inevitable product of the necessities of war. Success in that pursuit requires that the subjects of a monarch shall place unreservedly their lives and property at his disposal. He must be permitted to levy conscriptions without let or hindrance, and to impose taxes with the same freedom. The longer and more intense the militant activities, the more unmitigated the despotism. In Spain the conditions for the uninterrupted growth of such irresponsible power have been especially favorable. There were first the long wars with the Moors, then the Italian wars, the wars of the Reformation, the wars of the Spanish Succession, the Napoleonic wars, followed by a period of chronic revolution, and the wars carried on against the natives and other adversaries in the New World. The impulse toward a concentration of power in the hands of one man engendered by these incessant conflicts could not fail to blot out of existence every sentiment and institution of freedom. Only during the past twenty-five years of peace has either been able to gain a foothold and to give a promise of regeneration.

But the despotism growing out of war means more than the bare statement that all power over life and property has been placed in the hands of a monarch. It means that his subjects have been deprived of the right to think and act for themselves. He has taken charge of both their consciences and their conduct. In Spain, for some reason not easy to discover, the ecclesiastical despotism that accompanies the growth of political despotism became more potent and deadly than in the other countries of Europe. There the priests were more powerful sometimes than the monarch himself. With the institution of the Inquisition during the reign of Ferdinand and Isabella they wrought a havoc to the Spanish intellect that has no parallel outside of the great Oriental despotisms. To them is due the mental torpor of the Spaniards, who, according to U. J. Burke, wrapped themselves in a cloak and "sought safety in dignified silence." How could the spectacle of an *auto-da-fé* do otherwise than disincline a prudent man to think for himself and to tell what he thought?

That devotion to military pursuits inspires a contempt for industrial pursuits and gives birth to [123]
a feeling of superiority over the people engaged in them we see to-day in France and Germany. In those countries it has come to such a pass that civilians are regarded as almost without rights, since an officer imagining himself insulted may run them through with his sword, and as having no other function in the economy of the world but to work for their masters. In Spain during the years of her greatest military activity these feelings of a barbarian reached an intensity that can not now be realized. The only occupation outside of killing and plundering enemies either in Europe or America that a gentleman could follow was a career as a churchman or as an official in the home or colonial administration. "Public offices," says Henry C. Lea, describing the results of this absurd belief, "were multiplied recklessly, and the steady increase in the ranks of the clergy, regular and secular, was a constant subject of remonstrance. In 1626 Navarette tells us that there were thirty-two universities and more than four thousand grammar schools crowded with sons of artisans and peasants striving to fit themselves for public office or holy orders. Most of them failed in this through inaptitude, and drifted into the swarms of tramps and beggars who were a standing curse to the community." Hence the abnormal proportions of the ecclesiastical and bureaucratic establishments; hence also the almost total failure to develop the great natural resources of the country; hence, finally, the unprosperous condition of the industries, not crushed out of existence by the regulations of the official parasites.

To many people the callousness of Spaniards to suffering and their disregard of the rights of others have seemed the greatest mystery. Why is it that they still cling so tenaciously to the pleasures of the bull ring? Why was it that they appeared so indifferent to the miseries of the Cuban reconcentrados? In the light of the influence of war on the sympathies these questions present no difficulty. Clear also does it become why the Spaniards possess as little patriotism as the Chinese. Training for centuries in the belief that the most honorable occupation is the killing and plundering of enemies or the filling of positions in church and state that obviate the necessity of earning a livelihood by honest toil is not fitted to inspire a keen sense of justice or a lively fellow-feeling. When people have been plundered for centuries by a greedy bureaucratic despotism they can not persuade themselves that it is their duty to protect their oppressors from foreign or domestic assailants. What they are most interested in is an opportunity to get a living. Whether the honor of their country is at stake, or whether there is threatened the loss of the last remnant of a colonial empire that has cost them blood and treasure beyond estimate, they are certain to be as indifferent as the victims of a slave driver to the misfortunes that have overtaken him.

Some friends of Spain have been inclined to regard the loss of these colonies as the culmination of her misfortunes. We can not but regard it as the beginning of better days. Although Spain has not been engaged in war on an extensive scale for a long time, her efforts to retain the control of a people anxious to be delivered from her incapacity and despotism have tended to keep alive the barbarous feelings and traditions of the past. The Cubans and Porto Ricans were not governed for their own benefit like the colonists of Great Britain, but for the benefit of rapacious politicians [124]
and traders and manufacturers in Spain. In the colonial administration the former sought easy employment and speedy fortune. In the colonial commercial regulations the latter found an artificial support for trade and manufactures that could not have survived without them. By discriminations, Spanish millers, for instance, were able to import wheat, turn it into flour, and

sell it to the colonists at a price scandalously in excess of that charged for the American product. Sometimes the trouble to grind the wheat was not taken. After it had been imported into Spain it was shipped to the colonies, and upon them was thrown the expense of needless transportation and the profits of superfluous middlemen.

With the complete extinction of the colonial empire of Spain will come to an end these opportunities for the pillage of industrious peoples. The parasites, commercial and bureaucratic, that have depended upon them for a livelihood will be obliged to turn their attention to more legitimate employment. There will be brought to an end also the immense sacrifice of life and treasure required to suppress the ever-recurring insurrections. Both will be left in Spain to develop her resources and to add to her wealth and prosperity; but, best of all, will cease the encouragement to the militant and bureaucratic spirit that the possession of the colonies fostered. The sentiments as well as the employments appropriate to peace will receive an impulse that ought to enable Spain to fill an honorable if not a glorious place in the future history of Europe. But this bright outlook is based upon the assumption that she will not join in the mad competition of her neighbors in armaments and thus fall a prey with them to the economic and moral ravages of "an armed peace."

DREAM AND REALITY.

An ingenious article by M. Camille Mélinand, which appeared a few months ago in the *Revue des Deux Mondes* under the title of Le Rêve et la Réalité (Dream and Reality), is reproduced, in its more important points, in translation, in the present number of the Monthly, and will repay perusal for the novel views it presents. The object of the writer is to show that there is not so much difference as is commonly supposed between the waking and sleeping states, that our dreams are not so illusory nor our waking experiences so absolutely real as we are in the habit of assuming, and that, as we wake from dreams, so we may expect to wake from what we call life into a condition of existence that will give us a new standpoint, and reduce all the experiences which we now take so seriously and tragically to the level of a dream. The only substantial differences he recognizes between our waking state and the dream state are (1) that in our waking moments we know that there is another condition which we call dreaming, while in our dreams we do not recognize a separate waking state; and (2) that, while we wake from our dreams, we do not wake from what we call reality.

M. Mélinand writes in a candid spirit, and yet we think his article is calculated to encourage a somewhat unhealthy type of mysticism. We do not see how it is possible to take too serious a view of the life we live in the present. Whether we view it tragically or not must depend in large measure upon our individual experiences; and happy are they into whose lives tragedy does not enter. The very fact that M. Mélinand would dissuade us from taking life tragically shows that he [125]
recognizes that life—our waking life—can be brought under the rule of right reason. He does not advise us not to take our dreams tragically, for he knows that the dream state is one not susceptible of rational regulation, and this, we think, might very properly be accounted a third very important difference between dream and reality. The true advice to give to those whose happiness we have at heart is, not to look upon life as a kind of dream, but to take it seriously, to study its laws, and to accept the burdens and duties it imposes. It may be remarked that dreams give very little trouble, as a rule, to those whose waking hours are well spent, and whose minds and bodies are kept in a condition of healthful balance. We can indeed in the waking state take measures to reduce our dreams to a minimum, and to provide that at least they shall not be of a distressing character. Such being the case, it seems idle, to say the least, to speculate, as many besides M. Mélinand have done, on the possible reality of dreams. What Bottom said of his dream, "Man is but an ass if he go about to expound this dream," might be applied without much risk of error to dreams generally; unless the exposition takes the direction of endeavoring to explain what antecedent mental or physical condition, or what circumstances acting upon the sleeper, may have given rise to the dream in a given case.

M. Mélinand makes a remark which the experience of many will confirm, that dreams sometimes throw a light of extraordinary intensity on characters and situations, giving us, perhaps, truer views of certain things than we had ever attained in our waking hours. This, however, would only imply the withdrawal at such moments of influences or conditions which, in our waking life, may have the effect of rendering insight less keen and uncompromising. If, for example, we could in our dreams revert to the standpoint of childhood, we should see many things with a directness which is more or less lacking to our mature cogitations, and pronounce judgments in a correspondingly down-right manner, with perhaps a closer approximation to absolute truth. This, however, would manifestly not imply any extension of our mental range, nor afford any guarantee of the "reality" of the dream life. The intuitions of the novelist or dramatist, when they are true and profound, give a wonderful air of reality to the scenes which the author portrays, but do not make them real. There are various waking states in which our perceptions are more than normally acute; and, as we know, the loss of one physical organ leads frequently to an increase of power in others; but these facts throw little light on the main problem of life, which is how to develop and use our normal powers to the best purpose and with the best results. At the same time it is well not to despise any knowledge that may come to us from dreams in the way of self-revelation or otherwise, but to use it for the strengthening of what is weak and the rectifying of what is wrong. In that way dreams may be made subsidiary to the better government of our higher waking life.

As to the conclusion the writer draws, that, as we wake from dreams, so we may some day wake from this life, which is so like a dream, we leave it to the judgment of our readers, merely remarking that it would be very unfortunate if the thought of such an awakening should lead any

one to think little of this life, or abate any effort which he can make to render it, if a dream, a happy dream to himself and others.

Scientific Literature.

[126]

SPECIAL BOOKS.

THE period since the Congress of Vienna has been immensely fruitful of great and far-reaching events—of events that have essentially modified the fortunes of the world, its theories of government, and the condition of its peoples; and of that period the nearly fifty years covered by the second volume of Professor Andrews's history[13] have been most eventful and marked by momentous changes. At the opening of this history the continental sovereigns had established despotism throughout their domains on what they thought were firm foundations, and surrounded it with guards which they considered unassailable. The close of it finds the conditions reversed; government in the interests of the people recognized, and yielded to, even if grudgingly, by those backward monarchs who would prefer to contend against it. The first volume of Professor Andrews's history brings the story down to the close of the revolutionary movements of 1848, when the princes, again set upon their thrones, were studying and plotting as to how they might resume their old authority. In France, Louis Napoleon had become a central figure, and the tendencies were taking shape under which the republic was destroyed and imperialism established. Taking up the record again at this point, Mr. Andrews tells us he has treated only those phases of the history that concern the development of Europe in the larger sense, rather than that of each particular state or country. On the ground that no event can be understood in isolation, and that history is something more than a series of events chronologically considered, he has endeavored to give logical form to the treatment of the subject, to carry each movement forward to its conclusion before turning to the others; and has introduced nothing that did not seem to him to be absolutely essential to an understanding of the subject. He has not deemed it necessary to describe battles and military movements at length, and has omitted, with a few exceptions, biographical discussions. He has been successful in adhering to his plan, and, writing always dispassionately, yet without sacrificing interest, and with his mind fixed on the main object, has given a clear and complete view of what each event recorded signified and of what Europe has accomplished in the past half century. The first chapter concerns France, the failure of the second republic, and the rise of Napoleon III to imperial power. This was extremely unwelcome to the other sovereigns, who were disposed to resent the entrance of an intruder into their ranks, and led to diplomatic skirmishing, ending in the Crimean War—a war that "did not create the forces that led to the national unity of Italy and Germany, ... but gave to Cavour and Bismarck the opportunity that each was seeking." It requires but a few uncolored words at the beginning of the story of the achievement of the unity of Italy—the mightiest event of the whole series—to picture Victor Emanuel the hero that he was. With similar success are presented the masterly statesmanship of D'Azeglio and Cavour and the high-souled patriotism of the people of Italy. This achievement, a victory over opposing Europe, [127] compelled the recognition of an international principle based on the affinities of peoples, and inaugurated, "not only a new *régime* for Italy, but also a new public law for Europe." The empire of Napoleon, which rose to its culmination while these things were going on, was "nothing but an adventure out of accord with modern highly developed civilization," exhausted France and checked the education of the people in matters of government and habits of self-reliance. The rise of Prussia and the establishment, under Bismarck, of the unity of Germany, are regarded as an instance of the accomplishment of a noble end by the use of force. The struggle culminated in the war of 1870, the ultimate consequence of which was that "scarcely a vestige remained of those conditions of the Congress of Vienna which for so many years had been the anxious care of the European concert." The arrangement between Austria and Hungary, creating a dual monarchy, "established a government which was the result, not merely of political ingenuity, but of experience, and one that on the whole was successful"; and Austria has taken its place among the enlightened governments of Europe. The "Eastern question" is presented as one in which the attitude of the powers is no longer determined in Europe, but in China, India, and Africa, the settlement of which seems to be indefinitely postponed. The concluding chapters relate to present conditions.

Mr. *Seward* excuses himself in rather an apologetic way for undertaking to write a book on *Fossil Plants*[14] for the Cambridge Natural Science Manuals—a task which Professor Williamson, a founder of modern palæobotany, had considered too serious; but students of botany and geology have cause to thank him for having consented to attempt the writing of a book intended to render more accessible some of the important facts of the science, and to suggest lines of investigation in it. The botanist and geologist, not being always acquainted with each other's subjects in a sufficient degree to appreciate the significance of palæobotany in its several points of contact with geology and recent botany, the subject does not readily lend itself to adequate treatment in a work intended for students of both classes, and the author has accordingly tried to shape his treatment with this point in view, and so as to adapt it to both non-geological and non-botanical students. As a possible aid to those undertaking research in this field he has given more references than usually seem appropriate in an introductory treatise—often to specimens of coal-measure plants in the Williamson cabinet of microscopic sections, now in the British Museum—and has dealt with certain questions in greater detail than an elementary treatment of the subject

requires. His plan has been to treat certain selected types with some detail, and to refer briefly to such others as should be studied by any one desiring to pursue the subject more thoroughly, rather than to cover a wide range or to attempt to make the list of types complete. The book opens with a sketch of the history of palæobotany, which is followed by a discussion of the relation of palæobotany to botany and geology. A succinct review of geological history is then given, in which the several principal formations are briefly described. The theory of the process [128] of the preservation of plants as fossils is explained, the difficulties and sources of error in the determination of fossil plants are pointed out, and the rules for nomenclature and of priority in it are explained. The systematic part follows these introductory chapters, giving as full descriptions as the condition of the fossils admit, with illustrations—one hundred and eleven in all—of those belonging to the orders *Thallophyta*, *Bryophyta*, and *Pterodophyta*, carrying the subject as far as the *Sphenophyllales*. Technical as the subject necessarily is, the treatment is clear and, where the matter admits, fluent, so that no student need complain of difficulties in that line.

[13] The Historical Development of Modern Europe from the Congress of Vienna to the Present Time. By Charles M. Andrews. Vol. II, 1850-1897. New York: G. P. Putnam's Sons. Pp. 467. Price, $2.50.

[14] Fossil Plants. For Students of Botany and Geology. By A. C. Seward. With Illustrations. Cambridge, England: The University Press. New York: The Macmillan Company. Pp. 452. Pries, $3.

GENERAL NOTICES.

Dr. *W. Detmer's Practical Plant Physiology*[15] is a book of experiments for the use of teachers as well as of students in higher-grade schools, and supplies an aid to the study of the whole of that branch of the science by experimental processes. While the arrangement of the material in the second German edition is essentially the same as in the first, nearly every section has been enlarged or remodeled, and the book is essentially a new one; new experiments have been included for lecture demonstration or private work, and pains have been taken to render the book increasingly useful to serious students of plant physiology, especially to those who desire to familiarize themselves with methods of research. Great care has been taken in the selection of research material recommended for the experiments; and material suitable for winter work has received attention as well as summer material. This second German edition is presented by the publishers in the translation in its entirety, without addition or alteration. The two great divisions of the book are into the Physiology of Nutrition and the Physiology of Growth and Movements resulting from Irritability. In the first division the experiments bear upon the food of plants (assimilation, production of proteids, constituents of the ash, and organic compounds as food for plants); the molecular forces and processes (including movements of gases, absorption and movements of water, and absorption of mineral substances in plants); and metabolic processes in the plant. In the second division the characteristics of growing plant structures, the conditions necessary for growth, the influence of internal causes and external conditions; geotropic, heliotropic, and hydrotropic mutations, and other phenomena of irritability; the winding of tendrils and twining plants; dorsicentrality, polarity, and anisotropy and phenomena of correlation; and movements of variation, are presented.

The primary objects of Mr. *Hoffman's The Sphere of Science*[16] are to point out what constitutes a science, and set forth the ground upon which every science rests and the principles and rules that must be followed in order to construct one. The author maintains throughout that every department of knowledge is capable of scientific treatment, and must be so treated before any great advance can be made toward a consistent and rational conception of the universe. The subjects are considered in succession of the true conception and aims of science, what it takes for granted, the scientific method, certainty and probability in science, the use of the imagination, analogy as an aid, the limitations of science, recent advances in the physical sciences, the old and new psychology, modern scientific ethics, philosophy as the science of the sciences, and the harmony of the sciences. The author holds that the chief need in all departments of thought is not so much mere facts as a new arrangement and classification of facts already at hand; that we can be certain of no doctrine, but the most we can do to establish it [129] is to show that the balance of probabilities is in favor of it; that philosophy is the life of science and science the vital breath of philosophy, and if one is severed from the other both pine away and die; and that those scientific researches are successful which are not exclusively special, but are illuminated by an ample idea of science. The book is the outcome of a series of lectures given to classes in Union College to supplement their work in formal logic.

The *Text-Book of Geodetic Astronomy*[17] was prepared by Mr. *John F. Hayford* to meet the conditions of the course at Cornell University, the terms of which the standard works now in use could not be made to fit. The purpose of the book is to furnish a text short and easy enough to be mastered by the student of civil engineering in a single college term which shall give him a sufficiently exact and extensive knowledge of geodetic astronomy to serve as a basis for practice in that line after graduation. While it is primarily a manual for students, the author has endeavored to insert such matter, tables, and convenient formulas as would make it of value also to the engineer making astronomical observations. Mathematical processes have been omitted, except those that are actually necessary for developing the working formulas, and simple and special means for deriving the formulas have been chosen in every case admitting choice. Considerable attention has been devoted to a discussion of the various sources of error in each

kind of observations. Those formulas have been selected, so far as possible, that lead to accurate and rapid computation.

L'Année Psychologique[18] of M. *Alfred Binet* and his colaborers in the Laboratory of Physiological Psychology of the Sorbonne, Paris, is now in its fourth year, and the four volumes present a compendium of the psychological studies and literature of the period they cover, the value of which will be appreciated by any one who has occasion to examine the work. The first volume was a book of 619 pages, with 33 figures; the second, of 1010 pages, 141 figures, and several plates; the third, of 825 pages, 103 figures, and numerous plates; and the present volume has 849 pages and 117 figures. The plan of all the volumes is the same; it is to present in full the labors of the laboratory, with original memoirs, and to give a condensed but adequate and classified summary of the world's literature of the year relating to the subject. The present volume contains twenty-seven original memoirs, mostly by Professor Binet and M. N. Vaschide, with others by M. B. Bourdon and Mr. A. Le Clère; about ninety reviews of books and papers, classified under sixteen heads, according as they relate to the physiology of the nervous system, the several senses, mental faculties and operations, movements, individual psychology and character, sleep, dreams, and pathological cases, and animal psychology; a bibliography, also classified, of 123 pages; and an index of authors, occupying 17 double-columned pages.

Prof. Cyrus Thomas has given, in his *Introduction to the Study of North American Archæology*,[19] a brief summary of the progress in the investigation and study of the subject which has been made up to the present time. The increased activity among students, the numerous explorations made, the accumulation of data and the flood of light thrown on questions relating to prehistoric North America since the publication of the last general work on it seemed to call for such a summary. While the author's chief object is to present and arrange the data so as to afford the student some means of bringing into harmony and utilizing the facts and materials at hand, yet, in view of the impossibility of presenting a full account of the archæological remains of the continent, and discussing all the questions connected with them in a single small volume, only those considered the best representatives of the leading types and those which best illustrate the [130] arts, customs, and culture status of the former inhabitants are referred to. The movements and remains are treated under the three heads of the Arctic, Atlantic, and Pacific divisions; the first including the works of the Eskimos, the second those of the mound builders, and the third the curious variety of works scattered along the Pacific coast, and in Mexico and Central America, rising to great elaboration in the latter countries. Theories have to be considered, though they are all still uncertain, and Professor Thomas notices the various views which have been expressed as to the origin of the works and the people who executed them. He himself believes that they are all the work of the peoples who lived here when America was discovered, and are represented by the present Indians; that they are not of a very extreme antiquity; and that the continent was peopled by tribes who came down from the northwest through the region between Hudson Bay and the Rocky Mountains.

Of Nature books encouraging the study of the life around us we have an abundance—of some sorts, perhaps, a superfluity—and they have their uses, one of the chief of which is drawing people, who might otherwise never think of it, to the observation of natural facts, and to inquiry into their character and causes. Such books are fittingly complemented by the *Handbook of Nature Study*,[20] of *D. Lange*, of St. Paul, Minnesota, which teaches how system may be introduced into this occupation. In it, the author has undertaken to point out some of the material which may be made the basis of profitable lessons in Nature study, and to show how this material may be made available, and what the pupils may be taught about it. The author has arranged the matter of the subject of his teachings according to seasons and life communities. He begins at home in the spring, and directs the wanderings of the pupils to the waters, fields, and prairies, the roadsides and neglected corners, studying besides the plants and animals, the geological action of water, the flowers of the fields and the needs of neglected places, window flowers, and domestic animals. Then he goes to the woods—in spring, in summer, and in autumn—and their plant and animal life, the effect of all these upon the earth, and their relations to one another. Some practical precepts are given to teachers concerning the method of conducting the study of Nature.

In the presentation of his conception of *The State*[21] or the Elements of Politics, Prof. *Woodrow Wilson* has taken a comprehensive view. Designing a book for study and instruction, he has sought to set forth the evolution of existing systems of government from the beginning. Possessing no model, no text-book of like scope and purpose having apparently hitherto been attempted, he has had to make his own type; and, in the absence of anything else to refer the student to, has been obliged to include much that might otherwise have been omitted. The volume is consequently large; but this disadvantage, if it be one, is compensated for by the fact that the student has the whole subject before him. For his descriptions the author has chosen governments which are types of their several kinds. An indispensable prerequisite to studies of things of this sort is a knowledge of the constitutions of the states of classical antiquity; hence the institutions of Greece and Rome are studied: Greece, which furnished the spirit and inspiration under which the world has advanced; and Rome, which laid the foundations of modern jurisprudence. Before these, even, a glance at The Earliest Forms of Government, their Origin and Evolution, was required. Then, coming to modern systems, which are also traced in their historical development, "the government of France serves excellently as an example of a unitary government of one kind, and Great Britain equally well as an example of a unitary government of another kind; Germany exhibits a federal empire, Switzerland a federal republic of

one sort, the United States a federal republic of another; Austria-Hungary and Sweden-Norway show the only two existing European types of dual monarchies." Russia might have been [131] presented as having a place apart in European politics, but the book was full. The work has been prepared in the belief that "our own institutions can be understood and appreciated only by those who know other systems of government as well and the main facts of general institutional history." The accounts of the particular systems of government are followed by short chapters on the Nature and Forms of Government; Law, its Nature and Development; the functions and the objects of government; and summaries, in which the conclusion is expressed that law grows with the growth of the community, can not leap too far ahead of it, and must not lag behind it; and that "the method of political development is conservative adaptation, shaping old habits into new ones, modifying old means to accomplish new ends."

Mr. *H. E. Parkhurst* has made in his *How to Name the Birds*[22] a book on a different plan from the other books about birds that are now appearing so abundantly—not to rival them, but to serve as an introduction to their more general use. It is intended to aid the field ornithologist in determining an unknown species, by calling his attention to their more obvious features and those more distinguishable from a distance than those which observers using the ordinary bird books have to depend on as a means of recognition. Color is chiefly relied upon, and, as a further means of finding the birds, they are grouped by the seasons, when they may be seen in a given locality—the summer, winter, migrant, and permanent birds, and birds of prey. The first four groups are subgrouped according to color, and the larger color groups are further subdivided. Other devices and signs are contrived, so that a complete description of the bird, as it will appear to the amateur watching it from a little way off, is given in three or four lines. To this a brief comment is added regarding the nesting and habits of the bird. These descriptions are preceded by an analytical key similar to the botanical keys; and the study is aided by giving three pages of diagrams illustrating the distinctive areas of the bird's body, to which reference is made in describing the colors, stripes, and spots. The list comprises only those birds that are normally found within the territory described in the title as regular summer or winter visitants, as migrants, or as permanent species.

A very important contribution to the economy of city administration is the quarterly *Supplement to Municipal Affairs*, June, 1898, in which the late superintendent of street cleaning in the city of New York, *George E. Waring*, Jr., presents his observations on street-cleaning methods in European cities, and general reports of his own work in that line. The observations in Europe, made in the summer of 1896, in a special study of the subject, for the information and improvement of Mr. Waring's own department, include accounts of the conditions as to cleanliness and the methods of doing the work in Vienna, Budapest, Munich, Berlin, Cologne, Brussels, London, Birmingham, Paris, Turin, and Genoa. Mr. Waring finds that the regulations under which the streets are really kept clean in those cities are no better than ours; "but there is the immense difference that in Europe laws and ordinances mean something and are executed, while here they are treated as mere matters of form." The reports of Mr. Waring's own work in New York embrace a review of the general operations of the department, the report of the snow inspector, and an account of the highly successful plan for the adjustment of labor questions instituted by Mr. Waring.

Mr. *Lauros G. McConachie*, in the study and development of legislative methods which he publishes under the title of *Congressional Committees* (T. Y. Crowell & Co., New York, $1.75), assumes that a complete breakdown of parliamentary machinery took place on the floors of Congress under the sudden and vast augmentation of legislative burdens which our senators and representatives had to confront after the civil war. Two schools of reformers came to the front, one of which held up the British parliamentary system as a model and directed attention abroad in the search for light; while the other stood up for the defense of American legislative methods [132] as developments of American political conditions. The author has sought a mean between these schools, and has tried to glean from contemporary debates, memoirs, newspapers, and other records the reasons assigned for each innovation as it has entered and enlarged the codes, and has taken the testimony of contemporary legislators upon the conditions prevailing in successive stages in the history of the national House and Senate. Among the lessons presented by the book are those of the tremendous power wielded by the speaker of the House of Representatives and of "other anomalies in a supposed elective folk congress."

Whittaker's Mechanical Engineer's Pocket Book, prepared by *Philip R. Björling*, if it does not contain everything, contains a great many facts and formulas concerning matters on which the mechanician is often called upon to seek immediate information, a considerable proportion of which are not easily subject to systematic classification. Among the one hundred and thirty formulas and processes are those relating to the flow and force of water and wind, the pressure of gases and the air, the weight, proportions, and strength of parts of machinery; stresses, rate of delivery of elevators, etc., gauges, tables of areas and circumferences, squares, cubes, fourth and fifth powers and roots, and items which can be indicated only by viewing them in detail. It is a valuable and indispensable companion for the mechanical engineer. The Macmillan Company. Price, $1.75.

M. J. Costantin conceives that science consists in something more than the mere accumulation, description, and classification of facts, with which too many persons confound it, and that the important thing is what the facts teach, and, as related to it or as what may help to find it out, the theories that may be deduced from them. He applies this principle to the evolution of plant life in his book *Les Végétaux et les Milieux Cosmiques* (Plants and Cosmic Media)—adaptative

evolution, which is essentially a study of the operation of the various material factors of the environment on growth and development. "Guided by Goethe's ideas, he invites us to witness the incessant variations of organized existence everywhere visible in Nature," under the influence of cold and heat, light, gravity, and the aquatic medium, hoping in these studies to find new and decisive arguments in favor of transformist conceptions. He aims to show how the new characteristics produced by changes in the influence of these factors to which plants are subjected may be fixed and gradually become hereditary. (Published by Félix Alcan, Paris, in the *Bibliothèque Scientifique Internationale*.)

Mr. *A. G. Elliot's* little work on *Industrial Electricity*—a translation and adaptation from the French of Henry D. Graffigny—is the first and introductory volume of an electro-mechanical series published by Whittaker & Co., London, and the Macmillan Company, New York. The editor, in introducing the volumes, expresses the belief that there is room for them because they explain in very clear and non-mathematical language the many and various applications of electricity. Many thousand copies of the original French editions have been sold. The present volume is divided into short chapters, each dealing with a separate branch of practical electricity-its nature, the units, magnetism and induction, practical measurement, chemical generators, accumulators, dynamo-electric machinery, electric light, electricity as a motive power, electric chemistry and electro-plating, bells and telephones, and telegraphs. In the succeeding volumes of the series the more important branches of the subjects touched upon here will be treated separately and in detail.

Franklin Story Conant was born in Boston in 1870; was educated in the public schools of New England, at the University of South Carolina, and at Williams College; and was a Doctor of Philosophy, Fellow, and Adam T. Bruce Fellow in Johns Hopkins University. He showed great appetency for biological investigation and devoted himself to it, at Baltimore, Beaufort, N. C., Wood's Hole, and in Jamaica. He published a few papers of mark, and would have published many more if he had lived. He went to Jamaica in June, 1897, to continue his investigations, and worked for nearly three months on the development and on the physiology of the sense organs of the *Cubomedusæ*. After the death of the director of the expedition, Dr. J. E. Humphrey, he took [133] the burden upon himself, and labored faithfully till he contracted yellow fever; returned to Boston, and died there September 13, 1897. His associates of Johns Hopkins University have published as a memorial volume of him his dissertation on *The Cubomedusæ*, which he presented at the examination for the degree of Doctor of Philosophy in June, 1897, accompanied by a brief notice of his life and a portrait.

Frederick H. Ripley and *Thomas Tapper*, authors of the Natural Music Course, have arranged *A Short Course in Music*, consisting of two books, for use in schools in which the more complete course is deemed unnecessary or impracticable. In both books familiar songs are made the basis of elementary music instruction. In these songs the compositions of the best song writers are represented. Exercises in two and three parts in simple form are included in the course. A brief summary of elementary theory is inserted in the appendix. Few definitions are given, the thought of the learner being so directed as to render them either unnecessary or obvious. In the cultivation of tone and expression the authors insist that it is the mind rather than the vocal organs that at first needs attention. "If the pupil hears the ideal tone he will almost instinctively imitate it." A number of portraits of composers are given in connection with the songs. (American Book Company. Price, 35 cents.)

Mr. *Alfred Still*, believing that there was still room for a small book in which the principles determining the behavior of single-phase alternating currents under various conditions should be considered less from the point of view of the man of science than from that of the engineer, offers *Alternating Currents of Electricity and the Theory of Transformers* for the place. The book has been written, not only for engineering students, but also for those engineers who, while having extensive practical knowledge of the subject, are yet anxious to get a correct elementary idea of the leading principles involved. Graphical methods are used throughout, and the introduction of mathematics has been carefully avoided. (Published by Whittaker & Co., London; The Macmillan Company, New York. Price, $1.50.)

A paper by *A. B. Stickney*, president of the Chicago Great Western Railway Company, on *The Currency Problems of the United States in 1897-'98*, takes the ground that currency is the creature of commerce; that legislation has nothing to do with it; that its problems are purely economical; and that the only thing that can be done for it is to improve the machinery of exchanges.

A valuable and useful publication is New York *State Library Bulletin, Legislation, No. 9*, containing a summary of legislation by States in 1897. This is the eighth annual number of the series, and its purpose is to show at a glance what laws have been passed by States on any subject, except those of purely local interest. The summaries, though concise, so well cover the principal points of the laws cited that consultation of the text of the laws may often be dispensed with. Constitutional amendments receive special treatment. The references in the present bulletin cover thirty-six States and three Territories.

Two memoirs, published under one cover by the Peabody Institute of American Archæology and Ethnology, relate to explorations by *George Byron Gordon* in two districts of Honduras, affording relics different in character. The work at the ruins of Copan having been suspended during 1896

and 1897 by some act of the Government of Honduras, Mr. Gordon had to turn his attention elsewhere, to explorations the results of which are given under the titles of *Researches in the Uloa Valley* and *Caverns of Copan, Honduras*. The investigations in the Uloa Valley afforded a rich fund of objects of interest and of novel character—pottery adorned with elaborate and remarkably artistic designs, stone images, whistles, terra-cotta stamps, and only one idol. Human remains, of the most meager description, in connection with the pottery furnish reasonable evidence of burial places, but, being only crumbling fragments of bone, are too minute to supply any information respecting the form of burials or the relative position of the objects associated with them. The conclusions are drawn that the valley was at one time well populated, but not for [134] any length of time occupied by the people whose ruined buildings of stone are found in the region up to southern Mexico, and that it was visited by several distinct peoples in ancient times. Some mounds covered with stone were discovered which deserve further investigation. Five caves of different size and character, described in the second memoir, were explored near Copan, and afforded objects peculiar to themselves and evidences of sepulture. They were very dusty, although stalactites had formed in some of them, and, although undoubtedly used by man many centuries ago, they do not seem to indicate a constant occupation for an extended period of time, or to furnish evidence of an extreme antiquity of man in the region. The most striking feature about them is probably the entire difference in character of the pottery from that found at Copan, only a few miles away, and its want of resemblance with the pottery of any other locality with which the author is familiar.

A series of Bulletins, *Some Miscellaneous Results of the Work of the Division of Entomology*, of the United States Department of Agriculture, is intended to furnish such material as was formerly published in Insect Life, presenting the results of observations made in the office of the bureau which are not extensive enough upon any one topic to form an independent and complete bulletin. The second number contains notices by different authors, mostly connected with the bureau, on twelve insects predatory on economical plants, with numerous "general notes" and correspondence.

Under the Stars, and Other Verses, is a small collection of ballads, relating chiefly to naval fights, by *Wallace Rice* and *Barrett Eastman*, published by Way & Williams, Chicago. It is dedicated "to the wider patriotism," and appears well adapted to inflame the martial spirit, which is in this country already excited to an extremely unhealthy extent.

[15] Practical Plant Physiology. An Introduction to Original Research for Students and Teachers of Natural Science, Medicine, Agriculture, and Forestry. By Dr. W. Detmer. Translated from the second German edition by S. A. Moor. London: Swan, Sonnenschein & Co. New York: The Macmillan Company. Pp. 555. Price, $3.

[16] The Sphere of Science. By Frank Sargent Hoffman, Ph. D. New York: G. P. Putnam's Sons. Pp. 268. Price, $1.50.

[17] A Text-Book of Geodetic Astronomy. By John F. Hayford. New York: John Wiley & Sons. Pp. 851, with plates.

[18] L'Année Psychologique. Edited by Alfred Binet—with the Collaboration of H. Beaunis, Th. Ribot and Bourdon, Courtier, Farrand, Flournoy, Philippe, Vaschide, and Warren. Editorial secretary, Victor Henri. Fourth year. Paris: Librairie C. Reinwald. Schleicher Brothers, publishers. Pp 849. Price, 15 francs.

[19] Introduction to the Study of North American Archæology. By Prof. Cyrus Thomas. Cincinnati: The Robert Clarke Company. Pp. 891.

[20] Handbook of Nature Study for Teachers and Pupils in Elementary Schools. By D. Lange. New York: The Macmillan Company. Pp. 339. Price, $1.

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Fragments of Science.

Carbonic Acid and Glaciation.—In a paper on Hypotheses bearing on Climatic Changes, Prof. T. C. Chamberlin takes up a suggestion of Tyndall's that the periods of terrestrial glaciation might be dependent upon the carbon dioxide of the atmosphere, the peculiar competence of which to retain solar heat he had demonstrated. Following out the doctrine of atmospheric loss on its own lines, although only in a tentative way as yet, he seems to find a rhythmical action that may in part explain the glacial oscillations. The idea, he says, hinges on the action of the ocean as a reservoir of carbon dioxide, and on the losses of the organic cycle under the influence of cold. Cold water absorbs more carbon dioxide than warm water. As the atmosphere becomes impoverished and the temperature declines, the capacity of the ocean to take up carbonic acid in solution increases. Instead, therefore, of resupplying the atmosphere in the stress of its impoverishment, the ocean withholds its carbon dioxide to a certain extent, and possibly even turns robber itself by greater absorption. So also, with increased cold the progress of organic decay becomes less active, a greater part of the vegetal and animal matter remains undecomposed, and its carbon is thereby locked up; and hence the loss of carbon dioxide through the organic cycle is increased. The impoverishment of the atmosphere is thus hastened and the epoch of cold is precipitated. With the spread of glaciation the main crystalline areas whose alteration is the chief source of depletion become covered and frozen, and the abstraction of carbon dioxide by rock alteration is checked. The supply continuing the same, by hypothesis, re-

enrichment begins, and when it has sufficiently advanced warmth returns. With returning warmth the ocean gives up its carbon dioxide more freely, the accumulated organic products decay and add their contribution of carbonic acid, and the re-enrichment is accelerated and interglacial mildness is hastened.

Additions to the Missouri Botanical Garden.—We learn from the ninth annual report of the Missouri Botanical Garden that while the decorative features were maintained in 1897 in about the same manner as heretofore, considerable additions have been made in certain classes, especially orchids, and the collections of cultivated species, with their named varieties, are now estimated to number about five thousand. Circumstances made possible material additions to the contents of the herbarium; and, besides the purchased current collections, rather larger and more numerous than usual, the garden has secured the herbarium of the late J. H. Redfield, very rich in earlier collections representing the flora of the United States; the herbarium of the late Dr. J. F. Joor, containing 4,133 specimens, and largely adding to the representation of the flora of [136] Louisiana and Texas; the interesting herbarium of Gustav Jermy, of San Antonio, Texas, containing a very full set of Carpathian plants and a nearly complete local flora; the important pre-Linnæan herbarium formed by Boehmer and Ludwig; and a Chinese collection by Dr. A. Henry. Even larger additions were made to the library. The instruction of garden pupils was continued, and the garden was visited by several research students. Among the scientific papers accompanying the report and bound with it are those of C. H. Thompson on American Lemnaceæ; N. N. Glatfelter on *Salix longipes*; H. C. Irish on the Genus Capsicum; A. S. Hitchcock on Cryptogams collected in the Bahamas, Jamaica, and Grand Cayman; J. N. Rose on Agaves; C. H. Thompson on Cacti Anhalonium; and seven shorter papers under the heading of "Notes and Observations."

The Indian Idea of the "Midmost Self."—In attempting to explain the significance of a pentagonal stone dodecahedron with vestiges of figures on it found near Marietta, Ohio, Dr. J. C. Morris assumed that, besides the Aryan idea of three dimensions of space, there is, to the Indian and to the Eastern mind, another—the fullness. "It is not the length and breadth and thickness of a cube, for instance, but the whole of it, which is as much to be considered as any one of its sides. A cube would therefore be represented numerically by seven, a dodecahedron by thirteen. Among the Mexicans the thirteen lunar months would thus correspond in the year with the twelve zodiacal signs and the earth which passed under and embraced them all." Again, the five digits came to be a measure of man's power or individuality, and thus a sacred number. A pentagonal dodecahedron, then, might be the emblem of the world; and the best time to be active in some contemplated pursuit might be shown by the zodiacal sign that came uppermost when the dodecahedron was thrown or rolled with appropriate ceremonies. As Mr. Frank H. Cushing interpreted the doctrine at the same meeting of the Anthropological Society, when the primitive man contemplates or considers himself or anything in its relation to space or the surrounding directions, "he notices that there is ever a front or face, a rear or back; two sides, or a right and a left; a head and a foot, or an above and a below; and that of and within all of these is himself or it; that the essence of all these aspects in anything is the thing itself—that is, the thing that contains their numbers or sum, yet is one by itself. This is indeed the very key to his conception of himself and of anything in relation to space and the universe or cosmos. He observes that there are as many regions in the world as there are aspects of himself or sides to any equally separate thing; that there are as many directions from him or his place in the world (which is his 'midmost' or place of attachment to the Earth-mother), or from anything in the world (which is its midmost or natural station), toward these corresponding regions. Hence to him a plane would be symbolized not by four, but by five—its four sides and directions thence, and its central self—as was actually the notion of the prairie tribes; a cube, not by six, but by seven, as was the notion of the valley Pueblos and Navajos; a dodecahedron, not by twelve, but by thirteen, as was the notion of the Zuñis, the Aztecs, and apparently—from this example—of the mound builders as well."

The Bactrian Camel for the Klondike.—The great Siberian or Bactrian camel is recommended by Mr. Carl Hagenbeck, the famous Hamburg importer of wild beasts, as the best animal for the Klondike climate. It is at home in the coldest regions, can carry or go in harness, can cross mountains or traverse valleys, and is so easily supplied that Mr. Hagenbeck can undertake to deliver any number in New York, duty paid, for three hundred dollars each. It can endure thirst and long spells of hunger as well as freezing cold, and is not too delicate to make its bed on the snow. It sheds its coat before the summer heat, but as the cooler weather of the fall comes on "it grows a garment of fur almost as thick as a buffalo robe and equally cold-resisting. It is far more strongly built than the southern camel. It does not 'split' when on slippery ground, though it falls on moist, wet clay which yields to the foot. On ice and frozen snow it stands firmly, and can travel far." It is said that an excellent cross can be made between the male Bactrian and [137] the female Arabian camel; but when the parentage is reversed the progeny is useless. General Harlan is said to have marched two thousand Bactrian camels four hundred miles and crossed the Indian Caucasus in ice and snow, with the loss of only one animal, and that by an accident. This camel is native to the high plateaus, steppes, and deserts of Mongolia and South Siberia, and it has been found wild on the plain of Tsaidam, maintaining itself in this "arid, cold, and waterless region, where the herds are said to travel seventy miles to drink. Nothing," we are further told, "but too much comfort or a damp climate seems to hurt it. For food it prefers dry, salty plants and bushes and grows sick and lean on good pasture. The salty efflorescence of the steppes is eagerly eaten by it, and in this country it prefers dry food, especially wheat straw and hay. Prjevalski's camels would eat almost anything—straw, bleached bones, old pack saddles, straps, and leather. The Mongols told him of camels which had been without food a long time,

and then devoured an old tent belonging to their owner. They even ate meat and fish, and one of the traveler's camels made a meal of the bird skins ready for stuffing."

Nicaragua and its Ferns.—Tropical America is described by B. Shimek, in a paper on the Ferns of Nicaragua, as the fern paradise of the earth. "No other corresponding division of the earth's surface," he says, "presents as great a total number of species, or as many species which are peculiar to it. Nowhere else is the great variation in form and size, in structural characters and habits of growth, and in the arrangement and character of the reproductive organs, better shown than here. This richness in the fern flora, exhibited in almost unlimited variety, is, no doubt, accounted for by the topography and contour of that part of the American continent which lies within the tropics. It is narrow when compared with the continents of the Old World, and it contains high mountain chains, which form its longest axis. Its narrow form brings all of it more or less within the influence of the adjacent oceans, which furnish to most of it an abundance of moisture. Its high mountains supply all the conditions effected by altitude, and, moreover, cut off the otherwise abundant moisture from certain areas. We have thus within comparatively restricted limits all the possible degrees of moisture and temperature, and the effect of environment finds abundant expression in the great variety of fern structures." After palms, ferns form the most conspicuous feature of tropical vegetation, and in size they vary from species only a fraction of an inch high to splendid tree ferns or vines single fronds of which are more than thirty feet long. In texture "some rival the flimsiest lace, while others develop thick, leathery fronds.... In habit the variation is fully as great. In western Nicaragua, for example, where there is a distinct dry season, ferns growing on bare volcanic rock become so dry that they may be ground to powder between the fingers, and yet they retain life; while in the eastern part, with its deep jungles in which perpetual shade and moisture prevail, the more delicate as well as the more gorgeous forms have full opportunity for the development of their many peculiarities." In a very small territory of Nicaragua, including a strip along the San Juan River in no case extending more than six miles away from it, and in the little island of Ometepe in Lake Nicaragua, Mr. Shimek, in less than four months, while engaged in general botanical work, collected more than a hundred and twenty species of ferns; and yet only about one fifth of one hundred and twenty-one species recorded by Fournier, two fifths of one hundred and thirty-five species credited by Hemsley to Nicaragua, and two fifths of those reported by Baker and Hemsley from adjacent Costa Rica, occur in his list.

Wave Length and other Measurements.—Describing the measurement of absolute wave length before the Astronomical and Physical Society of Toronto, Mr. A. F. Miller remarked that a somewhat incorrect idea prevailed as to the smallness of the space occupied in the performance of luminous undulations; in fact, some people seem to regard the wave length of light as something almost inconceivably small. Really, however, we are familiar with much smaller dimensions. For instance, the author had found from actual measures that the wave length of one of the characteristic lines in the spectrum of sodium vapor was very nearly equal to 1/42000 of an [138] inch. The thickness of ordinary gold leaf is given as 1/282000 of an inch, from which it becomes evident that the wave length of sodium light, which is an average wave length for the visible spectrum, is six and a half times as great as the thickness of gold leaf. Such a dimension as 1/42000 of an inch could readily be measured by a suitable micrometer; but of course the waves of light, as well as the ether particles by which they are transmitted, are entirely invisible, and even were this otherwise the frequency of the undulations is so inconceivably great that the actual phenomena of the movements could never become perceptible. In measuring the absolute wave length, therefore, we are forced to take the indirect method of observing the results of undulations in cases where, by a suitable arrangement of the experiment, equal and opposite phases of vibration are made to arrive simultaneously at the same spot, so producing phenomena of interference.

The "Causses" of Southern France.—It is surprising to find existing, in a country so old and supposedly so familiar as France, a region similar to our Colorado plateau, full of cañons, caves, and cliff dwellings, until recently almost unknown and wholly unexplored. Yet such is the region of the Causses, described and illustrated with a striking series of lantern views, before the American Association for the Advancement of Science, by the well-known cave explorer, Dr. H. C. Hovey, of Newburyport, Mass. The local name Causse, derived from the Latin calx, lime, is applied to a limestone area, and here to a limestone plateau. Along the western slope of the Cévennes Mountains lies an elevated table-land, chiefly of Jurassic limestones, which had been cut and carved by the streams, especially the Tarn and its affluents, into a group of high plateaus separated by deep cañons. The cliffs of the Tarn Valley are from one to two thousand feet and even more in height, and with their precipitous sides and the brilliant and varied coloring of their strata are not unworthy of comparison with our own great cañon regions of the West. At some points, where the beds are markedly unequal in hardness, the weathering process has resulted in structures as remarkable as Monument Park or the Garden of the Gods. Such is the "rock city" known as Montpellier-le-Vieux, at the junction of the Jonté and the Durbais, on the Causse Noir. This strange area of natural ruins covers some two thousand acres with a fantastic similitude of castles, palaces, streets, and temples. It seems surprising that a country so picturesque for the tourist and so interesting for the geologist should have remained almost unknown till the present time. Fine roads pass over and around it, but they avoid the wild and rugged portions that possess such scenic interest, and leave the Causses—as they have been for ages—barren solitudes, occupied only by shepherds with their huts and flocks. The people, also, as is so often the case in such regions, have a superstitious dread of the deeper caverns and the seeming ruins, and do not lend themselves readily to exploration. The cliffs are full of caves, some of which—the

more accessible and simple—are used as sheepfolds, and even in some cases inhabited, but the wilder ones are held in dread. It seems that cliff dwellings are actually still in use to some extent in this region. The French Société de Spéléologie has now for some years been investigating the Causses with great interest. Ere long this will become a favorite region for tourists; but at present one must leave all ordinary facilities of travel and take to canoes and mules. This was done by Dr. Hovey and his party, under the leadership of M. Edouard A. Martel, of Paris, who has been one of the most active explorers. They entered and traversed many remarkable caves, some never before visited, and some that have been previously explored by M. Martel and others of the société. One of these, known as the Baumes Chaudes, is a great triple cavern, one of the main branches of which had yielded a large number of prehistoric skeletons to Dr. Prunières, of Marvejol. In the third division are a number of deep pits, locally called "wells," from forty to a hundred and thirty feet deep; these communicate with lower passages and subterranean streams. They are death-traps to animals, the remains of which, of many kinds and in all stages of decomposition, accumulate at the bottom, and are gradually covered by stalagmitic deposits. Another remarkable cave was discovered and named after its daring and enthusiastic explorer, [139]
M. Louis Armand, of Paris. It can only be entered by a "well" two hundred and forty feet deep, and below this lies another of still greater depth. The party was provided with rope ladders for use in such places; and the intrepid investigator who essayed the descent went down, by actual measurement, six hundred feet from the surface. He described the stalactites as magnificent. Both from a geological and an archæological point of view this account was of unusual interest. Dr. Hovey had many beautiful views of the cañons and the cave openings in their walls; while his observations, and those of the Société de Spéléologie, are very curious as to the persistence, in this strangely overlooked region, of conditions closely akin to what are usually called "prehistoric" times.

Molecular Asymmetry and Life.—Speaking in his presidential address to the Chemical Section of the British Association on Stereochemistry and Vitalism, Prof. A. R. Japp expressed the conclusion that "the production of single asymmetric compounds or their isolation from the mixture of their enantiomorphs [or opposite forms] is, as Pasteur firmly held, the prerogative of life. Only the living organism, with its asymmetric tissues, or the asymmetric productions of the living organism, or the living intelligence with its conception of asymmetry, can produce this result. Only asymmetry can beget asymmetry. The absolute origin of the compounds of one-sided asymmetry is a mystery as profound as the absolute origin of life itself. The two phenomena are intimately connected.... No fortuitous concourse of atoms, even with all eternity for them to clash and combine in, could compass this feat of the formation of the first optically active organic compound. Coincidence is excluded, and every purely mechanical explanation of the phenomena must necessarily fail. I see no escape from the conclusion that at the moment when life first arose a directive force came into play—a force of precisely the same character as that which enables the intelligent operator, by the exercise of his will, to select one crystallized enantiomorph and reject its asymmetric opposite. I would emphasize the fact that the operation of a directive force of this nature does not involve a violation of the law of the conservation of energy."

Dr. Russell's Photographic Researches.—At the recent meeting of the British Association at Bristol, Dr. W. T. Russell gave, before the Chemical Section, some further information regarding his recent researches on the surprising action exerted by certain substances in the absence of light on photographic plates. The Journal of the Society of Arts gives some of his more striking results: "Some ordinary type, a portion of the cover of Punch, and the wrapper of a packet of tobacco produced strongly defined pictures; the last mentioned was particularly interesting, inasmuch as the red ink had proved active, the blue inactive. Strangely, writing ink (old-fashioned) is quite inactive, and paper having writing on it in ink, even over a hundred years old, when placed between a sheet of active material and a sensitive plate, yielded a picture in which the writing appeared quite distinctly, white on black, in spite of the original being in some cases indistinct; ferrous sulphate behaves like ink. The list of materials that are active is very long, and includes wood, which gives a picture of the grain and knots. Many metals are active, but zinc is very active only when bright, so that a dirty sheet of zinc rubbed with sandpaper gives a picture of the scratches. Many alloys are also active, pewter and fusible metal being two of them, and curiously some brasses are, while others are not. The effective agency that passes from the material to the sensitive plate shows peculiarities. It passes through gelatin, gutta-percha, celluloid, collodion, wet gum arabic, and some paper, while other paper, glass, minerals transparent to light, and many other substances are opaque to these emanations, and some striking effects were exhibited demonstrating the interference of these opaque substances when interposed between an active substance and the sensitive plate. For instance, a five-pound note placed printing downward on the sensitive plate gave a picture of the printing inscription, but when placed under a zinc plate with the printing toward the zinc plate it gave a picture of the opaque paper with the water marks distinctly showing, and, what is still more astonishing, the zinc plate, after contact with the note, itself yielded a picture of the inscription, showing that the [140]
influence from the ink had passed to the zinc plate. It was noteworthy that the signature was not in writing ink. A cutting from the Times, the paper being transparent, showed a picture of the printing on both sides; the picture, moreover, was reversible, showing that a perfect picture of both sides of the paper had been impressed on the one plate. This interesting phenomenon is, however, not quite explained, but the great amount of work he has done leads him to the provisional opinion that the effect is due to the evolution of hydrogen peroxide."

Scientific "Trade Hunting."—The recent movement in England toward the establishment by the Government of a commercial intelligence office for the securing and diffusion of information

regarding foreign trade has given rise to considerable discussion among the English trade papers. The business of the office is to be the gathering of general information of interest and value to the English merchant with a foreign trade, and especially of pointing out new ways for the extension of foreign commerce, and calling attention to possible new markets for English goods. A number of schemes have been proposed, among others that of sending an expert once every year or two to the different foreign "trade areas," for the purpose of collecting information and samples, and of giving a trustworthy estimate of its commercial prospects; another, that of extending the consular reports in such a manner as to compass the same ends. There is considerable opposition to the scheme from some branches of business, where it is held that no one is so likely to get hold of useful information as the trader himself, and that the publishing of such Government reports as the scheme contemplates would result in giving the information to foreign as well as English traders, and thus negative whatever advantage might come to the English merchant from his individual discovery of a valuable market.

Dr. Neufeld.—The London Times of September 13th gives the following account of the career of Dr. Neufeld, who has just been delivered from captivity in Omdurman by the English forces: "Karl Neufeld studied medicine at Leipsic University, and went early in life to Egypt, following first his profession as a medical man and subsequently as a merchant. At the beginning of the eighties he had a practice at Keneh, Upper Egypt, where several Germans and also natives of his own home saw him. Subsequently he set up as a merchant at Assouan. After the fall of Khartoum and the firm establishment of the Mahdi's power at Omdurman, Neufeld seems to have formed a scheme for opening up commercial intercourse with the closed Soudan, for he equipped a caravan with which he proceeded to Berber, which was then in the hands of Osman Digna. The latter sent the German, whom he looked upon as a dangerous spy, to the Khalifa Abdullahi. This was in 1886. Neufeld was condemned to death, and was taken to the place of execution. He behaved there so courageously, asking to be executed like a Mohammedan, instead of suffering death by hanging, that the Khalifa was struck and respited him under the gallows. He was taken to the general prison, with heavy chains on his hands and feet, and treated altogether in a most abominable manner. He was kept alive by the women, who took pity on him and fed him, as they had done before him to Slatin. Then an endeavor was made to utilize his knowledge. He knew nothing about founding cannon, but he managed to manufacture powder, and he was also ordered to invent a machine for coining money. Owing to the escape of Father Ohrwalder and, later, of Slatin Pasha, his position became worse. He was again manacled and threatened with having his arms and feet hacked off if he should attempt to escape. There were many efforts to liberate him. The Austrian Catholic mission, induced by Father Ohrwalder, Slatin Pasha, the British Government, the German, and more especially the Austrian, representatives at Cairo, all endeavored to further the escape of Neufeld. He frequently received money, but he refused to escape, as he would not accept liberty without his wife—an Abyssinian slave presented to him by the Khalifa—and the two children whom she had borne him. The latter would have been exposed to fearful tortures, and thus Neufeld chose to remain a prisoner. He was active subsequently also as an artist, and as he could draw well he was ordered to decorate the mausoleum of the Mahdi, [141] and this pleased the women of the Khalifa so much that they petitioned the latter for his liberation. It is also said that he has written Arabic books and illustrated them. The latter part of his twelve years' detention appears to have been less onerous, as after the escape of Slatin he had to be interpreter to the Khalifa and translator of European newspapers which the ruler of the Soudan received regularly. It is to the credit of the Khalifa Abdullahi that not one of the Christian prisoners received a hurt on the approach of the Anglo-Egyptian forces. It is expected that a narrative of his experience in the Soudan will be shortly published by Dr. Neufeld."

Natural Selection and Fortuitous Variation.—The three principal objections urged against Darwin's theory of natural selection were stated by Prof. W. F. R. Weldon, in his presidential address to the Section of Zoology and Physiology of the British Association, as being that the species of animals we know fall into orderly series for the selection of which purely fortuitous variations can not be supposed to afford opportunity; that minute structural variations can not be supposed to affect the death-rate so much as the theory requires they should, while many of the characters by which species are distinguished appear to us so small and useless that they can not be supposed to affect the chance of survival at all; and that the process of evolution by natural selection is so extremely slow that the time required for its operation is longer than the extreme limit of time given by estimates of the age of the earth. The first of these objections the speaker alleged to be due to a misunderstanding of words; we regard as fortuitous what we do not understand; and he proceeded to explain how what we call chance may be shown, especially by a method developed by Professor Pearson, to be a real and important factor. To the other two objections Professor Weldon opposed the results of observations of his own and of Mr. Herbert Thompson on the small shore crabs (*Carcinus mœnas*) at Plymouth Beach. "In these crabs small changes in the size of the frontal breadth do, under certain circumstances, affect the death-rate; and the mean frontal breadth among this race of crabs is, in fact, changing at a rate sufficiently rapid for all the requirements of a theory of evolution." In conclusion, he said: "I hope I have convinced you that the law of chance enables one to express easily and simply the frequency of variations among animals, and I hope I have convinced you that the action of natural selection upon such fortuitous variations can be experimentally measured, at least in the only case in which any one has attempted to measure it. I hope I have convinced you that the process of evolution is sometimes so rapid that it can be observed in the space of a very few years." The whole difficulty of natural selection, he added, is a quantitative difficulty; and he insisted upon the need of observations and measurements of the rates of variation.

The Interior of Canada.—The country between Lake St. John and James Bay is under survey by the Department of Colonization and Mines of Quebec, in furtherance of a scheme for a transcontinental railroad to tap the Hudson Bay country and Lake Winnipeg. As to the commercial advantages of a railway center established at the head of James Bay or at the limit of tide water on the Nottaway River, Mr. O'Sullivan, the surveyor, shows that the shore line of Hudson and James Bay, following the east coast from the mouth of the Nottaway to the southern entrance to Hudson Strait, measures, in a line running due north, eight hundred miles, or about the same distance as the former point is north of the city of Washington; and the western shore line, measured in the same way to Rowe's Welcome, is about sixteen hundred miles, while the area inclosed amounts to more than three hundred and fifty thousand square miles. While Hudson Strait is blocked with ice during nine months of the year, the bay itself is navigable from June till November, and James Bay is generally open early in May. All the large rivers—the Albany, Moose, Hannah, Nottaway, Rupert, Main, and Big Rivers—converge along these shores, and the forest wealth of the thousands of miles drained by these and lesser rivers can be concentrated at the mouth of the Nottaway or Rupert. The land along the line from Lake St. John [142] is good dry land fit for settlement. The Nottaway at the crossing point is fourteen hundred and fifty feet wide, and admits bridge spans of five hundred feet. Thence, a direct line to Norway House, at the foot of Lake Winnipeg, would pass through the gypsum beds on Moose River, and give access to a vast area of rich agricultural land in the north part of the province of Quebec. The straight line continued would strike about the forks of the Peace and Smoky Rivers, near the center of the northwest wheat-growing region, and thence follow the valleys of the Peace and Skeene Rivers to the Pacific Ocean, crossing the Rocky Mountains at a point where the summit is two thousand feet lower than that of the Canadian Pacific Railway. As to the resources of this northwestern country, there are, according to a Dominion official report, an area of six hundred and fifty-six thousand square miles along the Mackenzie River suitable for the growth of potatoes, four hundred and seven thousand suitable for barley, and three hundred and sixteen thousand for wheat, with a pastoral area of eight hundred and sixty thousand square miles, two hundred and seventy-four thousand miles of which may be regarded as arable land. "The difference in latitude makes no corresponding difference in the climate. Flowers bloom as early in the spring and as late in autumn at Great Slave Lake as at Winnipeg or St. Paul and Minneapolis. The prevailing southwest or Chinook winds render the climate along the Peace and Liard Rivers as mild and salubrious as that of western Ontario. Wheat ripens along the Mackenzie River under the Arctic Circle, a thousand miles farther north than Rupert House."

MINOR PARAGRAPHS.

Mr. W. H. Huddleston, in his presidential address to the Geological Section of the British Association, spoke of the geology of the southwest of England, and began with supporting the claim of Bristol, where the association was meeting, to be regarded as the cradle of British geology, and even more; for, he said, Devonshire, Cornwall, and West Somerset first attracted the attention of the Ordnance Geological Survey. "Thus it comes to pass that the region which lies between the Bristol Channel and the English Channel claims the respect of geologists in all parts of the world, not only as the birthplace of stratigraphical paleontology, but also as the original home of systematic geological survey. The city of Bristol lies on the confines of this region, where it shades off northwestward into the Palæozoics of Wales and northeastward into the Mesozoics of the midland counties."

A committee of the English Society of Arts, appointed to inquire into the matter, attribute the doubtful quality of modern paper to "revolutionary" changes which the industry has undergone, including the introduction of new substances of varying qualities and chemical properties, in the working up of which there is still room for much improvement. The committee have examined many books, as evidence, on the question of the deterioration of paper. They distinguish two tendencies—to disintegration and to discoloration—which are independent but may be concurrent effects, and are notably concurrent in papers containing mechanical wood pulp. Disintegration, which has been brought to light in papers of all grades, is generally the result of chemical changes in the fibers, produced by acids in the rag papers, and by oxidation in the papers made of mechanical wood pulp. Discoloration of ordinary cellulose papers, as distinguished from papers containing mechanical wood pulp, is dependent upon the quality of the sizing, and particularly the proportion of rosin in it. The committee define as the normal standard of quality for book papers, required for publications of permanent value, fibers not less than seventy per cent of the cotton, flax, and hemp class, sizing not more than two per cent rosin, the paper to be finished with the normal acidity of pure alum, and the loading to be not more than ten per cent mineral matter.

Colonel G. E. Church, president of the Geographical Section of the British Association, pointed out in his opening address, which was on Argentine geography and the ancient Pampean Sea, that the drainage area of the Plata basin was, according to Dr. Bludan, 1,198,000 square miles, or more than two and a half times that of the Pacific slope of the Andes. The minimum water [143] discharge into the Plata estuary would, every twenty-four hours, make a lake one mile square and 1,650 feet deep. About seventy-four per cent of it would represent the flow of the Paraná, and twenty-six per cent that of the Uruguay River. These interlaced with the affluents of the Amazon along a line of fourteen degrees of longitude. The author sought to show that the Plata drainage

area was, in a recent geological period, much more extensive than it is to-day; that its extreme northern limit was in 10° 44' south latitude, and that nearly all the waters that now unite to form the Madeira River, the main affluent of the Amazon, once flowed southward into a Pampean sea that penetrated north over the plains of the present Argentine Republic to about 19° south latitude.

Dr. Le Neve Foster, who nearly met his death in 1897 from carbonic-oxide poisoning while investigating a mine accident in the Isle of Man, discussing, in his report on the disaster, the origin of the gas, points out that although it occurs occluded in certain rocks and minerals, it has never been found as a natural constituent of the atmosphere of the mines. He had, therefore, to seek an artificial source, and found it in the burning of the timber in the mine. It appeared that the combustion of a cubic foot of larch, the wood used in the timber construction of the Snaefell mine, gives rise to enough carbonic oxide to occupy four hundred and seventeen feet of space at a temperature of 60° F. and a pressure of thirty inches. Twenty-five cubic feet of timber will yield sufficient to infect the atmosphere with one per cent of the gas all through the mine—enough to cause almost immediate loss of consciousness and speedy death. It is important, therefore, to avoid as much as possible the use of combustible material in the shafts and roadways of mines, unless they are constantly wet or damp. It is also well to have compressed oxygen at hand for the restoration of asphyxiated persons, and also apparatus for penetrating noxious gases.

Rafting, similar to that which formerly distinguished the navigation of the Ohio and Mississippi Rivers, and to that which is still employed by the wood dealers on the great rivers of northern Russia and Siberia, is in use among the farmers of the middle and upper courses of the Yang-tse-Kiang as a means of getting their produce to market. They join rafts till they have a surface of two or three acres, care being taken not to have them too large for the river at its narrowest passages, and on these they build veritable farmsteads, with dwelling houses, barns, stables, and pigpens, for horses, cattle, and swine; and provide supplies of hay, fodder, and provisions for beast and man, to last the human and animal population of the craft during their journey of six hundred or nine hundred miles. The men on board are not idle through this journey, but have their stock of osier twigs and spend their time making baskets and other articles. Arrived at one of the great river marts, the people dispose of their animals and products, sell the articles they have made, and find markets for the material of their rafts with the dealers in lumber and firewood—just as the Ohio and Mississippi boatmen used to do. Then they return home.

NOTES.

The New York School of Applied Design for Women, 200 West Twenty-third Street, was organized for the purpose of affording to women instruction which will enable them to earn their livelihood by the employment of their taste and manual dexterity in the application of ornamental design to manufacture and the arts. Besides eight elementary courses, it has a course in historic ornament, advanced courses in the applications of design to the manufacture of wall paper and silk, and of the elementary instruction to the work of an architect's draughtsman, and to illustrating and lithography; and special courses in book-cover designing, advanced design, animal drawing for illustration, stained glass designing, watercolor painting, and interior decoration. The instructors are practical men from manufactories and architects' offices. Pupils are allowed to proceed as rapidly as they master the successive steps in the course of instruction, without having to conform to a fixed period.

Communicating to the American Association the results of experiments in fig-raising in California, Dr. L. O. Howard said that the trees produced from imported Smyrna cuttings dropped most of their fruit, whence it seemed that something was wanting. This was found to be the fertilizing insect, *Blastophora psenes*, which inhabits the wild fig trees or caprifigs of the [144] Mediterranean countries, and which the fig-growers procure by bringing down twigs of these trees from the mountains at the fertilizing season. Artificial fertilization of figs has been tried in California with considerable success; but it is thought that if the caprifig and its insect can be naturalized in California, there will be no difficulty in raising figs the equal to those of Smyrna.

Discussing at the meeting of the American Association the position of the trilobites in classification, Prof. A. S. Packard referred to the discovery of Beecher that certain genera of them have antennæ together with biramose legs, essentially the same for the head and trunk, and double, so that one portion is available for swimming and the other for crawling. He then showed that this uniformity of appendages does not occur in the *Crustaceæ*, to which the trilobites have been referred heretofore. For this reason, and because the young have a different form from crustacean young, zoölogists are inclined to refer the trilobites to a separate class and to regard them as an older, more primitive group. From certain obvious affinities, the *Limulus*, or king crab, may be regarded as a descendant from the trilobites.

On Thursday, September 15th, Mr. Stanley Spencer and Dr. Berson ascended from the Crystal Palace, near London, in a balloon inflated with pure hydrogen to the remarkable height of twenty-seven thousand five hundred feet, only fifteen hundred feet below the highest ascent of Coxwell and Glaisher. Numerous scientific instruments were carried, and also a cylinder of compressed oxygen for inhaling at great heights. It was found necessary to use the oxygen at twenty-five thousand feet.

In the discussion in the British Association of a communication by Professors E. B. Roser and

W. O. Atwater recording their experiments (American) on the amount of energy supplied to and obtainable from the human body—which are found to be equal—Prof. W. E. Ayrton, presiding, pointed out that the energy of muscular action is probably capillary or electrical, the human machine being more analogous to an electric battery or motor than to a steam engine.

In the list of officers of the American Association for 1899, published in our last number, the name of L. O. Howard, of the Department of Agriculture, Washington, should have appeared as permanent secretary.

The hundredth anniversary of the invention of the voltaic or electric pile is to be celebrated in 1899 at Como, the birthplace of Alexander Volta, by an international electrical exhibition. A national exhibition of the manufacture of silk—machinery, preparation, and processes—will be held in connection with it. An international congress will also be held for the discussion of the progress and applications of electricity.

A prize of five hundred guineas is offered by the Sulphate of Ammonia Committee, 4 Fenchurch Avenue, London, for the best essay on The Utility of Sulphate of Ammonia in Agriculture; the committee to have entire disposal of the selected essay, and the refusal of any of the others for not more than fifty guineas each. The essays—in English—should be in the hands of the committee not later than November 15, 1898.

Recent death lists include the names, among men known to science, of Prof. Park Merrill, chief of the Forecast Division of the Weather Bureau, at Washington, August 8th; Dr. E. V. Aveling, late assistant in physiology at Cambridge and professor of chemistry and physiology at New College, a writer upon scientific topics, in London, August 4th, aged forty-seven years; M. Paul Sevret, mathematician and member of the French Academy of Sciences, in Paris, June 24th, aged seventy years; W. F. R. Surringer, professor of botany in the University of Leyden, and director of the Botanical Garden and Herbarium; J. A. R. Newlands, the discoverer of the periodic law of the chemical elements, in Lower Clapton, London, July 29th, aged sixty-nine years; the astronomer Romberg, who succeeded Encke at Berlin in 1864, and was called to Pulkova in 1873, author of numerous papers in Monthly Notices on double stars and planetary and cometary observations, at Pulkova, July 6th, aged sixty-four years; John Hopkinson, an eminent British electrician, president of the Institute of Electrical Engineers in 1890 and 1896, killed with his three children in an attempt to ascend the Dent de Visivi, Alps, August 24th; Dr. H. Trimble, professor of practical chemistry in the Philadelphia College of Pharmacy, and editor of the American Journal of Pharmacy; M. de Windt, geologist of the Belgian Exploring Expedition to the Congo, drowned in Lake Tanganyika, Africa, August 9th; Dr. Paul Glan, assistant professor of physics in the University of Berlin, aged fifty-eight years; Dr. E. J. Bonsdorf, formerly professor of anatomy and physiology at Helsingfors, Finland, aged eighty-eight years; Dr. Robert Zimmerman, formerly professor of philosophy in the University of Vienna, at Salzburg, Austria, aged seventy-seven years; M. J. M. Moniz, known by his investigations of the natural history of Madeira, at Madeira, July 11th, aged sixty-six years; and M. Pomel, a distinguished French mining engineer, professor of geology and past director at the Algiers Scientific School, and author of a number of special works, at Oran, Algeria.

Transcriber's Notes:

Obvious typographical and punctuation errors repaired.

The image of Frank Wigglesworth Clarke has been moved to the corresponding article.

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