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SALTER'S EDITION.

FIELD'S CHROMATOGRAPHY;

OR,

TREATISE ON COLOURS AND PIGMENTS

AS USED BY ARTISTS.

***AN ENTIRELY NEW AND PRACTICAL EDITION*;**

REVISED, REWRITTEN, AND BROUGHT DOWN TO THE PRESENT TIME.

BY

THOMAS W. SALTER, F.C.S.

Ars probat artificem.

Ars probat artificem.

L O N D O N :

WINSOR AND NEWTON, **38**, RATHBONE PLACE,

Manufacturing Artists' Colourmen by Special Appointment to Her Majesty, and Their Royal Highnesses the Prince and Princess of Wales.

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NOTICE.

Among the works consulted in this Edition are the following, from most of which extracts have been taken:

Bancroft's Philosophy of Colours.

Brande's Manual of Chemistry.

Chemical News.

Chevreul on Colour.

Fownes' Manual of Chemistry.

Gmelin's Handbook of Chemistry.

Handbooks on Art.

Liebig and Kopp's Annual Report of the Progress of Chemistry.

Mérimée's Painting in Oil.

Muspratt's Dictionary of Chemistry.

Normandy's Commercial Handbook of Chemical Analysis.

O'Neill's Chemistry of Calico Printing.

Quarterly Journal of the Chemical Society.

Ruskin's Elements of Drawing.

Watts' Dictionary of Chemistry.

PART I.

ON COLOURS AND COLOURING.

CHROMATOGRAPHY;

OR,

A TREATISE ON COLOURS AND PIGMENTS.

CHAPTER I.

ON COLOURING.

How early, and to what extent, colouring may have attained the rank of science among the ancients, are questions not easily set at rest; but that some progress had been made, even at a very remote period, is proved by the magnificent tombs of the Egyptian kings at Thebes, where the walls of the royal mausoleum are described as being covered with paintings so fresh and perfect, as to require neither restoration nor improvement. So far from this, indeed, that with all care in copying, it was difficult to equal the brilliancy of the originals, which, as far as colours went, threw all others in the background. And yet, in spite of the scale having comprised pure vermilion, ochres, and indigo, it was not gaudy, owing to the judicious balance of the colours, and [4]
the artful management of the black. Nor was there an ornament throughout the dresses, wherein the red, yellow, and blue, were not so employed as to produce a delicious harmony.

Moreover, it is stated that in one painting eighty feet high and proportionably broad, which was divided into two ranges of gigantic figures, these were glowing with most exquisite colours, suited to the drapery and naked parts; and in which the azure, yellow, green, &c., were as well preserved as though they had been laid on yesterday. Again, an apartment was discovered among the stupendous ruins at Carnac, on the site of ancient Thebes, one hundred paces wide and sixty deep, completely crowded with pillars, which, together with the ceiling, roof, and walls, were decorated with figures in basso-relievo, and hieroglyphics—all marvellously beautiful and finely painted, and as fresh, splendid and glorious, after so many ages, as if they had just been finished.

In various accounts these colourings of the Egyptians are described in the warmest terms of admiration. The most charming are undoubtedly those on the tombs and temples: others of less merit have been found on the cases and cloths of mummies, and on papyrus rolls; but it is to the patterns on the walls and ceilings of their houses that they seem to have been most partial, and [5]
paid the most attention. The ordinary colours employed by them were red, yellow, green, and blue. Of the last there were two tints; black also was common. For white, the finely prepared stone-coloured ground was deemed sufficient. These colours were occasionally modified by mixture with chalk; but were always, or nearly always, applied singly, in an unmixed state. With regard to their composition, chemical analysis has shown several of the *blues* to be oxide of copper with a small proportion of iron; none containing cobalt. There is little doubt, however, that the most brilliant specimens—those which retain all their original force and beauty in the temples of Upper Egypt after an exposure of three thousand years, consist of ultramarine—the celebrated Armenian blue, possibly, of the ancients. The *reds* seem for the most part to be composed of oxide of iron mixed with lime, and were probably limited to iron earths and ochres, with a native cinnabar or vermilion. The *yellows* are said to have been, in many cases, vegetable colours; but it is likely earths and ochres were their chief source. The *greens* consist of yellow mixed with copper blue. The bluish-green which sometimes appears on Egyptian antiquities, is merely a faded blue. The *blacks* are both of vegetable and mineral origin, having been obtained [6]
from a variety of substances in a variety of ways.

But, as shown by Layard in his discoveries at Nineveh, a knowledge of colouring was not confined to the Egyptians; it was likewise possessed by the Assyrians. The painted ornaments of the latter are stated to have been remarkably elegant; and although the colours were limited to blue, red, white, yellow, and black, yet they were arranged with so much taste and skill, and the contrasts were so judiciously preserved, that the combinations were in general agreeable to the eye. The pale yellowish-white ground on which the designs were painted, resembled the tint on the walls of Egyptian monuments, and a strong well-defined black outline was found to be as peculiar a feature in Assyrian as in Egyptian painting, black frequently combining with white alone, or alternating with other colours. As far as they have been analysed, the pigments employed were mineral, the brightest being a blue derived from copper. No traces of vegetable colours have been found; it is presumed that they existed, but being subject to more rapid decay than the mineral pigments, they have disappeared. That all the colours, indeed, employed by the ancients were not permanent, was proved by the fact of certain blues and reds, brilliant and vivid when the earth was removed from them, fading rapidly when exposed to the air. [7]

From Philocles, the Egyptian, and Gyges, a Lydian, both of whom, according to Pliny, acquired the knowledge of the art of painting in Egypt, the Greeks obtained the knowledge of their *Ars Chromatica*, which they are said to have carried by gradual advances during several centuries, from the monochromatic of their earlier painters, to the perfection of colouring under Zeuxis and Apelles, 450 to 350 B.C. Unfortunately, not long after, or about 300 B.C., art rapidly deteriorated; the invasion of the Romans commenced; and the principles of light, shade, and colours in painting as understood by the Greeks, together with their valuable treatises on the subject were lost. The early Roman and Florentine painters, so eminent in other respects, were almost destitute of those principles, and of truly refined feeling for the effects of colouring.

The partial restoration of this branch seems to have been coeval with the earliest practice of painting in oil. The glory of it belongs to the Venetians, to whom the art of painting passed with the last remains of the Greek schools after the capture of Constantinople at the beginning of the thirteenth century. Giovanni Bellini laid the foundation of colouring, and Titian carried it to its highest practical perfection. From the Venetian it extended to the Lombard, Flemish, and [8]
Spanish schools. In the practice of these, however, there was perhaps as much of instinct as principle, colouring still remaining to be established in its perfection as a science.

According to the true, natural, and philosophical classification of painting, there are but three principal classes or schools; viz.: the gross and *material* which is content with mere nature, and to which belong the Dutch and Flemish schools; the *sensible*, which aims at refined and select nature, and accords with the Venetian school; and the *intellectual*, which aspires to the ideal in beauty, grandeur, and sublimity, and corresponds with the Greek, Roman, and Florentine schools. Modern art as founded upon the *intellectual* school of the ancient Greeks, became grand, scientific, and severe in the practice of Michael Angelo, and Leonardo da Vinci; graceful, beautiful and expressive in Raphael, Correggio, Dominichino, and Guido; and, aiming at *sensible* perfection, it attained harmony of colouring and effect in the works of Titian and Tintoret; but it sunk into grossness and sensuality while perfecting itself *materially* among the Flemish and Dutch.

In the practice of the individual in painting, as well as in all revolutions of pictorial art, in ancient Greece as in modern Italy, colouring in its perfection has been the last attainment of [9]
excellence in every school. It has been justly observed, indeed, that for near three hundred years, since painting was revived, we could hardly reckon six painters that had been good colourists, among the thousands who had laboured to become such. But there is reason to hope that as Zeuxis succeeded and excelled Polygnotus, and Titian Raphael, the artists of Britain will transcend all preceding schools in the chromatic department of painting. It is even probable that they may surpass them in all other branches, and in every mode and application of the art, as they have already more particularly done in an original and unrivalled use of water-colours.

Happily, too, there has arisen among us a school of colouring that confirms this expectation, strengthened as it is, by the suitableness of our climate to perfect vision. For in it we have that mean degree of light which is best adapted to the distinguishing of colours, a boundless diversity of hue in nature relieved by those fine effects of light and shade which are denied to more vertical suns, besides those beauties of complexion and feature in our females peculiar to England; respects in which at least our country is not unfavourable to art.

Even now it is urged by some to the *disparagement* of the British school, that it excels in colouring; as if this were incompatible with any other excellence, or as if nature, the great prototype of art, ever dispensed with it. The graphic branches of painting, owe everything to [10]
colour, which, if it does not constitute a picture, is its flesh and blood. Without it, the finest performances remain lifeless skeletons, and yield no pleasure. Painting is the art of representing visible things by light, shade, form, and colour; but of these, colour—and colour alone—is the immediate object which attracts the eye. Colouring is, therefore, the first requisite—the one thing imparting warmth and life—the chief quality engaging attention; in short, the best introduction to a picture, and that which continues to give it value so long as it is regarded. It is a power, too, which is with the most difficulty retained, being the first to leave the artist himself, and the first to quit a school on its decline. Graphic art without colouring, is as food without flavour; and it was the deficiency of colouring in the great works of the Roman and Florentine schools that caused Sir Joshua Reynolds to confess a certain want of attraction in them. To relish and estimate truly their greatness, required, he said, a forced and often-repeated attention, and "it was only those persons incapable of appreciating such divine performances, who made pretensions to instantaneous raptures on first beholding them." Gainsborough also, with a candour similar to that of Reynolds, upon viewing the cartoons at Hampton Court, acknowledged that their beauty [11]
was of a class he could neither appreciate nor enjoy.

Colouring, then, is a necessity; but there is in it a vicious extreme; that in which it is rendered so principal as, by want of subordination, to overlay the subject. There is also a negative excellence which consists in not always employing pleasing tints, but of sometimes taking advantage of the effects to be derived from impure hues, as Poussin did in his "Deluge." In this work, neither black nor white, blue, red, nor yellow appears; the whole mass being, with little variation, of a sombre grey, the true resemblance of a dark and humid atmosphere, by which every object is rendered indistinct and almost colourless. This absence of colour, however, is a merit, and not a fault. Vandyke employed such means with admirable effect in the background of a Crucifixion, and in his Pieta; and the Phaëton of Giulio Romano is celebrated for a suffusion of smothered red, which powerfully excites the idea of a world on fire.

Of the rank and value of this department of painting, there will be, as there has been, difference of judgment and opinion, as there is variety in the powers of the eye and understanding. But take from Rubens, Rembrandt, Titian, and other distinguished masters, the estimation of their colouring, and we fear all that is left to them would hardly preserve their names from oblivion. Art cannot, indeed, attain its appropriate end, that of pleasing, without [12] excellence in colouring. It is colour which the true artist most loves, and it is colouring in all its complex and high relations, that he ever seeks to attain. Looking above, and around, and beneath him, with the intelligent eye of the colourist, he finds a boundless source of never-ceasing enjoyment. With harmonies and accordances lost to the untutored gaze, colour meets him in every stone he treads on—in the mineral, vegetable, and animal creation—in the heavens, sea, and earth. For him, in truth, colour is as equally diffused as light, spreading itself over the entire face of nature, and clothing the whole world with beauty.

CHAPTER II. [13]

ON THE RELATIONS AND HARMONY OF COLOUR.

Assured as we must be of the importance of colouring as a branch of art, colours in all their bearings become interesting to the artist, and on their use and arrangement his reputation as a colourist must depend.

Colour, remarks Ruskin, is wholly *relative*; each hue throughout a work is altered by every touch added in other places. Thus, to place white beside a colour is to heighten its tone; to set black beside a colour is to weaken its tone; while to put grey beside a colour, is to render it more brilliant. If a dark colour be placed near a different, but lighter colour, the tone of the first is heightened, while that of the second is lowered. An important consequence of this principle is, that the first effect may neutralize the second, or even destroy it altogether. What was cold before, becomes warm when a colder colour is set near it, and what was in harmony before, becomes discordant as other colours are put beside it. For example, to place a light blue beside a [14] yellow, tinges it orange, and consequently heightens its tone. Again, there are some blues so dark relatively to the yellow that they weaken it, and not only hide the orange tint, but even cause sensitive eyes to feel that the yellow is rather green than orange—a very natural result when it is considered that the paler the yellow becomes, the more it tends to appear green.

We learn from these relations of colours, why dapplings of two or more produce effects in painting so much more clear and brilliant than uniform tints obtained by compounding the same colours: and why hatchings, or a touch of their contrasts, thrown as it were by accident upon local tints, have the same effect. We see, too, why colours mixed deteriorate each other, which they do more—in many cases—by imperfectly neutralizing or subduing each other chromatically, than by any chemical action. Finally, we are impressed with the necessity, not only of using colours pure, but of using pure colours; although pure colouring and brilliancy differ as much from crudeness and harshness, as tone and harmony from murkiness and monotony.

The powers of colours in contrasting each other agree with their correlative powers of light and shade, and are to be distinguished from their powers individually on the eye, which are those of light alone. Thus, although orange and blue are equal powers with respect to each other, as [15] regards the eye they are totally different and opposed. Orange is a luminous colour, and has a powerfully irritating effect, while blue is a shadowy colour, possessing a soothing quality—and it is the same, in various degrees, with other colours.

There are yet further modes of contrast or antagonism in colouring, which claim the attention and engage the skill of the colourist. Of the contrast of *hues*, upon which depend the brilliancy, force, and harmony of colouring, we have just spoken; but there is, secondly, the contrast of *shades*. To this belong all the powers of chiaroscuro, by which term the painter denotes the harmonious effects of light and shade; and though they form the simplest part of colouring, yet they cannot be separated from it—light and shade, the chiaroscuro, being a distinct and important branch of painting. A third mode of contrast in colouring is that of *warmth* and *coolness*, upon which depend the toning and general effect of a picture. Fourthly, there is the contrast of *colour* and *neutrality*, the chromatic and achromatic, or hue and shade. By the right management of this, local colours acquire value, gradation, keeping, and connection: whence come breadth, aërial perspective, and the due distribution of greys and shadows in a picture.

This principle of contrast applies even to *individual colours*, and conduces greatly to good [16] colouring. It may be carried with advantage into the variety of hue and tint in the same colour, not only as regards light and shade, but likewise with respect to warmth and coolness, as well as to colour and neutrality. Hence the judicious landscape-painter knows how to avail himself of warmth and coolness in the juxtaposition of his greens, in addition to their lightness and darkness, or brilliancy and brokenness, in producing the most beautiful and varied effects; effects which spring in other cases from a like management of blue, white, &c. These powers of a colour upon itself are highly important to the artist, and lead to that gratification from fine colouring, which a good eye ever enjoys.

In landscape we see nature employing broken colours in harmonious consonance and variety, while, equally true to picturesque relations, she uses also broken forms and figures, in conjoint harmony with colours; occasionally throwing into the composition a regular form, or a primary colour, for the sake of animation and contrast. And if we inspect her works more closely, we shall find that they have no uniform tints. Whether in the animal, vegetable or mineral creation—flesh or foliage, earth or sky, flower or stone—however uniform the colour may appear at a distance, it will, when examined nearly, be found to consist of a variety of hues and shades, compounded [17]
with harmony and intelligence.

It is for this reason that no two colours are ever found discordant in nature, however much so they may be in art. Blue and green have been termed discordant, and in painting they may undoubtedly be made so. Yet those are two colours which nature seems to intend never to be separated, and never to be felt, either of them, in its full beauty, without the other—a blue sky through green leaves, or a blue wave with green lights through it, being precisely the loveliest things, next to clouds at sunrise, in this coloured world of ours. A good eye for colour will soon discover how constantly nature puts green and purple together, purple and scarlet, green and blue, yellow and neutral grey, and the like; and how she strikes these colour-concords for general tones, before working into them with innumerable subordinate ones.

Upon the more intimate union, or the blending and gradience of contrasts from one to another mutually, depend some of the most fascinating effects of colouring. The practical principle employed in producing them is important, and consists in the blending and gradating by *mixture*, while we avoid the *compounding* of contrasting colours. That is, the colours must be kept distinct in the act of blending them, or otherwise they will run into dusky neutrality and defile each other. This is the case in blending and gradating from green to red, or from hue to [18]
hue—from blue to orange, or to and from coldness and warmth—from yellow to purple, or to and from advancing and retiring colours. It is the same in light and shade, or white and black, which *mix* with clearness. Now, there are only two ways in which this distinctness in union of contrasts can be effected in practice: the one is by hatching or breaking them together in mixture, without compounding them uniformly; and the other is by glazing, in which the colours unite and penetrate mutually, without monotonous composition.

The former process may be said to be the carrying out of the principle of separate colours to the utmost possible refinement, by using atoms of colour in juxtaposition, instead of in large spaces. And it is to be noted, in filling up minute interstices of this kind, that if the colour with which they are filled be wanted to show brightly, a rather positive point of it had better be put, with a little white left beside or round it in the interstice. This plan is preferable to laying a pale tint of the colour over the whole interstice. Yellow or orange, for instance, will hardly show, if pale, in small spaces; but they show brightly in free touches, however small, with white beside them. The latter mode is founded on the fact, that if a dark colour be laid first, and a little blue or white body-colour struck lightly over it, a more beautiful gray will be obtained than by mixing the [19]
colour and the blue or white. Similarly, if over a solid and perfectly dry touch of vermilion there be quickly washed a little very wet carmine, a much more brilliant red will be produced than by mixing the two colours.

Transparency and opacity constitute another contrast of colouring, the former of which belongs to shade and blackness, the latter to light and whiteness. Even contrast has its contrast, for *gradations* or *intermedia* are opposed to contrasts or *extremes*; and, upon the right management of contrasts and gradations depend the harmony and melody, the tone, effect, and general expression of a picture. Thus, painting is an affair of judicious contrasting so far as regards colour, if even it be not such altogether.

Colour, it has already been observed, is wholly *relative*. In contrasting, therefore, any colour, if we wish it to have light or brilliancy, we cast its opposite into the shade; if we would have it warm, we cool its antagonist; and if transparent, we oppose it by an opaque contrary, and *vice versâ*: indeed, in practice, all these must be in some measure combined.

Such are some of the powers of contrast in colouring alone, and such is the diversity of art upon which skill in colouring depends. It must not be forgotten, however, that contrasts or extremes, whether of light and shade, or of colours, become violent and offensive when they are [20]
not reconciled by the interposition of their media, or intermediates, which partake of both extremes of the contrasts. Thus blue and orange in contrast become reconciled, softened in effect, and harmonized, when a broken colour composed of the two intervenes. The same may be said of other colours, shades, and contrasts.

Seeing that the management and mastery of colours are to a great extent dependent on the same principles as light and shade, it might become a point of good discipline, after acquiring the use of black and white in the chiaroscuro, to paint designs in contrast; that is, with two contrasting colours only, in conjunction with black and white—for example, with blue and orange, before attempting the whole. Indeed, black can be dispensed with in these cases, because it may be compounded, since the neutral grey and third colours always arise from the compounding of contrasting colours. In this way, even flesh may be painted—for instance, with red and green alone, as Gainsborough is said at one period to have done.

Some artists have produced pictures in the above hot and cold colours only; which, although captivating to the eye, and true in theory with respect to colour, light and shade, are generally false in practice with regard to nature, which rarely employs such extreme accordances. [21] Colouring like this, therefore, is more beautiful than true. It is as though a painter were to execute a landscape in the full light of day, as he saw it looking through a prism, so that every object glowed with rainbow hues. Such a picture would present a beautiful fairy scene, and be true as regards colours, but as respects nature, it would be false.

Colour, and what in painting is called transparency, belong chiefly to shade. It has been a common error to ascribe those properties to light only, and hence many have employed a uniform shade tint, regarding shadows as simply darkness, blackness, or the mere absence of light; when, in truth, shadows are infinitely varied by colour, and always so by the colours of the lights which produce them. But while we incline attention toward the relation of colour to shade, both light and shade being strictly co-essential to colour, a vicious extreme must be avoided. For although, as transparent, colour inclines to shade, and, as opaque, it partakes of light; yet the general tendency of colour is to transparency and shade, all colour being a departure from light. Hence it becomes a maxim, which he who aspires to good colouring must never lose sight of, that *the colour of shadow is always transparent, and only that of extreme light objects opaque*. It follows, that white is to be kept as much as possible out of shadow, and black, for the same reason, out of [22] colour. In their stead, whenever it is necessary to cover, opaque tints may be employed, glazed over with transparent colours. Such practice would also be more favourable to durability of the tones of pictures, than the shades and tints produced with black and white. The hues and shadows of nature are in no ordinary case either black or white, which, except as local colours, are always poor and frigid. The perfection of colouring is to combine harmony with brilliancy, unity with variety, and freshness with force, without violating the laws of nature.

With regard to the *perspective of colours*, or the manner in which they affect the eye, according to position and distance, it is a branch of aërial perspective or the perspective of light and shade. This is distinguished from linear perspective, or the perspective of drawing, as drawing is from colouring; and they have progressed alike in the art. The most ancient painters seem to have known little of either; and linear perspective was established as science before the aërial, as drawing and composition preceded colouring.

The perspective of colours depends upon their powers to reflect the elements of light, powers which are by no means uniform. Accordingly, blue is lost in the distance before red, and yellow is seen at a point at which red would disappear; yet blue preserves its hue better than yellow, [23] because colours are cooled in the distance. In this respect, the compound colours partake of the powers of their components, in obedience to a general rule, by which local colours closely connected with black are first lost in the distance, and those nearly related to white disappear last. The same may be said of local light and shade, the latter of which is totally lost at great distances; and it is for this reason the shadowed side of the moon is not generally seen. These powers of colours are, however, varied by mist, air, altitude, and mixture, which produce evanescence; and by contrast, which preserves the force of colours by distinguishing them. Colours do not decline in force so much by height as by horizontal distance, because the upper atmosphere is less dense and clouded with vapour: and hence it is that mountains of great elevation appear much nearer than they really are. From all these circumstances, it is evident that a simple scumbling or uniform degradation of local colours will not effect a true perspective—for this will be the aërial of light and shade only—but such a subordination of hues and tints, as the various powers of colours require, and as is always observable in nature.

In furnishing or *setting the palette* philosophically and upon principle, it is necessary to supply it with pure blue, red, and yellow; to oppose to these an orange, of a hue that will neutralise the blue—green, of a hue that will neutralise the red—and purple, of a hue that will [24] neutralise the yellow; and so on to black and white, which will neutralise each other. As in nature, the general colour of the sky is blue, and the colour of light is always opposite to that of the sky and shade, so the white which is to represent light should be tinged with the orange of the palette sufficiently to neutralise the predominant coldness of black. Pure neutral white may thus be reserved as a "local" colour, which is a technical term for the *natural* colour of an object, unvaried by distance, reflection, or anything interfering with distinct vision; although, properly speaking, local colours are subject to all the relations and effects of the places they occupy in a composition—whether of light, shade, reflection, or distance.

From what we have said, it will be seen that the relations and harmony of colours form a complex subject, requiring constant and careful study; one, indeed, into which he who would become a colourist must enter heart and soul. For as colouring is the beginning and end of a painter's craft, so colour in all its aspects must be the chief lesson of his life. And this lesson can only be learnt, by ever watching with a loving eye those wondrous colourings of nature, in which there is nothing inharmonious or out of place.

PART II. [25]

ON COLOURS AND PIGMENTS GENERALLY. [26]

CHAPTER III. [27]

ON CLASSES OF COLOURS.

By mixing his *colours with white*, the artist obtains his *tints*. By mixing *colours with colours*, he produces compound colours, or *hues*. And by mixing *colours or tints with black*, he gets *shades*. It is a common error to confound these distinctions.

The above classification of colours enables us to understand the simplicity of relation which exists among an infinity of tints, hues, and shades of colour. Also, it is calculated to give precision to language respecting colours, the nomenclature of which has too often been vague and uncertain.

There are five classes of colours, viz.:—the *Neutral*, the *Primary*, the *Secondary*, the *Tertiary*, and the *Semi-neutral*.

Neutral Colours are three only, *white*, *black*, and grey. According to the laws of Optics, the two first comprise all other colours synthetically, and afford them all by analysis. These are sometimes called "extreme" colours, grey being their intermediate. [28]

Primary Colours are three only, *yellow*, *red*, and *blue*. They are such as yield others by being compounded, but are not themselves capable of being produced by composition of other colours. By way of distinction, they are occasionally designated "entire" colours.

Secondary Colours, are three only, *orange*, *green*, and *purple*. Each of these is composed of, or can be resolved into, two primaries. Thus, orange is composed of red and yellow; green, of yellow and blue; and purple, of blue and red.

Tertiary Colours are three only, *citrine*, *russet*, and *olive*. Each of these is composed of, or can be resolved into, either two secondary colours, or the three primaries. Thus, citrine consists of green and orange, or of a predominant yellow with blue and red; russet is compounded of orange and purple, or of a predominant red with blue and yellow; and olive is composed of purple and green, or of a predominant blue with yellow and red.

The last three genera of colours comprehend in an orderly gradation all those which are *positive* or definite; and the three colours of each genus, united or compounded in such subordination that neither of them predominates to the eye, constitute the *negative* or neutral colours, of which *black* and *white* have been stated to be the opposed extremes, and *greys* their [29]
intermediates. Thus black and white are constituted of, and comprise latently, the principles of all colours, and accompany them in their depth and brilliancy as shade and light.

Semi-neutral Colours belong to a class of which *brown*, marrone, and *gray* may be considered types. They are so called, because they comprehend all the combinations of the primary, secondary, and tertiary colours, with the neutral *black*. Of the various combinations of black, those in which yellow, orange, or citrine predominates, have obtained the name of brown, &c. A second class in which the compounds of black are of a predominant red, purple, or russet hue, comprises marrone, chocolate, &c. And a third class, in which the combinations of black have a predominating hue of blue, green, or olive, includes gray, slate, &c.

While treating of the classes of colours, it may not be out of place to note here the difference between gray as spelt with an *a*, and grey as spelt with an *e*, the two names being occasionally confounded. *Gray* is semi-neutral, and denotes a class of cool cinereous colours, faint of hue; whence we have blue grays, olive grays, green grays, purple grays, and grays of all hues in which blue predominates; but no yellow or red grays, the predominance of such hues carrying the compounds into the classes of brown and marrone, of which gray is the natural opposite. *Grey* is [30]
neutral, and is composed of or can be resolved into black and white alone, from a mixture of which two colours it springs in an infinite series.

It must be observed that each colour may comprehend an indefinite series of *shades* between the extremes of light and dark, as each compound colour also may comprise a similar series of *hues* between the extremes of the colours composing it. And as the relations of colours have been deduced regularly, from white or light to black or shade; so the same may be done, inversely, from black to white. On this plan the tertiaries, olive, russet, and citrine, take the place of the primaries, blue, red, and yellow; while the secondaries still retain their intermediate station and relation to both.

Thus, *russet and olive* compose or unite in *dark purple*; *citrine and olive* in *dark green*; *russet and citrine* in *dark orange*. The tertiaries have, therefore, the same order of relation to black that the primaries have to white; and we have black primaries, secondaries, and tertiaries, inversely, as we have white primaries, secondaries, and tertiaries, directly. In other words, we have light and dark colours in all classes.

CHAPTER IV. [31]

ON THE DURABILITY AND EVANESCENCE OF PIGMENTS.

Pigments may be defined as colours in a solid or insoluble state, prepared for the artists' use. Hitherto, we have treated of colours in the abstract sense, as appealing to the eye only: we have now to consider them as material bodies.

As colour itself is relative, so is durability of colour relative. For the reason that all material substances are changeable and in perpetual action and reaction, no pigment is so permanent as that nothing will alter its colour. On the other hand, none is so fugitive as not to last under some favouring circumstances. Time, of long or short continuance, has often the effect of fire, more or less intense. Indeed, it is some sort of criterion of the stability and changes of colour in pigments, that time and fire are apt to produce similar effects thereon. Thus, if fire deepen, or cool, or warm a colour, so may time; if it vary its hues, so may time; if it destroy a colour altogether, so may time ultimately. The power of time, however, varies extremely with regard to the period in [32] which it produces those effects, that are instantly accomplished by fire.

That there is no absolute but only relative durability of colour may be proved from the most celebrated pigments. For instance, the colour of native ultramarine, which will endure a hundred centuries under ordinary circumstances, may be at once destroyed by a drop of lemon juice; and the generally fugitive and changeable carmine of cochineal will, when secluded from light and air, continue fifty years or more; while fire or time, which merely deepen the former colour, will completely dissipate the latter. Again, there have been works of art in which the white of lead has retained its freshness for ages in a pure atmosphere, but has been changed to blackness after a few days' or even hours' exposure to foul air. These and other peculiarities of colours will be noticed, when we come to speak of pigments individually; not for the purpose of destroying the artist's confidence, but as a caution, and a guide to the availing himself of their powers properly.

It is, therefore, the lasting under the usual conditions of painting, and the common circumstances to which works of art are exposed, that entitles a colour to the character of permanency; and it is the not-so-enduring which attaches to it rightly the opposite character of evanescence: while a pigment may obtain a false repute for either, by accidental preservation or destruction under unusually favourable or fatal circumstances. [33]

Many have imagined that colours vitrified by intense heat are consequently durable when levigated for painting in oil or water. Had this been the case, the artist need not have looked farther for the furnishing of his palette than to a supply of well-burnt and levigated enamel pigments. But though such colours for the most part stand well when fluxed on glass, or in the glazing of enamel, they are nearly, without exception, subject to the most serious changes when ground to the degree of fineness necessary to their application as pigments, and become liable to all the chemical changes and affinities of the substances which compose them. These remarks even apply in a measure to native products, such as coloured earths and metallic ores.

Others have not unreasonably supposed that when pigments are locked up in varnishes and oils, they are safe from all possibility of change. The assumption would be more warranted if we had an impenetrable varnish—and even that would not resist the action of light, however well it might exclude the influence of air and moisture. But, in fact, varnishes and oils themselves yield to changes of temperature, to the action of a humid atmosphere, and to other influences: their protection of colour from change is therefore far from perfect.

Want of attention to the unceasing mutability of all chemical substances, as well as to their [34] reciprocal actions, has occasioned those changes of colour to be ascribed to fugitiveness of the pigment, which belong to the affinities of other substances with which it has been improperly mixed and applied. It is thus that the best pigments have suffered in reputation under the injudicious processes of the painter; although, owing to a desultory practice, the effects and results have not been uniform. If a colour be not extremely permanent, dilution will render it in some measure more weak and fugitive; and this occurs in several ways—by a too free use of the vehicle; by complex mixture in the formation of tints; by distribution, in glazing or lackering, of colours upon the lights downward, or scumbling colours upon the shades upward; or by a mixed mode very common among the Venetian painters, in which opaque pigments are combined, as umber and lake.

The fugitive colours do less injury in the shadows than in the lights of a picture, because they are employed pure, and in greater body in shadows, and are therefore less liable to decay by the action of light, and by mixture. Through partially fading, moreover, they balance any tendency to darken, to which the dead colouring of earthy and metallic pigments is disposed.

The foregoing circumstances, added to the variableness of pigments by nature, preparation, [35]
and sophistication, have often rendered their effects equivocal, and their powers questionable. These considerations enforce the expediency of using colours as pure and free from unnecessary mixture as possible; for simplicity of composition and management is equally a maxim of good mechanism, good chemistry, and good colouring. Accordingly, in respect to the latter, Sir Joshua Reynolds remarks, "Two colours mixed together will not preserve the brightness of either of them single, nor will three be as bright as two: of this observation, simple as it is, an artist who wishes to colour bright will know the value."

There prevail, notwithstanding, two principles of practice on the palette, opposed to each other—the one, simple; the other, multiple. The first is that of having as few pigments as possible; and consists, when carried to the extreme, in employing the three primary colours only. The second is that of having a number of pigments; and consists, also when carried to the extreme, of employing as many, if possible, as there are hues and shades of colour.

On the former plan, every tint requires to be compounded; on the latter, one pigment supplies the place of two or more. Now, the more pigments are mixed, the more they are deteriorated in colour, attenuated, and chemically set at variance. Original pigments, that is, such as are not made up of two or more colours, are purer in hue and generally more durable [36]
than those compounded. Hence pure intermediate tints in single, permanent, original pigments, are to be preferred to pigments compounded, often to the dilution and injury of their colours. Cadmium Orange, for instance, which is *naturally* an orange pigment and not composed of red and yellow, is superior to many mixtures of those colours in a chemical sense, and to all such mixtures in an artistic sense. At the same time, it is quite possible for the artist to multiply his pigments unnecessarily. Colours are sometimes brought out under new names which have no claim to be regarded as new colours, being, indeed, mere mixtures. Compound pigments like these may most frequently be dispensed with, in favour of hues and tints composed extemporaneously of original colours upon the palette.

It may be inferred from the foregoing that, between the modes of employing as few pigments as possible, and of having as many as there are hues and shades of colour, a middle course is the best. But, whatever the practice adopted, permanent *original* pigments should be used as often as the case will admit; it being borne in mind, that a pigment may be compound, although its colour may be primary. As a rule, the less colours are mixed, the purer, brighter, and more lasting they will be found.

To the practice of producing tints and hues by *grinding* pigments together, instead of [37]
blending them on the palette, may be attributed some of the peculiarities of the tints and textures of the Flemish school; they being, perhaps, results of intimate combination from grinding, and consequently of a more powerful chemical action among the ingredients compounded. This method has, in a great measure, fallen into disuse, and undoubtedly it conduced to foulness when the colours of the pigments ground were not pure and true, and did not assimilate well in mixture chemically.

The superiority of Rubens and the Flemings, and of Titian and the Venetian school, in colouring and effect, is due in a considerable degree to their sketching their designs in colours experimentally with a full palette. This practice, as derived from Reynolds, is common with the best masters of our own school, who, in executing their works, resort also to nature, with an improved knowledge of colours and colouring. Such attention to colouring and effect, from the first study and ground of a picture to the finishing, contributes a beauty to the painting no superinduced colouring can accomplish.

The durability of colour in substances is to a great extent dependent upon the condition in which they exist chemically. If pigments, for example, be in a state which chemists have termed *pro*toxide, they are liable to absorb oxygen on exposure to light, air, or moisture, and becoming [38]
what is called *per*oxidized, may, by consequence, change or fade. In like manner, lakes and carmines thrown down upon a base, may owe some of their fugacity to the oxidation of that base, as well as to the natural infirmity of their colouring matter. On the other hand, pigments and bases are subject to *de*oxidation, or to a loss of oxygen, in which case the colour is apt to deepen. Pigments generally are more affected by oxidation and fading in a water vehicle, and by deoxidation and darkening in one of oil.

A principal test of permanency in pigments is the impunity with which they bear exposure to light and air, an artistic proof of their stability the mere chemist is apt to neglect. Provided the colour remain unaffected by sulphuretted hydrogen, &c., he seldom hesitates to pronounce it safe. But a pigment may be fast in one sense and fugitive in another, believed in by the laboratory, and found wanting by the studio. It has happened before now that the same colour has been dubbed durable and the reverse, by the man of science and the man of art. The former, we take it, looks upon a pigment as a coloured substance of a certain composition, possessing maybe an acid and a base, either, or neither, or both of which, gases and other reagents may injure or destroy. The latter views a colour chiefly as part and parcel of his picture—that picture [39] which *may* meet with foul exhalations, but *must* be exposed to light and air. And he too often thinks as little of the effects of an impure atmosphere or injudicious admixture, as the chemist considers the action of air and light.

With the exception of madder, those colours mostly affected by *light and air* are of organic origin, such as gallstone, Indian yellow, and the yellow dye-wood lakes; the red and purple lakes of cochineal; indigo; and sap green. To these may be added the semi-organic Prussian blue; and the inorganic yellows and orange of arsenic.

The pigments liable to injury from *sulphuretted hydrogen*, &c., are notably those obtained from lead and copper; and that treacherous compound of iodine and mercury, known as pure scarlet.

Many colours are apt to change from the action of white *lead* and other lead pigments, &c., principally those which are altered by light and air.

Many, too, cannot safely come into contact with iron, or ferruginous pigments; especially the yellows of arsenic, the lakes of cochineal, and the blues and greens of copper. With these an iron palette knife is best avoided, one of ivory or horn being used instead. The latter, indeed, is preferable in all cases, several pigments being slightly affected by iron, cadmium yellow among the number.

Numerous colours are likewise injured by *lime* and *fire*, and cannot therefore be employed in [40] fresco, or enamel painting.

Of substances which may act deleteriously on colours, there remain the *vehicles and varnishes* with which they are mixed. Many of these have been blamed, and often with justice, for their injurious effects on pigments. The reputation of the most permanent colour may be ruined, if the vehicle, &c., employed with it be untrustworthy. The presence of lead, for instance, in such materials renders them liable to be blackened by foul air, and by consequence the pigments used therewith.

Time produces in many cases a mellow and harmonious change in pictures, but occasionally alterations altogether unfavourable. To ensure the former and prevent the latter, the attention of the artist in the course of his colouring should be to the employment of such pigments and colours as are prone to adapt themselves, in changing, to the intended key of his colouring, and the right effect of his picture. Thus, if he design a cool effect, ultramarine has a tendency through time to predominate and aid the natural key of blue. He will, therefore, compromise the permanence of this effect, if in such case he employ a declining or changeable blue, or if he introduce such reds and yellows as have a tendency to warmth or foxiness, by which the colouring of many pictures has been destroyed. In a glowing or warm key, the case is in some [41] measure reversed—not wholly so, for it is observable that those pictures have best preserved their colouring and harmony in which the blue has been most lasting, by the pigment counteracting the change of colour in the vehicle, and that suffusion of dusky yellow which time is wont to bestow upon pictures even of the best complexion.

Unless introduced and guaranteed by houses of acknowledged reputation, newly discovered pigments are to be used with caution. Good colours have ever been prized with so true an estimation of their value, that to produce such, after so many ages of research is no ordinary accomplishment. But too many resplendent pigments, fruits of the fecundity of modern chemistry, have been found deficient. The yellow and orange chromates of lead, for instance, withstanding as they do the action of the sunbeam, become by time, foul air, and the influence of other pigments, inferior to the ochres. So the dazzling scarlet of iodine and mercury must yield the palm of excellence to the more sober vermilion, being a chameleon colour, subject to the most sudden and opposite changes. And the blues of cobalt, as always tending to greenness and obscurity, cannot rank beside ultramarine.

We are far from asserting, however, that all modern pigments are inferior, or that pigments [42] should be looked upon with suspicion because they are modern. Several most valuable colours have lately claimed attention, notably the permanent transparent yellow called *Aureolin*. Seeing that, until its introduction, a yellow combining transparency with a perfect stability was unknown to the palette, the importance of such an addition, so long wanted and wished for, cannot be overrated. Equal in beauty and durability with the preceding, but possessing greater richness and depth, and of a semi-opacity, another yellow of the highest order merits regard, *Orient Yellow*, distinguished for its lustrous golden hue, resembling a bright Indian yellow. Dazzling in brilliancy, and absolute in permanency. *Cadmium Red* next attracts notice. This new aspirant for artistic fame is a most vivid orange-scarlet, the latter colour predominating, of intense fire, but with no approach to rankness or harshness, yielding delicate pale washes, and blending happily with white in the formation of flesh tints. With it may be coupled *Cadmium Orange*, a colour equally brilliant and stable, and equally without rankness or harshness, but of a true orange hue, admirably adapted for sunsets and the like. Last of all the fresh pigments of whose thorough durability there is *no* doubt, comes the splendid *Viridian*, a green nothing but fire will change, and no mixture of blue and yellow will afford. Clear, bright, and transparent as the emerald, it rivals velvet in its soft gorgeous richness. With this and Aureolin a series of beautiful foliage tints [43] may be formed, sparkling with sunshine, as it were.

Other colours there are which have been brought forward within the last few years, not possessing the absolute permanency of the five foregoing, but equal, or superior, to many formerly used. It were folly, therefore, and a silly conservatism on the part of the artist to limit himself to such pigments only as were employed by his forefathers, especially as their merits were often more than doubtful. New colours, it is true, have to be *learnt*, for each pigment has its own peculiar habitudes, chemical, physical, artistic; but if they be good and durable, no amount of time and study spent upon them is thrown away. To think less of the quality of one's materials than of the effects which can be produced with them is mistaken policy; and to be content with that quality when better can be had, shows no real love of art, but rather indolence and apathy.

Perhaps one reason why freshly introduced pigments have not as fair a chance as they are entitled to, is due to the fashion which prevails of exclaiming against the fugacity of modern colours. If their detractors would confine themselves to certain colours, there could be no denial; but to assert, as is often done, that the cause of modern pictures not standing is owing to modern pigments generally, is unjust. It is not the materials which should be blamed, but those who use them. [44] The fact is, that the artist's knowledge has not increased in proportion to the greater variety of colours at his command. In the early periods of art, when the palette was chiefly confined to native pigments, the painter could not very well go wrong. Now-a-days but too many, wanting the skill of the old masters, seek to make amends for it by brilliancy of colouring: with imperfect knowledge of their materials the result is obvious. The palette, we admit, wants weeding; not only of the bad new colours, but of the bad old colours. This, however, must be a work of time, and depend, not upon the colourman—for where there is a demand there will be a supply—but upon the artists themselves. To this end an increased acquaintance with the properties of pigments is required, whereby they may be able to choose the fast from the fugitive. It may be fairly assumed that the painter will be assisted in his task by the progress of chemical science, which will doubtless add from time to time to the list of stable pigments. We have heard it remarked that there are too many colours already—to which we reply, there are not too many good colours, and scarcely can be. The more crowded the palette is with reliable pigments, the more likely are the worthless to be pushed from their places. In our opinion, there is ample room for fresh colours, provided they be durable; and we have as little sympathy with the stereotyped [45] cry of there being too many, as with the fashionable unbelief in modern pigments. Certainly, the artist who seeks for permanence among the whites, reds, or blues, will not be troubled with a superfluity. Certainly, too, colours are as good as ever they were, and better—better made, better ground, better prepared for use. But, fast and fugitive, pigments are more numerous, and for that reason need more careful selection.

CHAPTER V. [46]

ON THE GENERAL QUALITIES OF PIGMENTS.

The general attributes of a perfect pigment are beauty of colour, comprehending pureness and richness, brilliancy and intensity, delicacy and depth,—truth of hue—transparency or opacity, well-working, crispness, setting up, or keeping its place, and desiccation, or drying well. To all of these must be superadded *durability* when used, a quality to which the health and vitality of a picture belong, and one so essential that all other properties put together without it are of no esteem with the artist who merits reputation. We have, therefore, given it a previous distinct consideration.

It must be observed that no pigment possesses all the foregoing qualifications in perfection, some being naturally at variance or opposed; nor is there any, perhaps, that cannot boast excellence in one or more of them.

Beauty commonly comprises in the same pigment delicacy, purity, and brilliancy; or depth, richness, and intensity. [47] Delicacy and depth in the beauty of colours are at variance in the production of all pigments, so that perfect success in producing the one is attended with more or less of failure in the other, and when they are united—as they occasionally are—it is with some sacrifice of both. Hence the judicious artist purveys for his palette at least two pigments of each colour, one eminent for delicate beauty, the other for richness and depth.

Truth of hue is a relative quality in all colours, except the extreme primaries, in the relations of which, blue, being of nearest affinity to black or shade, has properly but one other relation, in which it inclines to red and becomes purple-blue: it is, therefore, faulty or false, when, tending to yellow, it becomes of a green hue. But red, which is of equal affinity to light and shade, has two relations, by one of which it verges upon blue and becomes a purple-red or crimson; and by the other it leans to yellow, and becomes an orange-red or scarlet, neither of which is individually false or discordant. Yet yellow, which is of nearest affinity to white or light, has strictly but one true relation, by which it inclines to red, and becomes a warm or orange yellow, for by uniting with blue it becomes a defective green-yellow. The best example of true yellow in a pigment, tending neither to red nor blue, is furnished by *Aureolin*, alluded to in the last chapter. The secondary and tertiary colours, having all duplex relations, may incline without default to either [48] of their relatives.

Transparency is an essential property of all glazing pigments, and adds greatly to the value of dark or shading colours; indeed it is the prime quality upon which depth and darkness depend, as whiteness, or light, does upon opacity or reflecting power. *Opacity* is, therefore, the antagonist of transparency, and qualifies pigments to cover in dead-colouring, or solid painting, as well as to combine with transparent colours in forming tints; and hence it is that semi-transparent pigments are suited in a mean degree both for dead colouring and for finishing. As excellencies, therefore, transparency and opacity are relative only—the first being as indispensable to shade in all its gradations, as the latter is to light. With regard to transparent and opaque colours generally, it is worthy of attention in the practice of the oil-painter, that the best effects of the former are produced when they are used with a resinous varnish; as opaque pigments are best employed in oil, and the two become united with best effect in a mixture of these vehicles. The natural and artificial powers, or depth and brilliancy, of every colour lie within the extremes of black and white; hence it follows that the most powerful effects of transparent colours are obtained by glazing them over black and white. As, however, few transparent pigments have sufficient body, [49] or tinging power for this, it is often necessary to glaze them over tints, or deep opaque colours of the required hues. There is a charm in transparent colours which frequently leads to an undue use thereof in glazing; but glazing, scumbling, and their combined process must be employed with discretion, according to the objects and effects of a picture.

Working well is a quality which depends principally upon fineness of texture, and what is called *body* in colours; yet every pigment has its peculiarities in respect to working both in water and oil, and these must become matter of every artist's special experience. Some of the best pigments are most difficult of management, while some ineligible colours are rich in body and free in working. Accidental circumstances, however, may influence all pigments in these respects, according to the painter's particular mode of operation, and his vehicle; upon the affinities of colours with which depend their general faculties of working—such as keeping their place, crispness or setting up, and drying well. These latter, with other properties and accidents of pigments, will be particularly considered in treating of their individual characters; but it may be remarked that crispness or setting up, as well as keeping their place and form in which they are applied, are contrary to the nature of many pigments, and depend in painting with them upon a gelatinous mixture of their vehicle. For example, mastic and other resinous varnishes impart [50] this texture to oils which have been rendered drying by the acetate, or sugar of lead:—simple water, also albumen, and animal jelly made of glue and isinglass, give the same quality to oils and colours; and bees-wax has a similar effect in pure oils. Whitelac varnish, and other spirit varnishes, rubbed into the colours on the palette likewise enable them to keep their place very effectually in most instances. This is important, because glazing cannot be performed except with a vehicle which keeps its place, or with pigments which lend this property to the vehicle, as some lakes and transparent colours do.

Fineness of texture is produced by extreme grinding and levigation. Pigments ground in water in the state of a thick paste, are miscible in oil and dry therein firmly; and in case of utility or necessity, any water-colour in cake, being rubbed off thick in water may be diffused in oil, the gum acting as a medium of union between the two. Thus, pigments which cannot otherwise be employed in oil, or varnish, may be forced into the service and add to the resources of the oil-painter, care being taken to use the palette-knife, if of steel, with caution.

Desiccation or drying. The well-known additions of the acetate, or sugar of lead, litharge, and [51] sulphate of zinc, either mechanically ground, or in solution, for light colours; and japanner's gold size, or oils boiled upon litharge, for lakes; or, in some cases, manganese and verdigris for dark colours, are resorted to when the pigments or vehicles are not sufficiently good dryers alone. It would be well if lead and copper could be banished from the list of siccatives altogether: assuredly, no artist with any regard for the permanent texture of his work should employ them except in extreme cases, and in the smallest possible quantity. The best of pigments may be ruined by their injudicious use, and obtain a character for fugacity which they in no way deserve. It requires attention that an excess of dryer renders oil saponaceous, is inimical to drying, and is otherwise injurious. Some colours dry badly from not being sufficiently edulcorated or washed. Sulphate of zinc, as a siccative, is less powerful than acetate of lead, but is far preferable in a chemical sense. It is supposed erroneously to set the colours running; which is not positively the case, though it will not retain those disposed to move, because it wants the property the acetate of lead possesses, of gelatinizing the mixture of oil and varnish. These two dryers should not be employed together, since they counteract and decompose each other, forming two new substances—acetate of zinc, which is a bad siccative, and sulphate of lead, which is insoluble and [52] opaque. The inexperienced ought here to be guarded against the highly improper practice of some artists, who strew their pictures while wet with acetate of lead, or use that substance in some other mode, without grinding or solution; which, though it may promote present drying, will ultimately effloresce on the surface of the work, throw off the colour in sandy spots, and expose the paintings to peculiar risk from the damaging influence of impure air.

It is not always that ill drying is to be attributed to the pigments or vehicles, the states of the weather and atmosphere have great influence thereon. The direct rays of the sun are powerfully active in rendering oils and colours siccative, and were probably resorted to before dryers were—not always wisely—added to oils, particularly in the warm climate of Italy. The ground may also advance or retard drying, because some pigments united by mixing or glazing, become either more or less siccative by their conjunction. Many other accidental circumstances may likewise affect drying; and among these none is to be more guarded against by the artist than the presence of soap and alkali, too often left in the washing of his brushes, and which, besides other bad results, decompose and are decomposed by acetate of lead and most siccatives. In such cases desiccation is retarded, streaks and patches are formed on the painting, and the odium of ill drying falls upon some unlucky pigment. To free brushes from this disadvantage, they should be [53] cleansed with linseed oil and turpentine. Dryers should be added to colours only at the time of using them, because they exercise their drying property while chemically combining with the oils employed, during which the latter become thick or fatten. Too much of the siccative will, as before noticed, often retard drying.

The various affinities of pigments occasion each to have its more or less appropriate dryer; and it would be a matter of useful experience if the habits of every colour in this respect were ascertained. It is probable that siccatives of less power generally than the compounds of lead and copper might come into use in particular cases, such as the oxides of manganese, to which umber and the Cappagh browns owe their drying quality.

To other good attributes of pigments, it would be well if we could in all cases add the property of being *innoxious*. As this, however, cannot be, and colours are by no means to be sacrificed on that account, cleanliness and avoiding the habit of putting the brush unnecessarily to the mouth, so common in water-painting, are sufficient guards against any possibly pernicious effects from the use of any pigment. No colour which is not imbibed by the stomach will in the slightest degree injure the health of the artist.

[54]

PART III. [55]

ON COLOURS AND PIGMENTS INDIVIDUALLY. [56]

CHAPTER VI. [57]

ON COLOURS AND PIGMENTS INDIVIDUALLY.

Having briefly discussed the relations and attributes of colours and pigments generally, we come to their powers and properties individually—a subject pregnant with materials and of unlimited connexions, every substance in nature and art possessing colour, the first quality of pigments.

With regard to *colours* individually, it is a general law of their relations, confirmed by nature and the impressions of sense, that those colours which lie nearest in nature to light have their greatest beauty in their lightest tints: and that those which tend similarly towards shade are most beautiful in their greatest depth or fulness, a rule of course applying to black and white particularly. Thus, the most beautiful yellow, like white, is that which is lightest and most vivid; blue is most beautiful when deep and rich; while red is of greatest beauty when of intermediate depth, or somewhat inclined to light; and their compounds partake of these relations. We speak [58] here only of the individual beauty of colours, and not of that relative beauty by which every tint, hue, and shade of colour become pleasing, or otherwise according to space, place, and reference; for this latter beauty belongs to the general nature and harmony of colours.

In respect to *pigments* individually, it may be observed that—other things being equal—those pigments are the most beautiful which possess the most colour, whether they be light or dark, opaque or transparent, bright or subdued. There are some which exhibit all their colour at a glance: there are others that the more they are looked into the more colour they are found to have—containing, as they do, an amount of *latent colour*, not immediately apparent. Apart from the beauty which a wealth of colour imparts, those pigments imbued with it are, as a rule, the most permanent. And not unnaturally so, for the more colour there is present, the longer it takes to be affected, either by exposure or impure air. Colour within colour, therefore, not only lends charm to a pigment, but contributes to its safety.

There is often a vicious predilection of some artists in favour of a particular colour, from which many of our best colourists have not been totally free, and which arises from organic defect, or mental association. Such predilection is greatly to be guarded against by the colourist, who is every way surrounded by dangers. On the one hand, there is fear lest he fall into whiteness or chalkiness; on the other, into blackness or gloom: in front he may run into fire and foxiness, or he may slide backward into cold and leaden dulness: all of which are extremes he must avoid. There are also other important prejudices to which the eye is liable in regard to colours individually, that demand his particular attention. These are occasioned by the various specific powers of single colours acting on the eye according to their masses and the activity of light, or the length of time they are viewed. By consequence, vision becomes over-stimulated, unequally exhausted, and endued, even before it is fatigued, with a spectrum which not only clouds the colour itself, but gives a false brilliancy by contrast to surrounding hues, so as totally or partially to throw the eye off its balance, and mislead the judgment. This derangement of the organ may be caused by a powerful tint on the palette, a mass of drapery, the colour of a wall, the light of a room, or other accidental circumstance; and the remedy is to refresh the eye with a new object—of nature, if possible—or to give it rest. The powers of colours in these respects, as well as of pigments individually, together with their reciprocal action and influence chemically, will be adverted to under their distinct heads. [59]

The attention of the artist to the individual powers of pigments, although it may be of less concern than the attention to general effect in colouring, is by no means less necessary in practice. For he who would excel in colouring must study it from several points of view, in respect to the whole and the parts of a picture, as regards mind and body, and concerning itself alone. To this end, is needed a knowledge of his pigments individually. [60]

If nature has arrayed herself in all the colours of the rainbow, she has not been niggardly in offering man the materials wherewith to copy them. The mineral, animal, vegetable kingdom—each helps him to realize, however faintly, her many manifold beauties: to give some idea, however slight, of that glorious flood of colour, which light lets loose upon the world. Metal, ore, earth, stone; root, plant, flower, fruit; beast, fish, insect—in turn aid the arduous task. The painter's box is a very museum of curiosities, from every part of the universe. For it, the mines yield their treasures, as well as the depths of the sea: to it come Arab camel, and English ox, cuttle-fish and crawling coccus: in it the Indian indigo lies next the madder of France, and the gaudy vermilion of China brightens the mummy of Egypt. Varied, indeed, are the sources whence we derive our pigments; and if they still leave much to desire, improvement is clearly manifest. Slowly but surely, year by year, we are advancing. With the growth of science, the exhaustless [61] stores of creation, will there at last be attained—step by step, though it be—that summit of the artist's hopes, a perfect palette?

CHAPTER VII. [62]

ON THE NEUTRAL, WHITE.

The term "colour" is equivocal when applied to the neutrals, yet the artist is bound to consider them as colours; for a thing cannot but be that of which it is composed, and neutrals are composed of, or comprehend, all colours.

With regard to colour, then, *white* in a perfect state should be neutral in hue, and absolutely opaque; that white being the best which reflects light most brilliantly. This property in white is called *body*; by which in other pigments, especially those that are transparent, is meant *tingeing power*. White, besides its uses as a colour, is the instrument of light in painting, and compounds when pure with all colours, without changing their class. Yet it dilutes and cools all colours except blue, which is specifically cold; and, though it does not change nor defile any colour, it is changed and defiled by all colours. This pureness of white, if it be not in some degree broken or tinged, will cast down or degrade every other colour in a picture, and itself become harsh and [63] crude. Hence the lowness of tone which has been thought a necessity in painting, but is such only because our other colours do not approach to the purity of white. Had we all necessary colours thus relatively pure as white, colouring in painting might be carried up to the full brilliancy of nature; and, in fact, more progress has already been made in that respect, than the prejudice for dulness is disposed to tolerate.

Locally, white is the most advancing of all colours in a picture, and produces the effect of throwing others back in different degrees, according to their specific retiring and advancing powers. These latter, however, are not absolute qualities of colours, but depend on the relations of light and shade, which are variously appropriate to all colours. Hence it is that a white object rightly adapted, appears to detach, distribute, and put in keeping; as well as to give relief, decision, distinctness, and distance to every thing around it: hence, too, the use and requirement of a white or light object, in each separate group of a composition. White itself is advanced or brought forward, unless indeed white surround a dark object, in which case they retire together. In mixture, white communicates these properties to its tints, and harmonizes in conjunction with, or in opposition to all colours; but lies nearest in series to yellow, and remotest from blue, of which, next to black, it is the most thorough contrast. It is correlative with black, which is the [64] opposite extreme of neutrality.

Perfect white is opaque, and perfect black transparent; hence when added to black in minute proportion, white gives it solidity; and from a like small proportion of black combined with white, the latter acquires locality as a colour, and better preserves its hue in painting. Both white and black communicate these properties to other colours, in proportion to their lightness or depth; while they cool each other in mixture, and equally contrast each other when opposed. These extremes of the chromatic scale are each in its way most easily denied, as green, the mean of the scale, is the greatest defiler of all colours. Rubens regarded white as the nourishment of light, and the poison of shadow.

In a picture, white should not be merely glittering or brilliant, but tender as well as bright. The eye should seek it for rest, brilliant though it may be; and feel it as a space of strange heavenly paleness in the midst of the flushing of the colours. This effect can only be reached by general depth of middle tint, by the perfect absence of any white, save where it is needed, and by keeping the white itself subdued by grey, except at a few points of chief lustre.

White, as a pigment, is of more extensive use than any other colour in oil painting and fresco, owing to its local quality, its representing light, and its entering into composition with all colours [65] in the formation of tints. The old masters have been supposed by some to possess whites superior to our own, but this may be questioned. The pureness of whites in some celebrated old pictures is rather to be attributed to a proper method of using, careful preservation of the work, and in many instances to the introduction of ultramarine or a permanent cold colour into the white—such as plumbago—helped also by judicious contrast.

Notwithstanding white pigments are tolerably numerous, a thoroughly unexceptionable white is still a desideratum—one combining the perfect opacity or body of white lead with the perfect permanency of zinc white. The nearest approach to it that has yet been made, is Chinese white, which possesses in a great measure the property of the former, and, being a preparation of zinc, has wholly that of the latter. Unfortunately Chinese white is a water-colour pigment only, not retaining its several advantages, stability excepted, when employed in oil.

1. CONSTANT WHITE,

Also called *Permanent white*, and *Barytic white*, is, when well prepared, of superior body in water, but has less opacity in oil. It works in a somewhat unsatisfactory and unpleasant manner, and is considerably lower in its tone while wet than when dry, a fault which subjects even an [66] experienced artist to great uncertainty where he uses it in compound tints. The semi-transparency of the white, while wet, prevents his judging of the true tint until his colour has dried, when he frequently finds it harsh and chalky, and out of tone with the rest of his painting. As little gum as possible should be employed with it, gum being inimical to its body, or whiteness. The best way of preparing this pigment, as well as other terrene whites, so as to preserve their opacity, is to grind them in simple water, and to add towards the end of the grinding sufficient only of clear *cold* jelly of gum tragacanth as will connect them into a body, and attach them to the paper in painting. Cold starch will answer the same purpose.

Constant white is a sulphate of baryta, found native and known under the name of heavy-spar, or prepared artificially by adding sulphuric acid, or a soluble sulphate, to a solution of a barytic salt. In the first mode, if the white be not well purified from free acid, it is apt to act injuriously on some pigments. Sulphate of baryta is often used for the purpose of adulterating white lead, the native salt being ground to fine powder, and washed with dilute sulphuric acid, by which its colour is improved, and a little oxide of iron probably dissolved out. Whether native or artificial, the compound is quite unaffected by impure air, and is not poisonous. [67]

LEAD WHITES

Comprise and are known under the names of:—*White lead*, *Flake white* and *Body-white*, *Cremnitz*, or *Kremnitz*, *Crems* or *Krems white*, *London* and *Nottingham white*, *Flemish white*, *Pattison's white*, *Blanc d'argent* or *Silver white*, *Ceruse*, *Dutch white*, *French white*, *Venetian white*, *Hamburgh white*, *Kremser white*, *Sulphate of lead*, &c.

The heaviest and whitest of these are the best, and in point of colour and body, are superior to all other whites. When pure and properly applied in oil and varnish, they are comparatively safe and durable, drying well without addition; but excess of oil discolours them, and in water-painting they are changeable even to blackness. Upon all vegetable lakes, except those of madder, they have a destructive effect; and are injurious to gamboge, as well as to those almost obsolete pigments, red and orange leads, king's and patent yellow, massicot, and orpiment. With ultramarine, however, red and orange vermilions, yellow and orange chromes, yellow and orange and red cadmiums, aureolin, the ochres, viridian and other oxides of chromium, Indian red &c., they compound with little or no injury. Lead colours must not be employed in water-colour or crayon painting, distemper, or fresco. The whites of lead are carbonates of that metal, with two

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exceptions:—Flemish white or the sulphate, and Pattison's white or the oxychloride. In using all pigments of which lead is the basis, cleanliness is essential to health.

White lead, by which we must be understood to mean the carbonate, always contains when commercially prepared a certain proportion of hydrated oxide. The less of the latter there is present, the better does the white cover, and the less liable is it to turn brown. The products formed by precipitation have proved to be inferior in body: otherwise, pure mono-carbonate of lead-oxide, obtained by mixing solutions of carbonate of potash and a lead-salt, might be best adapted for a pigment. However, such a carbonate has been lately produced by Mr. Spence's process of passing carbonic acid gas into a caustic soda or potash solution of lead, and for this white an opacity is claimed equal to that of the ordinary compound.

Great as is the opacity of white lead, it is apt to lose that property in some measure in course of time, and become more or less transparent. If, over a series of dry oil-colour rubs of varied hues, there were brushed sufficient white lead paint to utterly obscure them, after some years those rubs would indistinctly appear, and by degrees become more and more visible, until at last their forms—if not their very colours—could be recognised. From this it would seem that white lead must slowly but surely part with some of its carbonic acid, and be at length converted into [69]
dicarbonate, a compound possessing less carbonic acid, and less coating power.

Impure air, or sulphuretted hydrogen, browns or blackens white lead, converting it partially or wholly into sulphide. It would appear from the recent investigations of Dr. D. S. Price, that white lead is less liable to be thus affected, when the pictures in which it is used are exposed to a strong light; also, that when such pictures have so suffered, a like exposure will restore them. We have ourselves noticed the rapidity with which an oil rub of white lead that has been damaged by foul gas, regains its former whiteness when submitted to air and sunshine. The action of drying oils has been likewise proved to be very powerful upon sulphide of lead, an exposure to light for a few days only being sufficient to change a surface of it, coated with a thin layer of boiled linseed oil, into a white one. Probably, these agents may have a similar effect upon other pigments injured by sulphuretted hydrogen, and many of the colours in paintings may be restored by treating them with boiled linseed oil, and submitting them to a strong light. That the result is due to oxidation, there can be no doubt. Indeed, the eminent French chemist, M. Thénard, was consulted some years back upon the means of bringing to their original whiteness the black spots which had formed upon a valuable drawing, by the changing of the white lead, and employed for [70]
that purpose oxygenated water. He had ascertained its power of converting the black sulphide of lead into the white sulphate, and, by touching the spots with a brush dipped in the fluid, soon succeeded in restoring the drawing to its primitive state. Here, again, the use of the agent might doubtless be extended to other colours, to which foul air is inimical.

In oil painting white lead is essential in the ground, in dead colouring, in the formation of tints of all colours, and in scumbling, either alone or mixed with other pigments. It is also the best local white, when neutralized with ultramarine or black; and it is the true representative of light, when warmed with Naples yellow, or orange vermilion or cadmium, or with a mixture of the yellow and either of the orange pigments, according to the light.

Ordinary white lead is often mixed with considerable quantities of heavy spar, gypsum, or chalk. These injure it in body and brightness, dispose it to dry more slowly, keep its place less firmly, and discolour the oil with which it is applied, as well as prevent it dissolving completely in boiling dilute potash-ley, a test by which pure white lead may be known.

The adulteration of pigments, which we have in some instances found practised to a large
extent abroad, is comparatively unfrequent in our own country, so far at least as regards the [71]
superior class of colours employed by artists. As a rule, such colours when manufactured in England may be fairly assumed to be genuine; and certainly the respectable colourmen of the present day are not in the habit of sophisticating them. We must bear testimony, indeed, to the zeal with which they purvey, regardless of necessary expense, the choicest and most perfect materials. This should be a matter of congratulation to the painter, who must of necessity rely on the faith and honesty of his colour-dealer; for if he were ever so good a chemist, it would be impossible for him to analyse each pigment before proceeding to use it. The fault must rest with himself, therefore, if, through a mistaken economy, he do not frequent the best houses and pay the best prices. Of a surety, the colours of the artist are not among those things in which quality can, or should, be sacrificed to cheapness.

2. BLANC D'ARGENT, OR SILVER WHITE.

These are false appellations of a white lead, called also *French white*. It is brought from Paris in the form of drops, is exquisitely white, but of less body than flake white, and has all the properties of the best white leads. Being subject to the same changes, it is unfit for general use [72]
as a water-colour, though good in oil or varnish.

3. CREMNITZ WHITE,

Known likewise as *Kremnitz*, *Crems*, or *Krems white*, is a carbonate of lead which derives its names from Kremnitz in Hungary, or Crems or Krems in Austria. It is also called *Vienna white*, being brought from Vienna in cakes of a cubical form. Cremnitz white is the brightest white that is used in oil: it possesses rather less body than flake white, because the particles are finer. When newly prepared, it gives out a strong smell of vinegar.

4. FLAKE WHITE,

Called, when levigated, *Body white*, is an English white lead in the form of scales or plates, sometimes grey on the surface. It takes its name from its figure, is occasionally equal to Crems white in colour, and generally surpasses in body all other white leads. In composition, it is a mixture of protocarbonate and hydrated oxide of lead, the latter decreasing the opacity of the product according to the greater proportion in which it is present.

5. FLEMISH WHITE, OR SULPHATE OF LEAD

Is an exceedingly white precipitate from any solution of lead by sulphuric acid, much resembling the blanc d'argent. It is inferior, however, both in body and permanence to the [73] ordinary carbonate. Hence, white lead which has more or less been converted by sulphuretted hydrogen into sulphide, and again been converted into sulphate by oxidation, with a view to restoring its colour, becomes peculiarly liable to the influence of impure air.

6. LONDON AND NOTTINGHAM WHITES.

The best of these do not essentially differ from each other, nor from the white leads of other manufactories. The latter variety, being prepared from flake white, is usually the greyer of the two.

7. PATTISON'S WHITE, OR OXYCHLORIDE OF LEAD

Is a mixture of chloride and oxide of lead, formed by precipitating a solution of chloride of lead with soda, potash, lime, or baryta, in the caustic or hydrated state. It would appear that when the oxychloride is used as a paint, the oxide contained in it gives rise to an oleate of lead, and, in consequence of this saponaceous matter, is capable of spreading over an extended surface. The product has been described as possessing properties which are superior to those of white lead, inasmuch as it does not so readily blacken as the latter body. Dr. Ure, however, found that water removes the chloride of lead from the paint compounded of this article, and, [74] consequently, that it is not so effectual as the carbonate. As an artist's pigment, a partially soluble compound of lead can decidedly not be eligible.

8. ROMAN WHITE

Is of the purest white colour, and differs only from blanc d'argent in the warm flesh tint of the external surface of the large square masses in which it is commonly prepared.

Besides the foregoing, there are other white leads, generally foreign, cheaper, and adulterated. Many of these are mixed with a small quantity of charcoal, indigo, or Prussian blue, so that the dead yellowish shade which they present may be enlivened to a brighter hue. Among them may be named—

9. CERUSE.

A French variety, not necessarily, but not unfrequently, mixed with different chalky earths in various proportions; and the following Belgian kinds:

10. DUTCH WHITE,

Containing three fourths of sulphate of baryta.

11. HAMBURGH WHITE.

A mixture of two parts of heavy spar and one of the plumbous compound.

12. KREMSER WHITE, [75]

Differing from the rest in being unadulterated.

13. VENETIAN WHITE

Composed of heavy spar and the carbonate in equal proportions.

ZINC WHITES.

14. CHINESE WHITE.

The introduction, in 1834, of this peculiar preparation of oxide of zinc has proved an incalculable boon to water-colour painters, who formerly had no white which combined perfect permanency with good body in working. Its invention obviated the necessity for using white lead, a pigment which, though it may be employed with comparative safety in oil, is quite unfitted for water. Since the period of its production, Chinese white has been generally preferred by water-colour artists, as being the most eligible in their peculiar department. Previous to that period, the complaints of whites changing were of constant occurrence; but in no instance has any picture, in which this white has been used, suffered from its employment. To the colour of oxide of zinc, sulphuretted hydrogen is altogether harmless; sulphide of zinc being itself white. The variety under notice works and washes well, possesses no pasty or clogging properties, and is prepared [76] beautifully white. Moreover, it has the desirable quality of dense body; so much so, that, as the painter works, his effects remain unaltered by the drying of the colour. It may likewise be safely mixed with all other pigments, the following blending very satisfactorily with the white for opaque lights—cadmium yellow, orange, and red; gamboge; aureolin; yellow ochre; vermilion; and light red. Without the artistic drawbacks of constant white or the chemical defects of white lead, and retaining the advantages of both, Chinese white cannot but be considered as a most important addition. It is a matter of regret that this pigment is not equally efficacious in oil.

15. ZINC WHITE

Is either the anhydrous oxide, the hydrate oxide, or hydrated basic carbonate of zinc. It varies in opacity and colour according to the mode of manufacture, and the purity of the compound, but may always be relied upon as permanent. The whiteness of the best samples rivals that of white lead, and it is not tarnished like the latter by sulphurous vapours. In opacity it never equals white lead, and might perhaps serve advantageously as a glaze over that pigment, either alone or compounded with other colours; as well as act as a medium of interposition between white lead [77] and those colours which are injured by it, such as gamboge, crimson lake, &c. When duly and skilfully prepared the colour and body of this pigment are sufficient to qualify it for a general use upon the palette in oil: in water it has been superseded by Chinese white.

Occasionally, starch, chalk, white clay, and carbonate of baryta, are employed as adulterants; none of which, however, are inimical to stability.

As a pigment, zinc white may be said to be innoxious. As oxide of zinc does not readily form a saponaceous compound with fats or oil like white lead, the paint prepared with it and ordinary linseed oil does not dry or harden so rapidly. For the purpose of causing it to be more siccative, the oil was boiled with a large quantity of litharge, but by this method the white was liable to tarnish on meeting with foul air. Instead of litharge, experiments have led to the choice of salts of zinc, such as the chloride or sulphate, a small percentage of which, on being mixed with the oil or oxide, confers upon it the property of rapidly hardening. The same result is attained by employing an oil, dried by boiling with about five per cent of peroxide of manganese. In either case, a paint retaining its white colour permanently is produced. These agents might, with advantage, be more generally used in the place of litharge for rendering oils siccative. Many [78] pigments which are not naturally affected by sulphurous emanations are apt to suffer if mixed with an oil made drying by means of lead.

16. *Cadmium White.*

Provided the metal be freed from iron, which we have commonly found to be more or less present, a white of considerable beauty may be produced; either directly by precipitation as hydrated oxide or carbonate, or indirectly by exposing the brown anhydrous oxide to air and light—the latter mode yielding a product of greater opacity. However prepared, cadmium white is deficient in body, and apt to assume a yellow tint on meeting with an impure atmosphere.

17. *Pearl White*

Is an insoluble basic nitrate of bismuth, a pearly white powder of loose texture, turning grey on exposure, and blackened by sulphuretted hydrogen. It is chiefly used as a cosmetic, but is said to injure the skin, rendering it yellow and leather-like; and it has been known to cause a spasmodic trembling of the face, ending in paralysis.

Another preparation under this name, and now obsolete we believe as a pigment, was obtained from mother-of-pearl. It is described as exquisitely white, and of good body in water, but of little force in oil or varnish. [79]

18. *Tin White*

Resembles zinc white in some respects, but has less body and colour, and dries badly. According to its composition, it is liable to turn either black or a dull yellow in contact with sulphurous vapours.

19. *White Chalk*

Is a well-known native carbonate of lime, employed by the artist only as a crayon, or for tracing his designs, for which purpose it is sawed into suitable lengths. White crayons and tracing chalks, to be good, must work and cut free from grit. From this material are prepared whitening and lime, which form the bases of many cheap pigments and colours, used in distemper, paper-staining, &c.

Besides those mentioned, there are other metallic whites varying in beauty and opacity, such as those of mercury, arsenic, and antimony; but none of them are of any value or reputation in painting, on account of their great disposition to change of colour, whether by light or foul air, both in water and oil.

There are also other terrene whites, under equivocal names, among which are Morat or Modan white, Spanish white, Troys or Troy white, Rouen white, China white, and Satin white; the latter being a sulphate of lime and alumina, which dries with a glossy surface. The common oyster-shell contains a soft white in its thick part, and there is the white of egg-shells. There is, too, an endless variety of native earths, in addition to those prepared by art. The whole of them, however, are destitute of body in oil; and several, owing to their alkaline nature, are injurious to many colours in water, as well as to all colours which cannot be employed in fresco. [80]

Among the infinitude of white substances, the artist finds that there are but three white pigments—those of lead, zinc, and baryta. The first possesses the greatest opacity, while the second and third are most durable. The last, however, has so many objectionable qualities, that the number of eligible whites, may almost be said to be two—lead and zinc. Of these, the former is blackened by foul air, and in oil, the latter is wanting in body. In fact, there is but one white pigment which approaches perfection—Chinese white; and this is only a water-colour.

CHAPTER VIII. [81]

ON THE PRIMARY, YELLOW.

Yellow is the first of the primary or simple colours, nearest in relation to, and partaking most of the nature of, the neutral white; it is accordingly a most advancing colour, of great power in reflecting light. Compounded with the primary *red*, it constitutes the secondary *orange*, as well as its relatives, scarlet, and other warm colours.

It is the archeus, or prime colour, of the tertiary *citrine*; characterises in like manner the endless number of semi-neutral colours called *brown*, and enters largely into the complex hues termed buff, bay, tawny, tan, dan, dun, drab, chestnut, roan, sorrel, hazel, auburn, isabela, fawn, feuillemort, &c. Yellow is naturally associated with red in transient and prismatic colours, and is the principal power with it in representing the effects of warmth, heat, and fire. Combined with the primary *blue*, yellow furnishes all the variety of the secondary *green*, as well as, subordinately, the tertiaries *russet* and *olive*. It also enters in a very subdued degree into cool, [82] semi-neutral, and broken colours, and assists in minor proportion with blue and red in the composition of *black*.

As a pigment, yellow is a tender delicate colour, easily defiled, when pure, by other colours. In painting it diminishes the power of the eye by its action in a strong light, at the same time becoming less distinct as a colour; while, on the contrary, it assists vision and becomes more distinct as a colour in a neutral somewhat declining light. These powers of colours upon vision require the particular attention of the colourist. To remedy the ill effect arising from the eyes having dwelt upon a colour, they should be either passed gradually to its opposite colour, and refreshed amid compound or neutral tints, or washed in the clear light of day. Hence, in viewing large collections of pictures, their colours will be more duly estimated by sometimes walking to the window, or by taking an occasional glance at a millboard, which may be carried in the hand, painted a cool gray.

In a warm light, yellow becomes totally lost, but is less diminished than all other colours, except white, by distance. The stronger tones of any colour subdue its fainter hues in the same proportion as opposite colours and contrasts exalt them. The contrasting colours of yellow are a purple inclining to blue when the yellow leans to orange, and a purple inclining to red when the [83] yellow tends to green, in the mean proportions of *thirteen* purple to *three* yellow, measured in surface or intensity. Being nearest to the neutral white in the natural scale of colours, yellow accords with it in conjunction; while, of all colours, except white, it contrasts black most powerfully. Yellow is discordant when standing alone with orange, unsupported by other colours.

On account of the paucity of fine yellows among the ancients, we find that in many paintings and beautiful illuminated MSS. of old, glowing with vermilion and ultramarine, the place of yellow was supplied by gilding. Now, certainly, no such scarcity exists; of the three primary colours, good yellows being the most numerous. It may be observed of yellow pigments that their colour being primary and therefore simple, they cannot be composed by any mixture of other colours. The same remark of course applies to pigments which are red or blue.

20. AUREOLIN.

In these days a new pigment soon finds its level, standing or falling according to its merits. There are too many colours already on the palette for a fresh comer to have much chance, unless it possess some great distinguishing quality, or can take a place which has never been occupied. Such a void aureolin fills. This "magnificent yellow pigment," says the *Chemical News*, "supplies a [84] desideratum hitherto in vain sought for by artists. It is the nearest approach to a perfect yellow in existence, and more closely resembles the purity of the prismatic spectrum than any other artificial colour. It is transparent, has great brilliancy and richness, both pure and in combination, and is very permanent, being entirely unaffected by exposure to sulphuretted hydrogen and other atmospheric impurities, or to the direct rays of the sun during an entire summer. Aureolin, with ultramarine and madder red, completes the triad of brilliant, permanent, and transparent primitive colours." The above only tallies with the statements of several scientific chemists and artists of note, statements which a prolonged personal experience of the colour enables us to endorse. To our knowledge, aureolin is quite uninjured by the severest tests to which a pigment can be subjected. We have found it bear with impunity, even in its lightest and faintest tints, the foulest gas and the brightest sunshine. Damp has no effect upon it; and in oil, water, or fresco, it is equally eligible. With all other colours aureolin mixes safely and readily, forming combinations of the utmost variety and value. It affords beautiful transparent tints, well defined, and of exceeding purity; the paler washes being at once clear and delicate, and admitting the most subtle gradations of tone. The artistic properties of aureolin, however, will be [85] best described by quoting the following extract from Mr. Aaron Penley's *English School of Painting in Water Colours*:—

"I have fully tested the qualifications of *Aureolin* for the Landscape Painter, and, without hesitation, pronounce it to be the most valuable addition to the 'colour box' since the introduction of Rose Madder. It has supplied a deficiency of a very important character. Hitherto, no Primitive Yellow has been quite satisfactory as to its persistence; so that the Aureolin will not only be regarded by the *artist* as a great boon in the production of his works, but it must also be considered as a *real* and *lasting benefit* to pictorial art in general. The permanence and unaltered purity of its lightest and faintest tints we are assured may be confidently relied upon, inasmuch as they have been fully established by the most severe tests to which colour can be subjected, by several of our ablest and most talented chemists. It is, therefore, needless to enlarge upon its merits, other than that I, for one, feel grateful for its introduction. Its uses are manifold, and may be considered available for every purpose requiring a Yellow of its character. As to Gray—

perhaps it is not possible to obtain more delicately pure and transparent aërial tints than are to be produced from a combination of Cobalt, Rose Madder and Aureolin; all of which are of a light [86] description and well suited for the representation of soft and thin effects of the atmosphere. These colours are each of them beautiful, and yield a most exquisite range of tones, which, as they mix together most kindly, render them desirable where purity and delicacy are sought. As to Foliage.—In speaking of Aureolin as adapted for the colouring of foliage and herbage, it is impossible to say too much in its praise. It imparts the vividness and freshness of nature to every colour with which it is combined—a quality of the highest order. As a colour for drapery it has no equal, and may be employed with perfect success, either by itself or with any of the other pigments.

"The following table of compound tints will be found extremely useful:—

Aureolin. Burnt Sienna. Indigo, or French Blue.	Aureolin. Vandyke Brown. Indigo, or French Blue.	Aureolin. Sepia.	Aureolin. Sepia, or Rose Madder. Cobalt.
Aureolin. Indigo.	Aureolin. Oxide of Chromium.	Aureolin. Emerald Green.	Aureolin. Light Red. Cobalt, or Indigo.
Aureolin. Burnt Sienna.	Aureolin. Burnt Umber.	Aureolin. Brown Madder.	Aureolin. Rose Madder.

"Aureolin, in combination with Cobalt and Sepia, or Rose Madder, gives most agreeable and delicate tints for distant trees, when under the influence of a soft light, or hazy state of the [87] atmosphere. Having most impartially and diligently tested the qualities of the Aureolin, I can and do most conscientiously recommend its adoption by all who practise water-colour painting."

The foregoing sufficiently proves the value of aureolin in water, and similar flattering notices have been given of the colour in oil. Both in a chemical and artistic sense, therefore, this new primitive yellow merits the highest regard, and justly claims a foremost place among that little band of pigments which are without fear and without reproach.

For mural decoration, aureolin is admirably adapted, but it cannot be used in enamel, the colour being destroyed by great heat.

CADMIUM YELLOWS.

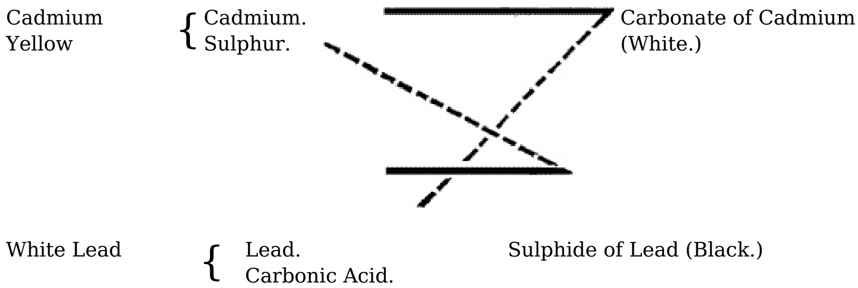
Of these there are three tints, *Deep*, a so-called *Pale*, and *Lemon*.

21. DEEP CADMIUM.

Cadmium Yellow is comparatively a recent introduction, the metal itself not having been discovered till 1818. The cadmium yellows of commerce are (the chromate excepted) all sulphides, and therefore not affected by impure air. Until lately, they were not manufactured in England but imported from abroad, and as a rule were sadly doctored. We have found in them a [88] large proportion of orpiment, chromate of lead, &c., together with quantities of soluble salt, extracted by boiling water. Owing to careless preparation, there was also present an unnecessary amount of dirt, which interfered as much with the purity of the colour, as sophistication lessened its stability. For these reasons, doubtless, cadmium yellows got to be regarded by some with disfavour and suspicion; and it may fairly be said that they did not attain their present popularity, until they became an article of home produce.

Deep cadmium yellow, if genuine, may without hesitation be declared permanent, both with respect to foul gas, and exposure to light or air. The variety under notice is of extreme depth, inclining to orange, glowing, lustrous, and brilliant. It is not very transparent, but wonderfully clear and bright, of great power, and the most richly toned yellow known. For draperies it is particularly adapted, and for gorgeous sunsets is invaluable. It works and washes well, readily throws all other yellows into the shade when used alone, and combines admirably with Chinese white for the light touches of bright clouds or mountains.

By admixture with white, cadmium gives a series of beautiful clear tints. When compounded with white lead, however, the colour has been stated to be destroyed. Theoretically, this might [89] very well happen. Cadmium yellow is composed of cadmium and sulphur—white lead of lead and carbonic acid. If the former parted with some of its sulphur to the latter, sulphide of lead would result, which is black. Hence, the partly decomposed yellow and white would be mixed with black, and there would be formed a blackish-yellow or a yellowish-black. Again, if the cadmium parted with the whole of its sulphur to the lead, receiving in exchange the carbonic acid of the latter, a mixture of black sulphide of lead with white carbonate of cadmium would be furnished, the result being a grey. Perhaps the following rough diagram may serve to make our meaning plainer:—



Such is the theory of the reaction which might take place, but which, as far as our own experience goes, does not. Some deep cadmium yellow which we ourselves prepared was intimately mixed and ground with an equal quantity by weight of Cremnitz white, and an oil rub of the compound laid upon a tile. Having placed the latter on a shelf in the laboratory, we watched from week to week to see if any approach to blackness occurred, any diminution in the beauty of the tint; but could perceive none. Hence, while admitting the possibility of the colour [90] being damaged or destroyed in the case of an inferior and spurious article, we conclude that an unadulterated cadmium yellow, containing no free sulphur, neither injures, nor is injured by, white lead, and may safely be used therewith. At the same time, the artist should be warned to satisfy himself of the genuineness of his pigment, or otherwise to employ the white of zinc, at least as a medium of intervention.

A good sample of cadmium yellow may rather advantageously than otherwise be compounded with white lead, for we have found that a mixture of equal parts by weight of the two will bear an atmosphere of sulphuretted hydrogen that completely blackens the white alone.

With all the sulphides of cadmium a steel palette knife is best avoided.

22. PALE CADMIUM.

The cadmium yellow so-called, is not strictly pale, but pale only when compared with the preceding. It is, in fact, a full rich colour, brilliant and permanent, but without that tendency to orange which distinguishes the deep. For some purposes, when a warm tone is not required, such a tint is preferable. In water, especially, where delicacy of colouring can be carried to a greater degree of refinement than in oil, these differences of hue are important. In the first medium the [91] faint washes show with a clearness which is not so apparent in the last, and the most subtle gradation of tone tells with a force in some measure lost in oil. As a consequence, the colour of the lightest tints in the distance must be as true as that of the deepest shades in the foreground, and hence the warmth or coldness of the pale washes of a pigment should be duly considered.

Pale cadmium yellow with or without aureolin, is adapted for golden sunsets, and yields with French blue a beautiful sea-green.

24. LEMON CADMIUM.

Very pale cadmium yellows are not permanent, and lemon cadmiums are decidedly fugitive. Being, like the deep and 'pale' varieties, sulphides, they are of course unaltered by sulphurous gas; but they will not stand exposure to light and air, or even to light alone. Some which were submitted in an air-tight bottle to the action of light gradually whitened next the glass. Yet they were almost identical in composition with the deepest and most orange hues, and might have reasonably been presumed stable. Repeated experiments, however, both with samples of our own making and of others' manufacture, have shown that for a cadmium to be durable, it must be of a full, rich, comparatively deep yellow; and that any paler product than the 'pale' alluded to cannot [92] be depended on. It is true that a light or lemon tint will fade quicker in water than in oil, but a colour which is fugitive in the one vehicle cannot be regarded as eligible in the other. From a somewhat long acquaintance with cadmiums, we have derived the opinion that their stability rests much on the mode of preparation, and that an amount of heat is needed sufficient to make the sulphur *bite into* the base. This opinion, indeed, extends to all metallic sulphides, and our belief is, that if vermilions were made generally by wet processes, they would not be found the permanent pigments they undoubtedly are.

25. MUTRIE YELLOW.

Under this name a lemon sulphide of cadmium has lately appeared, to which the foregoing remarks are applicable. A water colour rub on exposure to air and light faded rapidly, no trace of yellow remaining in the pale wash. The sample which came under our notice contained a quantity of free sulphur.

It is to be regretted that these lemon cadmiums are fugacious, so bright, so clear, are they, and of so pure a lemon tint can they be obtained. But as no beauty of colour compensates for want of durability, their place should be supplied by lemon yellow proper, or chromate of baryta.

26. CHROME YELLOWS, [93]

Also called *Jaune Minérale*, *Jaune de Cologne* or *Cologne Yellow*, *Pale Chrome*, and *Deep Chrome*, are chromates of lead, in which the latter metal more or less exists, according to the paleness or depth of the colour. Of modern introduction, they are distinguished for their brilliancy, their opacity and body, and their going cordially into tint with white, both in water and oil. Owing, however, to a harshness and hardness of tone for which they are peculiar, a coarse and disagreeable effect is apt to be produced by their use. In general, they do not accord with the modest hues of nature, nor harmonize well with the softer beauty of other colours. Rivalling the cadmiums in brightness, they are wanting in the mellow richness which belongs to the deeper varieties of those pigments, as well as in their permanency. Although they resist the sun's rays for a lengthened period, after some time they lose their original hue, whether employed alone or in tint, and may even become black in impure air. Upon several pigments they produce serious changes, ultimately destroying Prussian and Antwerp blues, when compounded therewith in the composition of greens, &c. Ranging from lemon to deep yellow, in oil, provided the atmosphere be good, the chromes may be found comparatively durable; but, on the whole, the artist cannot [94]
trust to them his reputation as a colourist.

The chromates are often mixed with sulphate of lead, as well as with the sulphates of baryta and lime. The presence of the first is especially objectionable, as increasing the tendency of the yellows to be blackened by foul gas. The sulphates of baryta and lime, however, are sometimes formed in the process of preparation, in which case they are rather an advantage than otherwise; inasmuch as they not only lend a softness to the colour, but decrease the proportion of leaden base, and consequently the tendency referred to. We may remark, indeed, with respect to pigments, that it is difficult in many instances to say where manufacture ends and adulteration begins. A substance may be present which, although not absolutely essential to the colour itself, has been legitimately employed to impart a desired quality, or a certain tint.

27. COLOGNE YELLOW

Is a cheap inferior chrome yellow, unfit for artistic purposes, and consists of twenty-five parts of chromate of lead, fifteen of sulphate of lead, and sixty of sulphate of lime.

28. JAUNE MINERALE

Is prepared in Paris, and differs in no essential particular from ordinary chromate of lead,
except in the paleness of its colour. The chrome yellows have also obtained other names from [95]
places or persons, whence they have been brought or by whom they have been made. Another lead yellow, not a chromate, has likewise been called jaune minérale.

29. CITRON YELLOW

Is chromate of zinc, a bright pale lemon-like yellow, slightly soluble in water. It is not affected by foul gas, but does not preserve its colour on exposure to light and air, or even when kept in a book. In contact with organic substances it is apt to turn green. Compounded, especially for foliage tints, this yellow is eligible; but if purity of hue be desired, it should certainly not be employed alone. In this chromate, as in many others, the affinity of the chromic acid to the base is small; the former is liable to separate from the latter, and, by deoxidation, to become converted into green oxide of chromium.

30. GALLSTONE

Is a deep-toned gorgeous yellow, affording richer tints than most other yellows, but it cannot be depended on for permanency, and therefore is seldom employed. Its colour is soon changed and destroyed by strong light, though not subject to alteration by impure air. In oil it is ineligible.
A true gallstone is an animal calculus formed in the gall-bladder, chiefly of oxen; but the pigment [96]

sold under that name is often replaced by a substitute, resembling the original in colour, but of greater stability.

31. GAMBOGE,

Sometimes designated *Drop Gum*, and variously written *Gamboge*, *Camboge*, *Gamboage*, *Cambogia*, *Cambadium*, *Cambogium*, *Gambodium*, *Gambogium*, &c., is the produce of several kinds of trees. The natives of the coast of Coromandel call the tree from which it is principally obtained Gokathu, which grows also in Ceylon and Siam. From the wounded leaves and young shoots the gamboge is collected in a liquid state and dried. Our indigenous herb Celandine yields abundantly, in the same manner, a beautiful yellow juice of the same properties as gamboge. Gamboge is of a gum-resinous nature and clear yellow colour. It is bright and transparent, but not of great depth, and in its deepest touches shines too much and verges upon brown. When properly used, it is more durable than generally reputed, both in water and oil; and conduces, when mixed with other colours, to their stability and keeping their place, on account of its gum and resin. It is deepened in some degree by ammoniacal and impure air, and somewhat weakened, but not easily discoloured, by the action of light. Time effects less change on this colour than on other bright vegetal yellows; but white lead and other metalline pigments injure, [97] while terrene and alkaline substances redden it. In water it works remarkably well, and forms an opaque emulsion without grinding or preparation, by means of its natural gum; but is with difficulty employed in oil, &c., in a dry condition. It dries well, however, in its natural state, and lasts in glazing when deprived of its gum. With regard to other colours it is perfectly innocent, and though a strong medicine, is not dangerous or deleterious in use. Gamboge has been employed as a yellow lake, precipitated upon an aluminous base; but a better way of preparing it is to form a paste of the colour in water, and mix it with lemon yellow, with which pigment being diffused it goes readily into oil or varnish. Glazed over other colours in water, its resin acts as a varnish which protects them; and under other colours its gum acts as a preparation which admits varnishing. It is injured by a less degree of heat than most pigments.

In landscape, gamboge affords with indigo or Antwerp blue clear bright greens, and with sepia a very useful sober tint. For sunrise and sunset clouds, a mixture of gamboge and cadmium yellow will be found useful.

32. EXTRACT OF GAMBOGE

Is the colouring matter separated from its greenish gum and impurities by solution in alcohol, [98] filtration and precipitation, by which it acquires a powdery texture, rendering it miscible in oil, &c., and capable of being employed in glazing. At the same time it is improved in colour, and retains its original property of working well in water with gum. Gamboge is likewise soluble in caustic potash, forming a red liquid, from which it is thrown down by acids.

33. INDIAN YELLOW

Is a pigment long employed in India under the name *Purree*, but has not many years been introduced generally into painting in Europe. It is imported in the form of balls of a fetid odour, and is produced from the urine of the camel. It appears to be a urio-phosphate of lime, and is of a beautiful pure yellow colour and light powdery texture; of greater body and depth than gamboge, but inferior in these respects to gallstone. Indian yellow resists the sun's rays with singular power in water painting; yet in ordinary light and air, or even in a book, the beauty of its colour is not lasting. In oil it is exceedingly fugitive, both alone and in tint. Owing probably to its alkaline nature, it has an injurious effect upon cochineal lakes and carmine when used with them. The colour is not damaged by foul air, and, as lime does not destroy it, the pigment may be employed in fresco according to its powers.

Indian yellow washes and works extremely well, and is adapted for draperies and for [99] compounding landscape greens—where permanency is not required. Blackness in the darkest shadows of the foliage will sometimes result from too great a use of indigo; should this evil exist, no colour is so fitted to regain the proper tone as Indian yellow employed thickly.

LAKES.

There are several pigments of this denomination, varying in colour and appearance according to the substances used and modes of preparation. Usually they are in the form of drops, and their colours are in general bright yellow, very transparent, and not liable to change in an impure atmosphere—qualities which would render them very valuable, were they not soon discoloured and even destroyed on exposure to air and light, both in water and oil. In the latter vehicle, they are bad driers, like most lakes, and they do not stand the action of white lead and other metallic pigments. If used, therefore, it should be as simple as possible. Of these lakes, the following are the best; but it must be borne in mind that, as not one of them is permanent, the compounds they afford are of necessity unstable.

34. YELLOW LAKE [100]

Is a bright transparent yellow, a difficult drier, and liable to be destroyed by light. It affords beautiful foliage tints, and would, if it could be depended on, be of extreme value in what is called "glazing."

35. ITALIAN PINK,

Also called *English* and *Dutch Pink*, is an absurd name for a stronger and richer kind of yellow lake, warmer in tint and more powerful than the preceding. It is a rich transparent yellow, yielding a variety of fine foliage tints by admixture with indigo and sepia in different proportions. These three colours with burnt sienna will produce almost every variety of sunny foliage. It gives likewise good olive greens with lamp black.

36. QUERCITRON LAKE,

Or *Quercitron Yellow*, is what its name implies. It is dark in substance, in grains of a glossy fracture, perfectly transparent, and when ground is of a beautiful yellow colour. In painting it follows, and adds richness and depth to, gamboge in water, and goes well into varnish; but any lead used in rendering oils siccative, browns it, and for the same reason it is useless in tints.

37. LEMON YELLOW, [101]

Or chromate of baryta, is exceedingly difficult to make well. Upon the mode of manufacture depend not only the beauty of the colour but its stability. If properly and carefully prepared, it is of a vivid lemon tint, deep or pale, very clear, very pure and permanent. It also washes well, and is entirely free from the slightest tinge of orange. This may be pronounced the only chromate which possesses durability, not being liable to change by damp or foul air, by the action of light or the steel palette-knife, or by mixture with white lead and other pigments, either in water or oil, in both of which it works pleasantly. Lemon yellow is chiefly adapted to points of high light, and has a peculiarly happy effect when glazed over greens in both modes of painting. In water it exceeds gamboge in brightness, and compounded therewith improves its beauty. This mixture also goes readily into oil; indeed it is the best and easiest way of rendering gamboge diffusible as an oil colour—simple emulsion of the gamboge in a little water, and trituration of the lemon yellow therewith, being all that is requisite for the purpose.

Lemon yellow has not much power, and is semi-opaque. In distance, its light wash is used with great effect for cool sunny greens, for which a minute quantity of emerald green may be added to it. Being uninjured by lime, the colour is eligible in fresco and crayons. [102]

38. MARS YELLOW,

Jaune de Mars, *Jaune de Fer*, *Iron Yellow*, &c., is an artificially prepared iron ochre, of the nature of sienna earth. In its general qualities it resembles the ochres, with the same eligibilities and exceptions, but is more transparent, as well as purer, clearer, richer, and brighter. Like them it is quite permanent. The colours of iron exist in endless variety in nature, and are capable of the same variation by art, from sienna yellow, through orange and red, to a species of purple, brown, and black, among which are useful and valuable distinctions. They were formerly introduced by the author, and have been received under the names of Mars yellow, Mars orange, Mars red, Mars violet, and Mars brown. All of them are brighter and purer than native ochres, and equally stable. When carefully prepared, these pigments dry well in proportion to their depth, are marked by a subdued richness rather than brilliancy, and have the general habits of sienna earths and ochres. Their faint washes possess the desirable quality of transparent clearness.

We have occasionally found Mars yellow mixed with orpiment, or chromate of lead, for the purpose of brightening the colour.

39. NAPLES YELLOW [103]

Was a compound of lead and antimony, anciently prepared at Naples under the name of *Giallolino*, and was variously of a pleasing light, warm yellow tint. It was opaque and of good body, not altered by the light of the sun, and might be used with comparative safety in oil or varnish, under the same management as the whites of lead. Like these, however, it was liable to change even to blackness by damp and impure air when employed in water. Iron was also destructive of the colour of this yellow, on which account great care was requisite, in grinding and using it, not to touch it with the common steel palette knife, but to compound its tints with a spatula of ivory or horn. For the same reason, it was apt to suffer in composition with ochres, Prussian and Antwerp blues, and other pigments of which iron was a principal or ingredient. Used pure or with white lead it was eligible in oil, in which it worked and dried well. It was also employed in enamel painting as it vitrified without change. In this state it was called *Giallolino di fornace*, and was introduced as a pigment for artists, under the erroneous conception that vitrification gives permanence to colours, when in truth it only increases the difficulty of levigation, and injures their texture for working. We have spoken of Naples yellow in the past [104] tense, because the pigment now sold as such is generally, or always, a compound colour, or manufactured with a zinc instead of a lead base. In either case the preceding remarks are not applicable to the present product, which is perfectly durable and trustworthy. The new Naples yellow presents an example of an old objectionable pigment being replaced by a different and superior preparation. However fugitive certain colours may have been, the fact of their once having had a place on the palette would seem to be sufficient recommendation to some. At any rate, they are still in occasional request, and we cannot but approve the pious fraud which offers under the same name a good substitute for a bad original. If an artist must needs demand a worthless pigment, he had better buy a colour like it that will stand, even if it be not what he asked for.

The tints of Naples yellow are readily and accurately imitated by admixture of deep cadmium yellow and white.

40. ANTIMONY YELLOW,

As its name denotes, was likewise a preparation of that metal, of a deeper colour than Naples yellow, but similar in its properties. It was principally used in enamel and porcelain painting, and differed greatly in tint. One variety, brighter than the rest, is stated not to have been affected by [105] foul air, and therefore could not have had a lead basis.

OCHRES,

Known as *Yellow Ochre*, *Brown Ochre*, *Roman Ochre*, *Transparent Gold Ochre*, *Oxford Ochre*, *Stone Ochre*, *Di Palito*, &c., are native earths, consisting chiefly of silica and alumina in combination with iron, which latter forms the principal colouring matter. They are among the most ancient of pigments, and their permanency is proved by the state of the old pictures. In a box of colours found at Pompeii, and analyzed by Count Chaptal, he discovered yellow ochre purified by washing, which had preserved its original freshness. They may all be produced artificially in endless variety as they exist in nature, and are all converted by burning into reds or reddish-browns. Several ochres are found in the natural state of so very fine a quality, that they require no other preparation than that of being washed. Their colours may be imitated to a certain extent by means of iron alone, uncombined with silica and alumina; but such ferruginous preparations are not equally durable, and as their chemical action is stronger, they are more likely to affect those pigments which are damaged by iron. It often happens in colours that one component of weak stability, or powerful for evil, is strengthened and held in check by another; [106] thus in the case of the ochres, the silica and alumina by keeping a tight hand on the iron, both ensure its safety, and prevent it injuring others.

41. YELLOW OCHRE,

Called also *Mineral Yellow*, is found in most countries, and abundantly in our own. It differs much both in constitution and colour, ranging from a tolerably bright though not vivid yellow to a brown-yellow, and is generally of a warm cast. Its natural variety is much increased by artificial dressing and compounding. The best yellow ochres possess no great force, but as far as they go are valuable pigments, particularly in fresco and distemper, being neither subject to change by ordinary light, nor sensibly affected by impure air, or the action of lime. By time, however, and the direct rays of the sun, they are somewhat darkened. Like other ochres, they may be safely used in admixture with pigments which are themselves permanent. With carmine and the cochineal lakes, or intense blue, the ochres are best not employed.

The impunity with which yellow ochre bears foul gas is one of its many recommendations. No immediate effect whatever is produced by sulphuretted hydrogen, and only a slight dirty brown [107] tint is imparted by its prolonged action. This discolouration a short exposure to air and light quickly removes. By keeping the ochre sufficiently long in contact with sulphide of ammonium a jet black is obtainable, but a rub of it in a moist unwashed state completely regains its yellow hue in a day or so. Hence, yellow ochre compounded with pigments which suffer from an impure atmosphere doubtless acts as a preservative agent.

Yellow ochre is usually employed in the distance and middle ground of a landscape. It possesses a slight degree of turbidness, and is esteemed for this property, which is considered to give it a retiring quality. By admixture with Antwerp blue or indigo it affords a fine range of quiet greens, also a very serviceable yellowish drab with Vandyke brown. The ochre is valuable in warm skies, the sails of ships and boats, sandstone rocks and cliffs, buildings, hay, sheep, &c. It does not compound kindly with any of the cold colours, and should therefore be used as a wash over others that are dry, when required to qualify their tints.

42. ROMAN OCHRE

Is rather deeper and more powerful than the preceding, as well as more transparent and cool in tint. In other respects it is similar, and forms with Antwerp blue and indigo a like excellent [108] range of greens. We may observe, however, that as indigo is not a permanent pigment, the colours it yields by admixture cannot be durable as far as the blue is concerned. Roman ochre and brown madder are admirably adapted for red sails, and autumnal effects of foliage.

43. BROWN OCHRE,

Likewise known as *Spruce Ochre* and *Ocre de Rue*, or, more correctly *Ru*, is a dense, deep-toned brownish yellow, fine in sandy foregrounds. With Indian yellow it gives a dark autumnal tint of great richness, but stable only as respects the ochre. When mixed with other colours, it furnishes a series of rich yet sober tones of extensive use. It covers well, without being too opaque; and compounded with black and a little brown-red is good for backgrounds, &c.

44. TRANSPARENT GOLD OCHRE

Resembles in a great degree Roman ochre, but is clearer in its tints, and more transparent. It is also brighter and much less opaque than yellow ochre. It approaches somewhat the character of clear bright raw sienna, though more pure and brilliant, serving for strong semi-transparent greens and sunny effects.

45. OXFORD OCHRE [109]

Is a native pigment from the neighbourhood of Oxford, semi-opaque, of a warm yellow colour and soft argillaceous texture, absorbent of water and oil, in both of which it may be safely employed. It is one of the best of yellow ochres.

46. STONE OCHRE

Has been confounded with the last variety, to which, as well as to Roman ochre, it is frequently similar. True stone ochres are found in balls or globular masses of various sizes in the solid body of stones, lying near the surface of rocks among the quarries of Gloucestershire and elsewhere. These balls are smooth and compact, in general free from grit, and of a powdery fracture. They vary exceedingly in colour, from yellow to brown, murrey, and gray, but otherwise do not differ from ordinary ochres.

In enamel they may be used for browns and dull reds.

47. DI PALITO

Is a light yellow ochre, with no special distinguishing quality, except that its tints are rather purer in colour than most ochres.

48. ORIENT YELLOW

[110]

Is an entirely new preparation of absolute permanence, and perfectly unexceptionable in all respects, both in water and oil. We can give it no higher praise than by saying it equals aureolin in stability, as well as in neither injuring, nor being injured by, other colours. Not possessed of the same amount of transparency, it is distinguished by greater richness and depth. Of a soft golden hue, lustrous and luminous, it resembles a brilliant and somewhat opaque Indian yellow. A gorgeous and durable substitute for that fugitive pigment is produced by compounding the orient with aureolin, or by using the latter as a glaze. Being more transparent than cadmiums and less obtrusive, the new yellow is adapted for mellow sunset and sunrise clouds, or for sunshine on distant mountains. With French blue it affords a beautiful sea green; and, mixed with aureolin, gives fine foliage tints. It is also eligible for draperies and illumination. For enamelling it is inadmissible, the colour being destroyed by great heat; but in fresco it may safely be employed.

As in the case of aureolin, we have had a prolonged personal experience of this new yellow, an experience which justifies us in asserting that there is none more permanent. In the whole range of artistic colours there is no pigment less affected by chemical or physical agents. Acid [111] and ammoniacal fumes, foul gases, and exposure to damp, air, light, or sunshine, equally fail to injure it. The perfect impunity with which it bears the action both of sulphuretted hydrogen and sulphide of ammonium is remarkable. The former gas may be continuously passed into the colour suspended in water, or a strong solution of the latter sulphide be poured upon it, and the yellow remains unchanged. Submitted to the direct rays of the sun during an entire summer, its lightest and faintest tints have preserved their original hue.

In a preceding chapter we remarked that, provided the colour be stable, the more colour a pigment possesses the better. The "latent colour" there alluded to, is one of the advantages of orient yellow. The more it is looked into, the more colour is seen—there is no suspicion of a base coloured, the pigment is colour itself.

49. ORPIMENT,

Also called *King's Yellow*, *Chinese Yellow*, *Yellow Orpiment*, &c., was known in ancient times: the Romans called it *auri pigmentum* or gold colour, whence, by corruption, its present name is derived. It is found in the native state in China and elsewhere, the best quality being in masses, consisting of plates of a fine golden hue, intermixed with portions of a vermilion or orange-red [112] colour; the inferior kinds are yellow or greenish yellow. Of orpiment, or sulphuret of arsenic, which is produced artificially, there are two distinct varieties; one of a bright pure yellow tint, in which the sulphur predominates, and one of an orange hue, in which the arsenic is in excess. The former is the most lasting, but it is not durable in water, and still less so in oil, although not discoloured by impure air. Compounded with white lead it is soon destroyed, nor can it be mixed with any colours into which lead enters, such as chrome yellow, the old Naples yellow, &c. The sulphur in combination with the arsenic, having less affinity for that metal than for lead, lets it go, and forms a sulphuret of lead of a dark greyish hue. Moreover, as orpiment is apt to deprive other pigments of their oxygen, and therefore to change and be changed by all pigments whose colour depends on that element—metallic pigments especially—it is probable that the orpiment after some time withdraws the oxygen from the lead; and this would be an additional cause for the darkening of the tint composed of the two colours. With sulphides or pigments containing sulphur, orpiment may be used with less danger. If employed at all, however, it had better be in a pure and unmixed state. We are far from recommending orpiment as an eligible colour, and it is highly poisonous. [113]

Brick dust and yellow ochre are sometimes found as adulterants.

50. RAW SIENNA,

Known likewise as *Raw Sienna Earth*, *Terra di Sienna*, &c., is a ferruginous native pigment, firm in substance, of a glossy fracture, and very absorbent. It is of rather an impure yellow colour, and much used in landscape, being very serviceable both in distance and foreground. Unless proper skill is exercised in its preparation, the sienna has the objection of being somewhat pasty in working. Being little liable to change by the action of either light, time, or impure air, it may safely be employed according to its powers, in oil, water, and other modes of practice. It possesses more body and transparency than the ochres; and by burning becomes deeper, orange-russet, as well as more transparent and drying.

Raw sienna compounded with cobalt, indigo, or Prussian blue, and a very little bistre, yields good sea greens, that with indigo being the most fugitive. Alone, it is adapted for shipping, sails, baskets, decayed leaves, brooks and running streams.

51. STRONTIAN YELLOW,

To justify its name, should be a chromate of strontia, a compound very slightly soluble in water, [114] and not more stable than the zinc chromate. The pigment, however, now sold as strontian yellow is usually formed by admixture, and contains no strontia whatever. Its absence cannot be considered a disadvantage, for the substitute possesses a durability to which the original could lay no claim. Other things being equal, we prefer an original pigment to one compounded, but a good mixture is decidedly better than a bad original. A light primrose, clear and delicate.

The foregoing comprise those yellows more generally employed, advisedly or not, as the case may be. The following are for the most part not commercially obtainable, a remark that will apply in ensuing chapters to all numbered colours printed in italics. As a rule, these have become obsolete as pigments, or have never been introduced as such. The former could not well be omitted in a work of this kind, and the latter deserve notice as being at least suggestive. At present, many of them must be regarded as mere curiosities, being obtainable only from materials of excessive rarity. In time, however, the sources whence they are derived may possibly be found in greater abundance, and these now fancy products prove of value to the palette. The [115] new metal indium, for instance, furnishes a bright yellow sulphide, like that of cadmium. The colour could not be affected by foul air, and might possess other advantages which would render indium yellow a desirable pigment. With regard to those compounds available for artistic use, but which have not to our knowledge been adopted, several are quite ineligible. It may be thought that they are needlessly referred to, but they are mentioned as a warning and a guide. Strange preparations have been offered as pigments, and sometimes accepted, witness turbith mineral, iodine yellow, &c. In these days of chemistry there is less chance for them, but they are continually submitted to one's notice, their merits being enlarged upon in proportion to their worthlessness. Through an exceptional ignorance they may still gain a place, and it has been deemed, therefore, not superfluous to allude to them. At the same time we do not pretend to exhaust the list, any more than we claim to note all substances possessing colour, but yet not admissible as pigments. Some there are which do not retain that colour on drying; others, whose preparation involves processes too nice, complicated, or expensive, for manufacturing purposes. There are many colours, again, which exist only on paper. We have too often found the imaginations of chemical writers far more vivid than the colours they describe. Gorgeous yellows turn out dingy drabs; dazzling scarlets dirty reds; and brilliant blues dusky slates. As respects [116] colours, most books of science need revising.

52. *Arsenic Yellow,*

Called also *Mineral Yellow*, has improperly been classed as an orpiment, from which it differs in not being a sulphide, and in containing lead. It is prepared from arsenic fluxed with litharge, and reduced to powder. It is much like orpiment in colour, dries better, and not being affected by lead, is less liable to change in tint. The presence of the litharge, however, renders it subject to be blackened by sulphuretted hydrogen. Of course it is poisonous.

53. *Bismuth Yellow,*

Or chromate of bismuth, may be obtained either as a lemon or an orange yellow, sparingly soluble in water. The colour is not permanent, and turns greenish-brown even when excluded from light and air.

54. *Copper Yellow,*

Or chromate of copper-potassa, is of a bright yellow tint, not insoluble in water. It is discoloured both by foul gas and exposure.

55. *Gelbin's Yellow,* [117]

Or chromate of lime, is a pale whitish yellow, poor in colour, partly soluble, and not at all to be depended on.

56. *Indium Yellow.*

Whether the new metal indium will ever be found in sufficient quantity to render it practically useful remains to be seen. The most abundant source at present known is the Freiberg blende, 100,000 parts of which only yield from twenty-five to forty parts of indium. The metal is chiefly interesting in an artistic sense on account of its sulphide, a fine bright yellow resembling cadmium, and best obtained by precipitating an acetic acid solution with sulphuretted hydrogen, or sulphide of ammonium. In the latter, the yellow dissolves on being heated, but deposits again on cooling of a rather paler tint. With one modification, what was said in a former edition of this Treatise concerning cadmium yellow may be repeated of indium yellow. "The metal from which it is prepared being hitherto scarce, it has not been employed as a pigment, and its habits are not therefore ascertained." All we can tell is, that the colour does not suffer from impure air.

Indium is likewise distinguished by a straw-yellow oxide. [118]

57. *Iodine Yellow,*

Or iodide of lead, is one of those compounds whose presence on the palette should never have been allowed. Exceedingly brilliant, it is also utterly fugitive, destroyed by exposure or foul gas, and useless in admixture. We may state here that, whatever its colour, no pigment containing iodine can in the slightest degree be relied upon. One of the most unstable of substances, being slowly volatile even at common temperatures, iodine is or ought to be quite inadmissible as a constituent. Combined with lead, which is in itself objectionable, it forms a yellow possessing every bad quality.

58. *Iron Yellow,*

Or oxalate of protoxide of iron, has very unadvisedly been recommended as a pigment. It is a bright pale yellow, but soon loses the beauty of its tint when submitted to air and light, becoming, by peroxidation, red and buffy. Even in a book the colour changes.

59. *Madder Yellow.*

As our (the Editor's) experience of this product is somewhat at variance with that of the [119]
author, we subjoin his original statement. "Madder yellow is a preparation from the madder-root. The best is of a bright colour, resembling Indian yellow, but more powerful and transparent, though hardly equal to it in durability of hue; metallic, terrene, and alkaline substances acting on and reddening it as they do gamboge: even alone it has by time a natural tendency to become orange and foxy. We have produced it of various hues and tints, from an opaque and ochrous yellow, to a colour the most brilliant, transparent, and deep. Upon the whole, however, after an experience of many years, we do not consider them eligible pigments."

While agreeing with Mr. Field as to the character given of these yellows, we must confess that we have never been able to obtain, nor have we ever seen, a "most brilliant" madder yellow. Colours bearing that name have come under our notice, but if their hue was pure and vivid, they have always proved to be falsely so called, the madder being conspicuous by its absence. What we have succeeded in producing, and the genuine samples we have met with, have been fawns, buffs, drabs, &c., decidedly "ochrous" yellows, and wanting in stability. It is certain that no true madder yellow, brilliant and pure, ranks as a pigment at the present day. A variety known as Cory's Yellow Madder may be briefly described as Cory's *Brown* Madder.

60. *Massicot,* [120]

Or *Masticot*, is a protoxide of lead, varying from the purest and most tender straw colour to a dull orange yellow, and known as Light, Yellow, and Golden Massicot. It has in painting all the properties of white lead, from which it may be prepared by gentle calcination in an open furnace. In tint with that pigment, however, it soon loses its colour and returns to white, probably extracting some carbonic acid therefrom. If used in an unmixed state, it is permanent in oil under the same conditions as white lead, but should not be employed in water, on account of its changing even to blackness by the action of damp or impure air. It is an admirable dryer, and has much the same effect as litharge in rendering oils siccative.

Litharge is merely fused massicot. Old writers speak of litharge of silver and litharge of gold, oxides of lead, pale and reddish yellow respectively. Commercial litharge, especially that which is foreign, contains sometimes a considerable proportion of oxide of copper and iron. The principal impurity, however, is generally silica, left undissolved on treating the litharge with nitric or acetic acid. Litharge is commonly used in preparing drying oils, which contain a greater or less
amount of the oxide in the form of oleate of lead. Oils made siccative by means of litharge are [121]
therefore liable to be damaged by foul gas. It is a matter of congratulation that such injury is not lasting, and that the oil, like white lead, recovers its original colour on exposure to air and light. Some drying oil which we exposed on a tile to an atmosphere of sulphuretted hydrogen until it

was completely blackened, regained its former yellow hue on being submitted for a day or so to air and light. Hence, although the employment of lead as a siccative is not desirable, its effects are not so deleterious as might be imagined.

61. *Patent Yellow,*

Turner's Yellow, *Montpellier Yellow*, *Mineral Yellow*, *Cassel Yellow*, &c., is a mixture of chloride and oxide of lead, obtainable either as a pale or a deep yellow. It is a hard, ponderous, sparkling substance, of a crystalline texture and bright colour; hardly inferior, when ground, to chrome yellow. Of an excellent body, and working well in oil and water, but soon injured both by the sun's light and impure air. A variety, mentioned by Mérimée, in which bismuth and antimony are also used, is of greater durability.

62. *Platinum Yellow.*

Our own opinion of this costly preparation is that the good qualities of the product do not justify its price. It may be obtained as a bright, rich, deep yellow, of considerable transparency; but the colour is acted upon by foul gas and exposure. Even in a book we have found it assume a dirty greyish cast, and a specimen which had been kept in a drawer, wrapped up in paper, became perfectly black in a few years. The presence of palladium interferes with the beauty of the original tint, but does not affect its stability. [122]

63. *Thallium Yellow.*

The new metal thallium yields in combination with chromic acid two yellow colours, a pale and an orange. They are not absolutely insoluble in water, and the sulphide of thallium being brown, would probably be damaged by impure air. But whatever their properties as pigments may be, their habitudes as such are not yet known. The present scarcity of the metal renders the colours produced from it mere scientific curiosities.

64. *Thwaites' Yellow.*

Under this name chromate of cadmium was introduced some few years back. If well prepared, it is a fine soft powder of a very vivid light yellow colour. The compound is too soluble, however, to be of value, its washings even with cold water being continually tinged yellow. Hence it turns green after a time, and becomes otherwise discoloured. [123] Like citron yellow and other chromates apt to assume a green cast, it should only be employed, if at all, when compounded for foliage tints, &c. This want of durability is to be regretted, for a good sample of cadmium chrome is marked by exceeding beauty, unsurpassed for clearness and purity by any other yellow.

65. *Turbith Mineral,*

Or *Queen's Yellow*, is a subsulphate of mercury, of a beautiful lemon yellow colour, but so liable to change by the action of light or impure air, that it cannot be used safely, and hardly deserves attention as a pigment.

66. *Uranium Yellow*

Can be produced of a pale or orange tint, differing in brightness and depth of colour according to the mode of preparation. It is fairly eligible as a pigment, and far superior to the many fugitive compounds which have from time to time appeared. Being very expensive, however, and not possessing the good qualities of its compeers lately introduced, uranium yellow has but little chance of being employed now.

67. *Yellow Carmine*

Is a rich transparent colour, somewhat resembling an ochre compounded with Indian yellow. On [124] exposure to light, it behaves much as a mixture of those pigments would do, the rich *yellowness* entirely disappearing, and the sober-coloured earth being left behind.

From several metals besides those mentioned, yellows more or less vivid and durable may be obtained—from tin, nickel, cerium, molybdenum, &c.; but we do not know that any one of them would be a really desirable addition. To justify its being brought out, a new pigment should own some special advantage, chemical or artistic, by which it may be distinguished from other colours. No purpose would be answered by crowding the palette with mere repetitions, even though they were stable. If, for instance, indium yellow were found exactly similar to that of cadmium, in colour, opacity, permanence, its presence would be quite superfluous. The mistake is often made of offering a fresh compound for a pigment when something as good or better, and cheaper may be, already exists. We remember a patient experimenter, who had produced a pink from cobalt, wondering why his colour should be so generally declined. The product was not wanting in either beauty or stability, but he forgot that the lakes of madder were far more beautiful, at least as durable, and much less expensive. We have said that we do not join in the [125]
cry of there being too many pigments, or share the opinion that there is not room for more, but we do enforce the necessity of progress. Let us have as many good colours as possible, but let the new be superior to the old, and all be distinct from each other.

As far as yellows are concerned, the palette possesses both variety and durability. Opaque or transparent, bright or subdued, deep or pale, it presents a sufficiency of permanent pigments. Most noteworthy are aureolin, the deep and 'pale' cadmiums, lemon yellow, Mars yellow, the modern Naples yellow, the ochres, orient yellow, and raw sienna. Whether used alone or in tint these are, if genuine, perfectly reliable, and comprise the list of those durable colours which may be called pigments of the first class.

Among pigments of the second class, or the semi-stable, gamboge holds the foremost place, for although not strictly durable in itself, it conduces to the permanence of other colours. Chrome yellows, citron yellow, strontian yellow, and Thwaites' yellow, also belong to this division.

As third class pigments, or the fugitive, must be ranked Mutrie yellow and other lemon cadmiums, the true gallstone, Indian yellow, the lakes, orpiment, Gelbin's yellow, massicot, patent yellow, and turbith mineral.

It must not be forgotten, however, that these three classes are subject to modification. A [126]
durable pigment may be so adulterated as to descend to the second or even the third division, while a semi-stable or fugitive colour may be replaced by a permanent or comparatively permanent substitute, as in the case of strontian yellow and gallstone. It should likewise be remembered that pigments are apt to vary in stability according to the mode of their preparation; and that, as there are different degrees of permanence, there are different degrees of fugacity.

CHAPTER IX. [127]

ON THE PRIMARY, RED.

Red is the second and intermediate of the primary colours, standing between *yellow* and *blue*; and is also in like intermediate relation to *white* and *black*, or light and shade. Hence red is pre-eminent among colours, as well as the most positive of all, forming with yellow the secondary *orange* and its near relatives, scarlet, &c.; and with blue, the secondary *purple* and its allies, crimson, &c. It gives some degree of warmth to all colours, especially to those which partake of yellow.

Red is the archeus, or principal colour in the tertiary *russet*; enters subordinately into the two other tertiaries, *citrine* and *olive*; goes largely into the composition of the various hues and shades of the semi-neutral *marrone* or chocolate, and its relations, puce, murrey, morelle, mordore, pompadour, &c.; and is more or less present in *browns*, *grays*, and all broken colours. It
is likewise the second power in harmonizing and contrasting other colours, as well as in [128]
compounding *black* and all other neutrals, into which it enters in the proportion of five,—to blue, eight,—and yellow, three.

Red is a colour of double power in this respect too; that, in union or connexion with yellow, it becomes hot and *advancing*; but mixed or combined with blue, cool and *retiring*. It is, however, more congenial with yellow than with blue, and thence partakes more of the character of the former in its effects of warmth, the influence of light and distance, and action on the eye, by which the power of vision is diminished on viewing this colour in a strong light. On the other hand, red appears to deepen in colour rapidly in a declining light as night comes on, or in shade. These qualities of red give it great importance, render it difficult of management, and require it to be generally kept subordinate in painting. It is therefore rarely used unbroken, as the ruling or predominating colour, or for toning a picture; on which account it will always seem detached or insulated, unless repeated and subordinated. Hence Nature is sparing with her red, employing it with as much reserve in the decoration of her works as she is profuse in lavishing green upon them. This latter is of all colours the most soothing to the eye, and the true contrasting or harmonizing equivalent of red, in the proportional quantity of eleven to five, according to surface [129] or intensity: being, when the red inclines to scarlet or orange, a *blue*-green; and when it tends to crimson or purple, a *yellow*-green.

Red breaks and diffuses with white with peculiar loveliness. It is discordant when standing with orange only, requiring to be joined or accompanied by their proper contrast, to resolve or harmonize the dissonance. In landscapes, &c., abounding with hues allied to green, a red object properly placed as regards light, shade, or distance, conduces wonderfully to the life, beauty, harmony, and connexion of the colouring. Red is, indeed, the chief element of beauty in floral nature, the prime ornament of the green garb of the vegetal kingdom.

Being the most *positive* of colours, and holding the middle station of the primaries, red contrasts and harmonizes with black and white, which are the *negative* powers or neutrals of colours, and the extremes of the scale. Moreover, as red is less nearly allied to black or shade than to white or light, this harmony is most remarkable in the union or opposition of white and red, and this contrast most powerful in black and red.

As a primary and simple colour, red cannot be composed by mixture of other colours. So much is it the instrument of beauty in nature and art in flesh, flowers, &c., that good pigments of this genus are most indispensable. On the whole, the palette cannot be considered so well [130] furnished with reds as with yellows. Especially is there wanting a permanent transparent scarlet, a colour for which a prize of £500 has for many years been offered by the Society of Arts.

68. CADMIUM RED.

The deep, pale, and lemon yellows which cadmium at first afforded, were followed by an orange, which has quite recently been succeeded by a red. This is a most vivid orange-scarlet, the red predominating, of exceeding depth, and intense fire. It is a simple original pigment, containing no base but cadmium, and possessing a large amount of latent colour. It is more orange in hue than vermilion, and has the advantages of flowing and drying well, of greater brilliancy, of retaining that brilliancy when dry, and of considerable transparency. Hence this red is preferably employed where opacity is to be avoided—in sunset clouds for instance. As day declines or by artificial light, the colour approaches very nearly to a deep pure scarlet; and the best substitute for a permanent transparent scarlet which has yet been obtained is furnished by admixture of cadmium red with madder carmine, or by using the latter as a glaze. Compounded with white, the red yields a series of fine flesh tints; and it mixes readily and safely with other colours. Without harshness or rankness, neither injured by an impure atmosphere nor exposure [131] to light and air, cadmium red is eligible in every department of art, enamel painting only excepted. In illumination, the red contrasted by viridian will be found most beautiful and effective. Seeing that previous to its introduction the number of bright reds, not being crimson, nor of a crimson cast, was limited to vermilions, pure scarlet, red chrome, and red lead, of which the first alone were permanent, there was room on the palette for a strictly durable and somewhat transparent pigment like cadmium red, with its many distinctive properties.

COCHINEAL LAKES.

Lake, a term derived from the *lac* or *lacca* of India, is the name of a number of transparent red and other coloured pigments of great beauty, prepared for the most part by precipitating coloured tinctures of dyeing drugs upon aluminous bases. Consequently, the lakes form a numerous class, both with respect to the variety of their appellations, and the substances whence they are produced. Those under notice are known as *Carmine*, *Crimson Lake*, *Scarlet Lake*, *Purple Lake*, *Chinese Lake*, *Florentine Lake*, *Hamburgh Lake*, *Roman Lake*, *Venetian Lake*, &c., and are obtained from the "coccus cacti," an insect found on a species of cactus, from the juice of which it extracts its nourishment. This coccus is a native of Mexico, where two kinds are [132] recognised, under names which signify wild cochineal and fine cochineal. The latter may be considered a cultivated product, its food and wants being carefully attended to, while the former is left in a natural state, and is less valuable. Wild cochineal is distinguished by having a woolly downy coat, which is not the case with the fine cochineal. The females, of which there are from one hundred and fifty to two hundred for each male, are marked by the absence of wings, and constitute the commercial article. They are generally killed by immersion in boiling water, which causes them to swell to twice their natural size, and are then dried and packed for market. The insects shrivel in drying, and assume the form of irregular grains, fluted and concave. The best sorts have a silvery-grey colour, with a purplish reflection, and seem to be dusted with a white powder. This appearance is often given by means of heavy spar, carbonate of lead, Venice talc, &c. A good lens, however, will mostly expose the fraud; or it may be detected by macerating the insect in water, and allowing the loosened pulverised particles to settle.

Cochineal is a very rich colouring substance, yielding about half its weight of real colouring matter, which may be easily extracted by boiling in water. Dr. Warren De La Rue, who examined the living animal, states that on piercing the side of the insect a purplish-red fluid exuded, [133] containing the colouring matter in minute granules. This colouring matter he succeeded in obtaining pure, in the form of a purple-brown friable mass, pulverizable to a fine red powder, transparent when viewed by the microscope, and soluble both in water and alcohol in all proportions. At temperatures above 136° it decomposed, and by alkalies its colour was turned to purple. These facts account for the care required in drying cochineal lakes, and for their liability to change of hue when in contact with alkaline substances, as in mural decoration.

The lakes of cochineal may be known from those of the dye-woods by their solubility in ammonia, a liquid which purples but does not dissolve the colours produced from the latter.

69. CARMINE.

A name once given only to the fine feculences of kermes and cochineal tinctures, now denotes generally any pigment which resembles them in beauty, richness of hue, and powdery texture. We have, therefore, blue and other coloured carmines, though the term is usually confined to the crimson and scarlet lakes of cochineal. As at present commonly understood, carmine is that preparation of cochineal which contains the most colouring matter and the least aluminous base. Hence it is the richest, deepest, most intense, and most permanent. Although not [134] to be classed as durable, yet by reason of its extreme depth, carmine is more stable than the weaker crimson, scarlet, and purple lakes. When well-made, pure, and employed alone and in body, it has been known to retain its colour for years, especially if protected by oil or varnish. In tint with white lead, however, it has no stability; and though little affected by impure air, in glazing it is soon discoloured and destroyed by the action of light. Of great power in its full touches, it possesses considerable clearness in the pale washes, and works admirably. In landscape, carmine is seldom used, the colour being chiefly valued in flower painting and illumination.

It has been erroneously stated that the finest carmines cannot be made in England, owing to a want of clearness in the atmosphere and a scarcity of sunshine. For many years, however, they have been produced in this country, not only finer than any foreign preparations, but equally good in winter as in summer.

Carmine is sometimes sophisticated with starch, vermilion, and with alumina not formed in the process of manufacture. Occasionally also, a portion of the animal matter of the cochineal from which it has been obtained is left mixed with it. These accidental or intentional impurities [135] may mostly be detected by heating the carmine with liquid ammonia, which entirely dissolves the colouring matter and leaves the impurities in an insoluble state.

70. CRIMSON LAKE

Is a cochineal pigment containing more aluminous base than carmine, and is consequently weaker in colour and less stable. Deficient in much of the depth and brilliancy which belong to the latter, it is more commonly employed and more generally useful. This lake is of service in mixing tints, to impart richness, in flower painting and illumination, and is, like all cochineal colours, of greater utility in water than in oil. With cobalt and gamboge it yields an excellent gray, and with cobalt alone a fine purple for heather. Distant hills may be strengthened with a tint of French blue and lake, and Vandyke brown with the crimson will be found admirable for a rich coloured foreground. Many other beautiful tints, unexceptionable in an artistic sense, are afforded by crimson lake on admixture. It should be remembered, however, that not one of them is permanent as far as the lake is concerned. All cochineal pigments are more or less affected by strong light, which weakens their tints, and in time deprives them of colour; and it is not by being compounded that a fugitive colour is rendered durable.

71. SCARLET LAKE [136]

Is prepared in the form of drops from cochineal, and is of a fine transparent red colour and excellent body, though, like other lakes, it dries slowly. Discoloured and destroyed by strong light both in water and oil, and not permanent in tint with white lead or in combination with other pigments, it possesses the common attributes of cochineal lakes. Yet when well prepared, used in sufficient body, and not unduly exposed, it has been found to last a lengthened period; but it ought never to be employed in glazing, nor at all in works that aim at high reputation and stability. It is in general tinted with vermilion, which has probably been mixed with lakes at all times to give their scarlet hue and add to their weight; for upon examining with a powerful lens some fine pictures of ancient masters, in which lake had been used in glazing, particles of vermilion were apparent, from which lake had evidently flown. Unfortunately, these lakes are injured by vermilion as they are by lead, so that glazings of cochineal over vermilion or lead are particularly apt to vanish. This effect is very remarkable in several pictures of Cuyp, where he has introduced a figure in red from which the shadows have disappeared, owing to their having been formed with lake over vermilion. The scarlet hue of this lake should properly be imparted to [137] it during the process of manufacture, and not by subsequent mechanical admixture.

72. PURPLE LAKE

Is a species of crimson lake with a purple cast, transparent and deep-toned, and useful in shadows: in other respects resembling that pigment. Red being its predominant colour, we have preferred classing this so-called purple among the reds, in spite of its name. On the whole it is more durable than crimson lake.

73. FLORENTINE LAKE

Differs from scarlet lake only in the mode of preparation. Formerly the lake so called was extracted from the shreds of scarlet cloth. The same may be said of *Chinese Lake*.

74. HAMBURGH LAKE

Is a lake of great power and depth of colour, purplish or inclining to crimson, which dries with extreme difficulty, but differs in no other essential respect from preceding cochineal lakes—an observation which applies to *Roman Lake*, *Venetian Lake*, and many others; none of which, however beautiful or reputed, is entitled to the character of stability either in hue, shade, or tint.

75. DRAGON'S BLOOD

Is a resin brought from the East Indies. It is of a warm semi-transparent, rather dull red colour, [138]
which is deepened by impure air, and darkened by light. There are two or three sorts, but that in drops is the best. White lead soon destroys it, and in oil it dries with extreme difficulty. It is sometimes used to colour varnishes and lackers, being soluble in oils and alcohol. Although it has been recommended as a pigment, dragon's blood does not merit the attention of the artist.

76. INDIAN LAKE,

Likewise called *Lac Lake*. This is obtained from the lac or lacca of India, a resinous secretion which seems to depend upon the puncture of a small insect—*coccus ficus*—made for the sake of depositing its ova on the branches of several plants, found in Siam, Assam, and Bengal. The twigs soon become encrusted with a mammelated substance of a red colour more or less deep, nearly transparent, hard, and having a brilliant conchoidal fracture. The roughly-prepared coating is imported in two forms, called lac-lake and lac-dye, which contain about 50 per cent of colouring matter, combined with more or less resin, and with earthy matters, consisting chiefly of carbonate and sulphate of lime and silica.

Indian lake is rich, transparent, and deep,—less brilliant and more durable than the colours [139]
of cochineal, but inferior in both respects to those of madder. Used thickly or in strong glazing, as a shadow colour, it is of great body and much permanence; but in thin glazing it changes and flies, as it also does in tint with white lead. In the properties of drying, &c., it resembles other lakes. The pigment may be dispensed with in favour of madder lake and madder brown, whose combinations serve for every purpose to which it can be applied, and are stable.

Lac appears to be the lake which has stood best in old pictures, and was probably employed by the Venetians, who had the trade of India when painting flourished at Venice.

MADDER LAKES.

Rubric Lakes, or *Field's Lakes*, are derived from the root of "rubia tinctorum," a plant largely grown in France and Holland, whence the bulk of that used in England is obtained. The French madders are in a state of very fine powder, containing one half their weight of gum, sugar, salts, and other soluble substances, which water speedily dissolves. Madder roots in the unground state are imported from the Levant, and called Turkey roots. Good qualities of Turkey madder yield near sixty per cent of extractive matters, a term that includes everything removable by
water and dilute alkalis: the woody fibre is therefore about forty per cent. This is presuming the [140]
root to be genuine, for madder is often adulterated with brickdust, red ochre, red sand, clay, mahogany sawdust, logwood, sandal and japan-wood, and bran.

Unlike cochineal, madder possesses several colouring matters; the question of which, despite the learned researches of Dr. Schunck and others, is far from settled yet. The following remarks embody our own experience of the root, simply as a pigment-producing product:—

Madder contains five colouring matters—yellow, red, orange, purple, and brown. Of these, the first colour is soluble in cold water. By washing the powdered root quickly with it by decantation, the yellow and brown are extracted in the form of an opaque liquid. If this be decanted and allowed to stand, the brown deposits, leaving a clear buffish-yellow supernatant liquor. In the root from which the extract was poured, the remaining three colours are left. On adding a strong boiling solution of alum, these are dissolved, yielding a fine red liquid. From this there can be thrown down, by the agency of different chemicals, a red, an orange, or a purple precipitate. Or, supposing the whole of the colouring matter to be deposited as a red lake, it is possible to convert this—also by the agency of different chemicals—either into orange or purple. Hence, for all practical purposes, madder contains but three colouring matters: a yellow, soluble [141] in cold water; a brown, not soluble in, but capable of being extracted by cold water; and a red, soluble in boiling alum, and furnishing at will a purple or an orange.

As was observed in the previous chapter, no good pigment is obtained from the yellow, of which the less there is present the better; but the brown affords a valued product, which will be duly noticed. It is essential to the purity of the reds, that the madder should be freed from both these colours; and it was probably due to insufficient aqueous washing of the root, that the old lakes were dull and muddy, mere brick-reds of ochrous hues. For many years, however, lakes have been prepared perfectly transparent, and literally as beautiful and pure in colour as the rose; qualities in which they are unrivalled by the lakes and carmine of cochineal. They have justly been considered as supplying a desideratum, and as among the most valuable acquisitions of the palette in modern times, since permanent transparent red and rose pigments were previously unknown. The red varieties range from rich crimson to a delicate rose, and are known as *Madder Carmine*, *Field's Carmine*, *Pink Madder*, *Rose Madder*, *Madder Lake*, and *Liquid Rubiate* or *Liquid Madder Lake*.

77. MADDER CARMINE, [142]

Or *Field's Carmine*, like that of cochineal, is the richest and deepest lake prepared, containing most colouring matter and least base. It differs from the paler products chiefly in transparency and intensity, and is the only durable carmine for painting either in water or oil; for both which it is qualified by texture without previous grinding. In common with the other reds of madder, its faint washes possess greater clearness than those of cochineal. This carmine is a difficult colour to make well, exceeding care and nicety being required to obtain the fullest tint: hence it is apt to vary in hue according to the skill of the manufacturer. Being expensive also, the price increasing according to depth of colour, the lake has been the most liable to adulteration, of all the reds of madder. Mérimée states that samples were sent to him from Berlin, under the name of "carmine madder," which evidently owed their brightness to tincture of cochineal. It is certain that madder lakes have been imitated on the Continent with various success by those of lac, cochineal, and carthamus or safflower. The best we have seen is the *laque de garance*, which was tinged with the rouge of carthamus, and was of course inferior in durability. As, however, liquid ammonia and alkalis generally dissolve the colours of cochineal, lac, and safflower, the test is simple. If the [143] liquid remain uncoloured on adding ammonia to an assumed madder lake, in all probability the pigment is genuine.

78. ROSE MADDER.

The exquisite flowers of Bartholomew, Miss Mutrie, and others, give evidence of the beauty, purity, and stability of the reds of madder, both in water and oil. This variety, less intense than the preceding and without its carmine hue, is of a rich rose colour—a true rose—tending neither to crimson, scarlet, nor purple. Marked by a peculiar softness, and an unusual clearness in its pale washes, rose madder affords the most perfect carnation tints known. Not liable to change by the action of light, impure air, or admixture with white lead and other colours, it resembles all madder lakes in these respects. Like them, too, it is but a tardy dryer in oil unless thoroughly edulcorated, and does not work in water with the entire fulness and facility of cochineal pigments. When, therefore, permanence is of no consideration, the latter may still be preferred. In those works, however, where the hues and tints of nature are to be imitated with stability and pure effect, the rose colours of madder are become indispensable. They have this advantage, moreover, that they possess the property of ultramarine of improving in hue by time—their tendency being to their own specific prismatic red colour. As they are too beautiful and require [144] saddening for the general use of the painter, the addition of manganese brown, cappagh brown, or burnt umber, adds to their powers, and improves their drying in oils; for which last purpose a little japanner's gold size may be likewise employed.

In the light touches of bright clouds or mountains, where a mixture of cadmium yellow and Chinese white is used, rose madder is invaluable for glazing over such touches when dry, should they be required of a warmer hue. The red portion of sunset skies may be improved by a thin wash of this pigment, tinged perhaps with the above yellow, or with gamboge. Most serviceable landscape tints are afforded by admixture of rose madder with cobalt, Indian red, purple madder, yellow ochre, lamp black, &c. In painting flesh, the lake cannot be dispensed with.

79. PINK MADDER

Was a weaker preparation of the preceding, paler in hue and possessing less colour. It was formerly employed in miniature painting, but with the decline of that art became less and less used, until it may now be said to be obsolete. The name, however, still lives, but is applied to rose madder, which is indeed indifferently called *Rose Madder*, *Pink Madder*, or *Madder Lake*. Speaking of pink roses, Mrs. Duffield remarks that "the local colour is best imitated with pink madder," and the Messrs. Rowbotham observe "this heather may be best represented by cobalt [145] and madder lake." In trade catalogues several names are often given, as in this instance, to one and the same pigment. The seeming superfluity is rendered necessary through some artists knowing a pigment by one name and some by another. Hence arises the value of a list of synonyms.

80. LIQUID RUBIATE,

Rose Rubiate, or *Liquid Madder Lake*, is a concentrated tincture of madder of the most beautiful and perfect rose colour and transparency. It is used as a water colour only in its simple state, diluted with water, and with or without gum. In oil it dries by acting as a siccative. Mixed or ground with all other madder colours, with or without gum, it forms combinations which work freely in water, and produce the most charming and stable effects. The rubiate also furnishes a fine red ink, and is a durable stain for printing on cotton, &c. To the tinting of maps and charts permanently, it is peculiarly suited.

81. MARS RED

Or *Rouge de Mars*, is an artificial iron ochre, similar in subdued tint and permanence to the native earths. Its chemical affinities, however, are greater than those of the latter, and it therefore requires to be employed cautiously with pigments affected by iron. In this respect the red resembles its compeers, Mars yellow, Mars orange, Mars violet, and Mars brown, all of which [146] are iron ochres artificially prepared. Possessing the richness and depth of Indian red, it is distinguished by the russet-orange hue of light red. Its pale washes are marked by considerable clearness. In keeping the Mars colours separate from the ochres, we have followed the plan of the author.

OCHRES

Comprise *Red Ochre*, *Indian Red*, *Light Red*, *Venetian Red*, *English Red*, *Persian Red*, *Prussian Red*, *Spanish Red*, *Brown Red*, *Indian Ochre*, *Scarlet Ochre*, *Carnagione*, *Terra Puzzoli*, *English Vermilion*, *Spanish Brown*, *Majolica*, *Redding*, *Ruddle*, *Bole*, *Almagra*, *Sil Atticum*, *Terra Sinopica*, &c. They are rather hues and tints than definite colours, or more properly belong to the tertiary, semi-neutral, and broken colours. As a rule they are native pigments, found in most countries, and very abundantly and fine in our own; but some are products of manufacture, and obtainable in the variety of nature by art.

The colouring matter of these earths is the red oxide of iron, as that of the yellow ochres is the yellow oxide. All the yellow ochres are more or less reddened by being burnt, as yellow oxide of iron itself becomes red on calcination. It was observed in the fourth chapter that time has often the effect of fire, more or less intense; and hence it is that yellow ochres occasionally [147] assume a buffish-red hue, by the gradual peroxidation of the iron. Similarly, if a yellow ochre be but partially calcined, the red so obtained is apt to deepen or darken. Especially do these changes take place when the iron oxides are not associated with an earthy base; when, in fact, the so-called ochres cannot be classed as such. In this case, too, as was lately remarked, the pigments are more chemically active, and more likely to affect those colours to which iron is inimical.

82. RED OCHRE

Is a native earth; sometimes brown ochre burnt, and called *Brown Red*. It is less pure in hue and clear in its tints than light red, and is best reserved for dark and vigorous shades and touches. For draperies of a dusky red it is well suited, or even for the shadows of bright-red drapery. In dead colouring it is very valuable. Like all ochres, it is characterized by permanence in water, oil, crayons, and fresco; and is, like most of them, available in enamel-painting.

Almagra, the Sil Atticum of the ancients, is a deep red ochre found in Andalusia; as is also their Terra Sinopica or Armenian Bole, dug originally in Cappadocia, and now found in New Jersey and elsewhere under the name of Bloodstone.

83. INDIAN RED, [148]

Once known as *Persian Red*, is brought from Bengal. It is a natural earth rich in peroxide of iron, of a purple russet hue and good body, and valued when fine for the clearness and soft lakey tone of its tints. In a crude state it is a coarse powder, full of extremely hard and brilliant particles of a dark appearance and sometimes magnetic. It is greatly improved by grinding and washing over, and is very permanent. Neither light, impure air, mixture with other colours, time, nor fire, effects any sensible change in it; but being opaque and not keeping its place well, it is unsuited for glazing. This pigment differs considerably in its hues, that which is most rosy being esteemed the best, and affording the purest tints. Inferior ochres were formerly substituted for Indian red, which procured it a variable character; but the colour being now obtained abundantly can in general be had genuine. It is a good drier.

Mixed with Indian ink, it furnishes useful shadows; and compounded with cobalt or indigo, most serviceable grays. For sunsets, where deep purple lines are louring over the horizon's brink, a mixture of French blue with a little Indian red and lake is admirably adapted. In twilight and stormy clouds, in sails and buildings, in shade carnations of portraits and backgrounds, &c., the red is often employed.

84. LIGHT RED [149]

Is an ochre of an orange-russet hue, chiefly valued for its tints. The principal yellow ochres afford this colour best, and the brighter and clearer the yellow ochre is from which it is prepared, the brighter will the red be, and the better flesh tints will it yield with white. Light red has the good properties common to ochres, dries capitally, and furnishes an excellent crayon. It is much used both in figure and landscape painting, giving fine grays with cobalt, and serviceable compounds with yellow ochre, indigo, lamp black, rose madder, Payne's grey, brown madder, &c.

Terra Puzzoli, a volcanic production, is a species of light red, as is the Carnagione of the Italians.

85. VENETIAN RED,

Less known as *English Red*, *Prussian Red*, and *Scarlet Ochre*. True Venetian red, that is, the red of the Venetians, was probably brought from India, and similar to our modern Indian red. The Venetian red of the present day, however, is an artificial product, containing no earthy base, and therefore improperly classed among the ochres. It is prepared by calcining sulphate of iron, to which a little nitre may be advantageously added. The result is a peroxide of iron, resembling light red, but more powerful, and of a more scarlet hue. It is very permanent, but being a purely
iron pigment, should be cautiously employed with colours affected by that metal. Though not [150]
bright, its tints are clear, and it mixes and works kindly with cobalt or French blue, affording fine pearly grays. Heightened by madder lake, it furnishes a glowing red, very useful in some descriptions of skies; and saddened by black, it gives low toned reds of good quality for buildings. With white it produces carnation tints nearly approaching to nature, and much employed by Titian, Vandyke, and others. Compounded with aureolin, Venetian red yields a clear orange of considerable transparency.

Spanish Red is an ochre differing little from the above.

86. PURE SCARLET,

Or *Iodine Scarlet*, is an iodide of mercury, having the body and opacity of vermilion, and being as much inferior to it in permanence as it is superior in brilliancy. Of all artistic pigments, it is at once the most dazzling and the most fugitive, and should have no place on the palette. If used, it should be with an ivory knife, as iron and most metals change it to colours varying from yellow to black; hence it should never be compounded with metallic pigments. So sensitive, indeed, is it to the slightest touch of metal, that it has been known to turn to a dull brown merely by being
washed over with a colour which had been taken out of its saucer with a penknife. In the cake, it [151]
must be carefully kept wrapped up in paper, otherwise the presence of metal tubes or a knife in the colour-box may spoil it. By a foul atmosphere, the scarlet is soon utterly destroyed, and even

metallized. In contact with the air, it quickly fades away; and has been found to vanish completely, when exposed to light alone. Employed in water, a thick glaze of gum-arabic or gamboge adds to its stability. As a landscape pigment, the colour is out of the general scale of nature; but in flower-painting its charms are almost irresistible. Nothing certainly can approach it as a colour for scarlet geraniums, but its beauty is almost as fleeting as the flowers.

87. RED CHROME,

Also called *Scarlet Chrome*, is a bright chromate of lead of an orange-red colour, the red being predominant. Rank in tone, it is liable to the changes of the yellow chromes, though in a less degree. The recent introduction of cadmium red renders the use of this unnecessary.

88. RED LEAD,

Minium, or *Saturnine Red*, is an ancient pigment, by some old writers confounded with cinnabar, and termed Sinoper or Synoper. It is an oxide of uncertain composition, prepared by subjecting massicot to the heat of a furnace with an expanded surface and free accession of air. Of a scarlet colour and fine hue, it is warmer than common vermilion, whose body and opacity it possesses, [152] and with which it was once customary to mix it. Bright, but not so vivid as the iodide of mercury, it is more durable, although far less so than vermilion. When pure and alone, light does not affect its colour, which soon flies, however, on being mixed with white lead or any preparation of that metal. By impure air, red lead is blackened and ultimately metallized.

On account of its extreme fugacity when compounded with white lead, this red cannot be used in tints; but employed, unmixed with other pigments, in simple varnish or oil not rendered drying by any metallic oxide, it may stand a long time under favourable circumstances. It is an excellent dryer in oil, and has often been used as a siccative with other colours, but it cannot safely be so employed except with the ochres, earths, and blacks in general. Oils, varnishes, and, in some measure, strong mucilages, are preventive of chemical action in the compounding of colours, by intervening and clothing the particles of pigments; and hence heterogeneous and injudicious tints and mixtures have sometimes stood well, but are not to be relied upon in practice. Altogether, red lead is a dangerous pigment in any but skilled hands, and has naturally had a variable character for permanence. It is frequently adulterated with earthy substances, such as brickdust, red ochre, and colcotha.

VERMILIONS. [153]

Vermilion is so called from the Italian word *vermiglio* (little worm,) given to the kermes or "coccus ilicis," which was used as a scarlet dye before the introduction of cochineal. It is a sulphuret of mercury, which previous to levigation is called Cinnabar; and is found native in quicksilver mines, as well as produced artificially. This is an ancient pigment, the κιννάβαρι of the Greeks, and the *minium*—a term now confined to red lead—of older writers. Pliny states that it was so esteemed by the Romans, as to have its price fixed by express law of state. Among other places, the natural product is met with in California, Spain, and Peru; and in China there is a native cinnabar so pure as only to require grinding to become very perfect vermilion. Whether the natural possesses any advantages over the artificial, appears to admit of doubt: Bouvier thought that the former blackened more than the latter, and others coincide with him. As, however, native vermilion has become commercially obsolete, the question of their comparative permanence is of little importance. Theoretically, it is difficult to assign a reason why there should be any difference between the two.

Vermilion is capable of being made by both wet and dry processes, but the last are almost exclusively adopted on a scale, and are, we believe, preferable. Our opinion, expressed with some [154] diffidence, is, that pigments whose colour depends on the union of sulphur with a metal—such as vermilion and cadmium yellow—are more stable when the sulphur is forced to bite into the base. This can only be effected by a considerable degree of heat, far greater than can be obtained in any moist method. We hold that in pigments so produced, the sulphur is less liable to oxidation by air and light, and that therefore the colour better withstands exposure to those agents. Before now, vermilions have been taxed with fading in a strong light: supposing them genuine, it would be interesting to know by what mode they were manufactured.

There are two kinds of vermilion in common use, European and Chinese, of which the first inclines to orange and the second to purple. These include the several varieties known as —*Vermilion*, *Deep Vermilion*, *Pale Vermilion*, *Scarlet Vermilion*, *Chinese Vermilion*, *Carmine Vermilion*, *Extract of Vermilion*, *Orange Vermilion*, and *Field's Orange Vermilion*.

89. VERMILION,

Deep or pale, when well made and pure is of strict permanence, not sensibly affected by light, time, or foul air; and eligible either in water, oil, or fresco. For an enamel colour it is unsuited, being dissipated at a red heat, a test that detects the presence of any non-volatile adulterant. The [155] best vermilion is a powerful vivid colour, higher in tone than all reds, except the scarlet iodide of mercury. With this it should not be compounded, but with other pigments it may safely be used in admixture, as far as its own colour is concerned. Of great body, weight, and opacity, it is a somewhat slow drier; and does not retain that brilliancy when dry, which is peculiar to it while wet. A want of transparency, and not drying well, prevent its being so generally employed as would be desirable. Pictures should seem to be painted with colour, not with pigment, the material being lost amid the hues, tints, and shades; but with such compounds as vermilion, the art of concealing art becomes difficult indeed. The pigment is apt to predominate over the colour, and the painting to look mechanical rather than natural: particles are apparent where hues alone should be seen, and all sense of reality is destroyed. For these reasons, vermilion is a dangerous pigment in unskilled hands, needing an intimate acquaintance with its physical properties. The extreme weight or specific gravity of the red renders it liable to sink and separate when compounded with other colours; hence the heavier those mixed with it the better. Its almost equal opacity, too, and habit of washing up, militate against its use by young painters. With experience, however, and due care, this is a serviceable colour; yielding with white most delicate [156] flesh tints, and in minute proportion with cobalt or French blue and white, tender aërial grays.

Being cheaper than formerly, vermilion is not so much adulterated as it once was; although, even now, brickdust, orpiment, &c. sometimes sophisticate it. The knavish practices to which the pigment has been subjected, have acquired it an ill-fame both with authors and artists. Vermilion has been charged with fading in the light, and with being blackened by impure air; but it was the custom to crimson the colour by means of lake, or tone it to a scarlet hue by red lead. With pigments as with persons, evil communications corrupt good manners—a motto that might be written with advantage on every palette.

90. SCARLET VERMILION

Resembles the preceding in all respects, except in being more scarlet in its tint, and washing better; advantages which render it more useful when the tone is required to be very bright and pure. At one time, the Dutch alone in Europe possessed the secret of giving to vermilion a rich scarlet colour.

91. CHINESE VERMILION,

Or *Carmine Vermilion*, partakes of a crimson hue, and is adapted, mixed with white, for the rose [157] and lilac-tints of some complexions. Like other vermilions, however, the colour needs much nicety of management; and it must not be attempted to further enrich it by admixture of cochineal lakes. Those colours, as we have remarked, cannot safely be brought into contact with vermilion, either compounded or as a glaze. The reds of madder should be substituted for them.

92. EXTRACT OF VERMILION,

A somewhat curious name for a metallic colour, was a peculiar preparation of the author, possessing in its time certain advantages over other vermilions, and especially distinguished by a more scarlet hue. Now, however, extract of vermilion and scarlet vermilion are synonymous terms.

93. ORANGE VERMILION

Is rather more transparent than ordinary vermilion, with a clear but not bright orange hue. It also washes better, and is for landscape purposes more generally useful. Resembling red-lead in appearance, it is not subject to its changes, being perfectly durable in oil and water. A most powerful tinger of white, its tints are warmer than red-lead's, affording delicate carnations similar to those of Titian and Rubens. This pigment—or, preferably, the succeeding variety—may [158] be employed with excellent results in scumbling of flesh, for which Sir Joshua Reynolds improperly used the so-called red orpiment. It dries in simple linseed oil, but works with best effect in water with a considerable portion of gum. In speaking of sunset and sunrise clouds, Mr. Penley observes—"Orange vermilion if used so thin as to get rid of its opacity, is a fine tone; but it must be remembered that *transparency* is the character of the sunset or sunrise, and hence arises the difficulty of employing such opaque colour effectively." Before the introduction of cadmium red, this and the following pigment were the best and only unexceptionable orange-reds known. It is probable, however, that the new colour will in a great measure supersede these latter in cases where transparency is sought. Orange vermilion is often a mixture, in which case the yellow employed is apt to separate from the red and float on its surface.

94. FIELD'S ORANGE VERMILION

Is a superior preparation to the preceding, being brighter, purer, and clearer. It possesses also, less opacity, and is not a compound. Both pigments are rather reds with an orange cast than strictly orange colours, and are therefore inserted in this chapter.

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95 *Antimony Red,* [159]

Or Mineral Kermes. We have obtained this colour ranging from light orange to deep carmine, of different degrees of brightness and stability. Some of the tints stood well in a book, but faded on exposure to light and air; and some even vanished when secluded from those agents. It has more than once been recommended as a pigment, but our experience is against its adoption by artists. The colour is not affected by sulphuretted hydrogen.

96. *Chica Red*

Is extracted from the leaves of a tree growing in central and southern America. A sample examined by Mr. O'Neill was in small irregular lumps, of a bright scarlet colour, adherent to the tongue like indigo, and taking a metallic polish of a greenish reflection, when rubbed against a hard smooth body, as the finger nail. So far it seems to be only employed by the Indians as a paint for their bodies, mixed up with fatty matters. It has doubtless been used in painting: for in the old churches of those parts of America there is a good deal of red colour, which remains brilliant and sound after a couple of centuries; and from the appearance of it, and such accounts as can be collected, it is probably this chica. A portion was forwarded to an eminent artist in [160] England, to ascertain whether it would be of any value as a pigment in the fine arts. His report is stated to have been unfavourable; and the chica, contained in a gourd labelled "Chica d'Andiguez," was then tested as to its capabilities for dyeing and printing. Fine and durable reds were found to be produced by it upon woollen, equal to those of cochineal. To mordanted calico the shades imparted were dull and heavy, but very solid. Chica is described as a very strong colouring matter, a small quantity dyeing a large amount of cloth, and as more nearly resembling lac lake than anything else.

No information existing as to its price, or the quantity that could be obtained if it were wanted, chica remains in the state of an unapplied product. If it really possess, however, the durability assigned to it, this red is worth attention. With regard to the artist's disapproval, the chica sent him may not have been properly or sufficiently prepared to adapt it for a pigment.

97. *Coal-Tar Colours.*

Our work might be considered incomplete without some allusion to the coal-tar colours, even though they are rather dyes than pigments, not possessing sufficient stability for the palette. To avoid repeated reference, we have preferred grouping them in this chapter, irrespective of hue. Consequently, yellow, red, blue, orange, green, purple, brown, and black, will be all comprised [161] under the heading of coal-tar colours.

Previous to the year 1856 the colouring matters derived from coal-tar were practically unknown. Until then, that black evil-smelling substance was looked upon as almost worthless; but gradually the unsightly grub emerged into a beautiful butterfly, clothed first in mauve and next in magenta. After its long winter of neglect, there sprung from coal-tar the most vivid and varied hues, like flowers from the earth at spring. At a touch of the fairy wand of science, the waste land became a garden of tropic tints, and colour succeeded colour, until the whole gamut had been gone through. Never was transformation more dazzling or more complete. The once despised refuse was now a valued commercial product—indeed a trade in itself. Perfectly fascinated by the study, chemists threw themselves heart and soul into coal-tar, and coal-tar colours were to be seen everywhere.

It were beside our purpose to enter into the various stages through which coal has to pass to become colour. Enough to state that to the introduction of gas-light we are indebted for the acquisition of coal-tar colours, the starting point for the production of mauve, magenta, &c., being the manufacture of coal-gas. From the destructive distillation of coal, coal-tar oil results; and from this are obtained the products which yield the colours in question. Among these [162] products may be mentioned aniline, rosaniline, napthaline, chinoline, carbolic acid, picric acid, &c., with their derivatives.

Of the fifty-one compounds furnished by the distillation of coal, perhaps the most popularly associated with coal-tar colours is aniline, to which we will therefore confine ourselves. Discovered in 1826, this body was formerly prepared from indigo—in Spanish, *anil*, whence the name; but is now produced on a larger scale from benzol, a coal-tar product. As the source of mauve and magenta, aniline must be considered the parent of coal-tar colours generally. Little was known of it at one time except that on being mixed with a solution of chloride of lime there was formed a splendid purple liquid, which immediately gave place to a dingy reddish precipitate. From the investigation of this simple fact, however, by Mr. W. Perkin, there was created a new and important branch of chemical industry—the manufacture of coal-tar colours. The violet mauve led the way, followed by the red magenta, the blue azuline, the yellow phosphine, the green emeraldine, the orange aurine, by purple, and brown, and black. Such were the hues, with many intermediate tints and shades, which one reaction brought forth. The world rubbed its eyes with astonishment; and truly it seemed almost as wonderful to produce the [163]
colours of the rainbow from a lump of coal, as to extract sunshine from cucumbers.

The history of these colours reads more like a romance than a sober story, but to the artist it is of slight practical interest. Sufficiently stable as dyes, though they be, coal-tar colours are not adapted to the palette. Mauve, magenta, with a few others, hare been introduced as pigments and fairly tried, but a want of permanence has been fatal to their success. Mauve is more durable than magenta, and the rest vary in stability, but none of them have proved really fitted for artists' colours. Exposed to light and air, they all more or less fade, especially in thin washes; and they have mostly the objection of staining and permeating the paper or canvas on which they are employed. Used in body, some may be found eligible in portfolio illuminations and the like, where the brilliancy of their colours shows to advantage; but in landscapes and pictures of life, coal-tar pigments are best avoided.

Cakes of red, blue, violet, and other hues, may be prepared for painting, by combining the colours with a mixture of starch and alumina, or with soap and alumina in a moist state—thus: 150 parts of white curd soap, dissolved in 1000 parts of hot water, are mixed with an alcoholic or a methylated spirit solution of six parts of the crystallized or solid coal-tar colour. To this are [164]
added 250 parts by weight of washed gelatinous alumina. The whole is then well stirred, collected on a filter, drained, and dried. Several hues, tints, and shades may be obtained by compounding: for instance, an orange is produced on admixture of picric yellow with aniline red, or a green by adding the same yellow to aniline blue.

98. *Cobalt Reds.*

There are obtainable from cobalt by different processes rose and red colours of more or less beauty and intensity, but all vastly inferior to those of madder, in whose absence alone they could gain a place on the palette. Durable as a rule, they are in general characterized by a fatal chalkiness, and poorness of hue. More expensive than the madder colours, and without their purity, delicacy, depth, or transparency, cobalt reds have often been offered as pigments, and as often declined. A colour may be good in itself, but if there is something better and at the same time cheaper, its introduction into commerce is out of the question.

99. *Copper Reds.*

A somewhat finely coloured red oxide is produced by exposing to a white heat for twenty minutes, a mixture of certain proportions of blue vitriol, mono-carbonate of soda, and copper [165]
filings. The product, however, is affected by impure air, and is otherwise not so desirable as an iron oxide.

An interesting account has lately been given by Professor Church of a new animal pigment, containing copper, found in the feathers of the violet plantain-eater and two species of Turacus, natives respectively of the Gold Coast, the Cape, and Natal. *Turacine*, the name proposed for it, is noticed here only because it is the first animal or vegetable pigment, with copper as an essential element, which has been hitherto isolated. The colour is extracted by solution in an alkali, and precipitation by an acid, and is changed on long exposure to air and moisture to a green hue. As the entire plumage of a bird yields not more than three grains of pigment, turacine must be looked upon as a mere curiosity.

100. *Ferrate of Baryta,*

Produced by adding aqueous ferrate of potash to an excess of dilute solutions of baryta salts, has been described as carmine-coloured and permanent. We have not found it to be so—an experience which has evidently not been confined to ourselves; and we cannot help thinking that this is one of those errors which get copied from one chemical work into another, to the special confusion of students. It is but fair, however, to add that in Mr. Watts' Dictionary of Chemistry, [166]
the latest and best work of the kind, this ferrate is said to become "brick-red after washing and

drying at 100100° C.," and to be only "tolerably stable."

101. *Gold Reds.*

Many organic substances added to gold solutions throw down either the metallic gold or the red oxide, which then unites with the organic compound more or less decomposed and forms a red precipitate. Sugar, gum, the decoctions of cochineal, gamboge, fustic, turmeric, sumach, catechu, and Brazil wood, all afford red pulverulent colours. Boiled with sugar, gold solution gives first a light and then a dark red. Whatever their merits, the excessive costliness of these preparations renders them inadmissible as pigments. At one time, indeed, a gold compound known as purple of Cassius was so employed, but this soon became obsolete on the introduction of madder purple.

102. *Iodine Pink.*

There may be obtained from iodine and mercury a very pretty pink colour, analogous in composition to pure scarlet. It is apt to pass into the scarlet modification, and is in other respects even less to be depended on than that variety.

103. *Kermes Lake* [167]

Is an ancient pigment, perhaps the earliest of the European lakes, and so called from the Arabic Alkermes. It is sometimes spelt *cermes*, whence probably cermosin and crimson, and kermine and carmine. In old books it is named vermilion, in allusion to the insect, or *vermes*, from which it is prepared. This insect is the "coccus ilicis," which feeds upon the leaves of the prickly oak in the south of Europe. Like the "coccus cacti," it is covered with a whitish dust, and yields a tinctorial matter soluble in water and alcohol. Kermes and the lac of India doubtless afforded the lakes of the Venetians, and appear to have been used by the earliest painters in oil of the school of Van Eyck. The former, under the appellation κύρνο κόκινο, is said to be employed by the modern Greeks for dyeing their caps red.

Some old specimens of this pigment which the author obtained were in drops of a powdery texture and crimson colour, warmer than cochineal lakes, and having less body and brilliancy. They worked well, however, and withstood the action of light better than the latter, though the sun ultimately discoloured and destroyed them. In other respects, they resembled the lakes of
cochineal. As a colouring matter, kermes is only about one-twelfth part as powerful as that [168]
substance.

104. *Lawson's Red.*

In 1861 it was stated that Professor Lawson had prepared a new dye of great richness, in the laboratory of Queen's College, Canada, from an insect, a species of coccus, found the previous summer for the first time on a tree of the common black spruce (*Abies nigra*), in the neighbourhood of Kingston. Having been but recently observed, a sufficient quantity had not been obtained for a complete series of experiments as to its nature and uses; but the habits of the insect, as well as the properties of the dye, seemed to indicate that it might become of practical importance. In colour it closely resembled ordinary cochineal, but was rather more scarlet in hue. It was described as capable of being produced in temperate countries. The colouring matter had not then been thrown upon a base, nor do we know that it has since been introduced as a pigment. If it possessed greater stability than cochineal, with equal brilliancy and depth, this dye might form one of those colours of the future, to whose possible sources we would direct attention.

105. *Manganese Red.*

Bisulphide of arsenic combines with basic metallic sulphides forming a class of sulphur-salts, [169]
called by Berzelius, hyposulpharsenites. The hyposulpharsenite of manganese is a dark red precipitate, uninjured by sulphuretted hydrogen, and so far applicable as a pigment. Containing arsenic, it would of course be poisonous; and would probably be found to fade on exposure to air and light.

106. *Murexide.*

The red obtained from this substance created a great deal of interest among printers and dyers on its introduction in 1857, or thereabouts. For purity and brilliancy of shade it was not excelled by any other colour, but not being able to stand the effects of air and light, its employment was limited. We are not aware that murexide has yet been brought forward as a pigment, and judging from its character as a dye, it would scarcely enrich the palette. Dyes and pigments have much in common, and a fugitive dye cannot be expected to furnish a permanent pigment.

Murexide is produced by the action of ammonia on alloxan, which is itself derived from the uric acid of guano by treatment with nitric acid, and was known nearly forty years back to stain the fingers and nails red. The first murexide sent into the market was a reddish-purple powder, dissolving in water with a fine purple tint, leaving a little residue undissolved. Owing to [170] improvements in manufacture, it is now capable of being prepared almost chemically pure, and with that green metallic reflection peculiar to several coal-tar salts and the wings of certain insects. When sulphuretted hydrogen is passed through a concentrated solution of murexide, it is immediately decoloured; a fact which renders it likely that murexide pigments would be as liable to suffer from an impure atmosphere, as from exposure to light and air.

When an alkaline solution of murexide is precipitated by an acid, a light shining powder results, called purpuric acid. This dissolves in alkalies, and combines with metalline bases to form various coloured compounds, termed *Purpurates*. Among them may be mentioned a red purpurate of lead, a purple-red and a rose-coloured purpurate of mercury, a purple-red purpurate of silver, a dark red-brown purpurate of strontia, a crystalline red purpurate of cobalt, a scarlet purpurate of platinum, a yellow purpurate of zinc, and a green purpurate of baryta. All of these, however, being more or less soluble in water, and owing their colours to murexide, would be ill adapted for pigments.

107. *Paille de Mil,*

Or African Cochineal, is a substance obtained from Africa. Whether it has received its name of [171] cochineal from its appearance or origin is not clear, but it behaves more like galls and sumac than cochineal, though it does give a kind of red with alumina mordants. The colours it yields are deficient in brightness, and it has otherwise been reported unfavourably of.

108. *Peganum Harmala,*

The seeds of which afford a red colour, has been investigated by the French, but described as inferior to existing reds both in brilliancy and stability.

109. *Persulphomolybdates.*

The metallic compounds formed by the combination of persulphomolybdic acid with a base are pulverulent, in many cases of a red colour, and for the most part insoluble in water. With barium, the acid furnishes a yellowish-red powder, insoluble in, but made denser by water, which imparts to it a cinnabar colour. With calcium it is said to yield a scarlet, sparingly soluble in water. With chromium, uranium, lead, platinum, and copper, it gives a dark red; that from the last metal turning brown when collected on a filter. It likewise produces reds with zinc, cadmium, iron, mercury, and tin; of which the last is slightly soluble in water.

Molybdenum being a rare metal, and persulphomolybdate of potash, the salt used in the foregoing reactions, difficult to prepare, it is unlikely that the colours named will rank among the [172] pigments of this generation. Nevertheless, as we have observed before, such fancy products should not be altogether ignored, it being quite as well to have some knowledge of our resources, even though those resources be not at present available. All the rare metals afford coloured compounds: tantalum, niobium, pelopium, vanadium, tellurium, titanium, yttrium, lanthanum, didymium, glucinum, cerium, thorinum, zirconium, palladium, rhodium, iridium, ruthenium, osmium, indium, thallium, &c.; and it is just possible that some of these may one day scrape acquaintance with the palette.

110. *Red Chalk,*

The colouring matter of which is sesquioxide of iron, is used as a crayon. Some specimens are excessively hard, so much so that they are difficult to crush, even in an iron mortar; while others have the consistence of the softest iron-ochres. They vary too in tint from a fawn colour to the softest brick-red, occasionally being almost as bright as a mixture of equal weights of vermilion and Venetian red. The amount of iron oxide present has been found to range from four to thirty-seven per cent, according to the depth and hardness of the samples. When a specimen of red chalk tolerably rich, but not too rich, in iron oxide is finely powdered and strongly ignited, it [173] offers a remarkable change of colour, becoming a dull sage-green. Perhaps this, if it were permanent, might prove useful in foliage tints.

111. *Red Precipitate,*

Or mercuric oxide, may be obtained either of a brick-red or orange-yellow colour. It is destroyed by impure air, and on exposure to sunshine gradually turns black, being superficially decomposed into oxygen and metallic mercury or mercurous oxide.

112. *Rose Pink*

Is a coarse kind of lake, produced by dyeing chalk or whitening with decoction of Brazil wood, peachwood, sapan, bar, camwood, &c. It is a pigment much used by paper-stainers, and in the commonest distemper painting, &c., but is too perishable to merit the attention of the artist.

Chevreul obtained a crystalline substance from Brazil wood, which he looked upon as the pure colouring matter, or as containing the pure colouring matter, and which gave red and crimson precipitates with many salts. Possibly some of these might prove more durable than the roughly made rose pink.

113. *Rouge,*

The rouge végétale of the French, is a species of carmine, prepared from safflower or [174] carthamus, which is the flower of a plant growing in the north of Africa, India, and other warm climates. Safflower yields two colours—a valueless yellow which dissolves in cold water, and about five per cent of red, insoluble in water but dissolved by alkalies. The red, or carthamin, furnishes a pigment of exquisite beauty, marked by richness, transparency, and free working. Its extreme fugacity, however, militates against its employment by artists. As a dye, its manner of fixing upon fibre is different from that of any other colouring matter; requiring no mordant, like madder or cochineal, and needing no solution, like indigo or anotta, but fixing at once as soon as the cloth is brought into contact with it. But even for a dye the colour is fugitive, fading after a few hours' exposure to sunshine, and sometimes being quite bleached in the course of a day. It is when combined with levigated talc to form the paint of the toilette that the red becomes most serviceable. Possessing a peculiar softness and velvety glow, rouge is an unrivalled—and a most harmless—aid to beauty.

Chinese Rouge and *Pink Saucers* have much of the qualities of, and appear to be also prepared from, the safflower.

114. *Rufigallic Red.*

When a duly proportioned mixture of gallic acid and oil of vitriol is carefully and gradually [175] heated to 140°, a viscid wine-red liquid results. If this be poured into cold water, after cooling, a heavy brown-red granular precipitate is formed, soluble in 3333 parts of boiling water. It dissolves in potash-ley, and to fabrics impregnated with alum or iron mordants, imparts the same shades of colour as madder; the colours so produced withstanding soap but not chlorine.

Whether brilliant lakes could be obtained from the potash solution of the red, and whether those reds would be stable, it might be worth while to ascertain.

115. *Sandal Red.*

We have kept this separate from other reds derived from woods, because it is said (by Professor H. Dussance) to be obtainable not only equal in beauty and brightness to carmine, but of greater permanence. The process of preparation is as follows:—The powdered root exhausted by alcohol gives a solution to which hydrated oxide of lead is added in excess. The combination of colouring matter and lead oxide is then collected on a filter, washed with alcohol, dried, dissolved in acetic acid, and mixed with a quantity of water. The red being insoluble therein is precipitated, while the acetate of lead remains dissolved. After being washed, the colour is dried at a low temperature. The Professor affirms that the red so produced is unaffected by sulphuretted [176] hydrogen, or by light and air; and it is stated that the colour which was used to paint the carriages of the Emperor Napoleon, remained as bright at the end of nine years as when it was put on. Possessing such properties, it is curious that the red has never been—in this country at least—introduced as an artistic pigment, the more especially as seventeen years have elapsed since its discovery.

116. *Silver Red.*

By adding monochromate of potash to an acid solution of nitrate of silver, a particularly fine ochre-red is obtained. It is, however, apt to be injured both by foul air and exposure.

117. *Sorgho Red.*

Some nine years back there was found to be a carmine colouring matter in most parts of the Chinese sorgho, chiefly in the unpressed stem. The red, which is extracted in an impure state, is dissolved in weak potash-ley, thrown down by sulphuric acid, and washed with water. This purified product, soluble in alcohol, caustic alkalies, and dilute acids, has been employed in Austria, Baden, &c., for the dyeing of silks and woollens with the common tin mordants. The colours produced from it are unchanged, they say, by warm soapsuds or light. We do not know [177] whether the red found its way to England, but it has certainly not appeared here as a pigment.

118. *Thallium Red.*

The orange-yellow precipitate formed by mixing a neutral salt of protoxide of thallium with bichromate of potash, is converted by nitric acid into an orange-red. The latter compound, which is a terchromate, is almost insoluble in cold water, 2814 parts being required to dissolve it. If the colour be boiled in a large excess of moderately strong nitric acid it is dissolved, yielding magnificent cinnabar red crystals on the solution cooling. These crystals likewise seem to be the terchromate.

119. *Tin Pink.*

By igniting strongly for some hours a mixture of stannic oxide, chalk, chromate of potash, and a little silica and alumina, a dingy red mass is obtained, which acquires a beautiful rose-red colour on being washed with water containing hydrochloric acid. For the same reason that the pinks of cobalt are superfluous as artistic pigments, this tin product is commercially ineligible. Having, however, the advantage of being cheap, and being probably durable, it would be well adapted for the common purposes of painting, in place of the fugitive rose pink.

120. *Ultramarine Red?* [178]

In Gmelin's Handbook of Chemistry it is remarked that "Hydrogen gas passed over ignited ultramarine, colours it light red, from formation of liver of sulphur, hydrosulphuric acid gas and water being evolved at the same time." On most carefully making the experiment with a sample of native blue (the variety referred to) we did not succeed in effecting this change: no alteration to red or even to purple took place, the only result being that the colour was entirely spoilt, having assumed a leaden slate-gray hue. At our request, the trial was kindly repeated by well-known chemists, who took every precaution to ensure success. Several specimens of ultramarine were acted upon, but in no case was a red or anything like a red obtained, the products ranging from a slate-gray to a drab-grey. Sufficient hydrosulphuric acid gas was evolved to blacken paper moistened with acetate of lead, a fact which proved that the blue had lost some of its sulphur. Seeing that not only no red was produced, but that no tendency to red was imparted, is it possible the change described by Gmelin occurred under exceptional circumstances? All conversant with chemical matters will admit that results are obtained occasionally which cannot be repeated, owing it may be to some slight difference in the materials employed, or some slight variation of the process. Perhaps a link, considered of no importance at the time and overlooked, [179] has been lost, and thus the whole chain of proceeding becomes useless. It is, therefore, within the bounds of probability that the red ultramarine of the great German chemist was furnished either by a peculiar specimen of blue, or by a modified form of the method he gives. We have noticed the subject at some length because if a red ultramarine, brilliant and durable, could be obtained, the colour might prove of value. A permanent artificial compound corresponding to French blue would certainly be an acquisition.

121. *Uranium Red.*

By treating the yellow sulphite of uranium with a prolonged current of sulphuretted hydrogen, and saturating gradually with ammonia, a red finally results. This colour is insoluble in water, and it has the objection of remaining partially suspended for an almost indefinite time, colouring the liquid light red. The product is brighter and more beautiful while moist; when dried and powdered, its tone—slightly approaching vermilion—is duller. The colour may be obtained of several degrees of brilliancy, but, apart from the question of expense, it would be inadmissible in oil, the red gradually altering by contact therewith. The most persistent tint at length resembles burnt Sienna.

122. *Wongshy Red.* [180]

There was imported a few years ago from Batavia a new colouring principle, under the name of *wongshy*, and consisting of the seed-capsule of a species of gentian. The aqueous extract, freed from the pectin which it contains, yields with baryta- and lime-water yellow precipitates, from which acids separate the colouring matter of a vermilion hue. When thus prepared it is insoluble in water, and would so far be adapted for a pigment. The red has not, however, been employed as such, and we are unacquainted with its habitudes.

The concluding remarks appended to the chapter on yellow apply equally to red, and indeed to all other colours. It is not assumed that the list is exhausted: there are other reds, but they are, like some we have mentioned, ineligible as pigments, either by reason of their fugacity, their costliness, the difficulty of producing them on a scale, or the sources whence they are derived being commercially unavailable. While endeavouring throughout the work to render complete the collection of pigments actually in use, it is our object to give a selection only of numbered italicised colours; ample enough, however, to include those which have become obsolete or [181] nearly so, and full enough to afford some insight into our resources. The nearer we approach perfection, the more eager we are to arrive at it: the path before us, therefore, cannot fail to be of interest.

Looking back, and noting those pigments commonly employed, we find that the reds like the yellows are divisible into three classes—the good, bad, and indifferent; or the permanent, the semi-stable, and the fugitive.

Among permanent reds, rank cadmium red, madder reds, Mars red, the ochres, and vermilions.

In the second or semi-stable class, must be placed cochineal lakes, Indian lake, and red chrome.

To the third division, or the fugitive, belong dragon's blood, pure scarlet, red lead, and the coal-tar reds.

With regard to the foregoing classification, it must be borne in mind that the properties and effects of pigments are much influenced by adventitious circumstances. Sometimes pigments are varied or altogether changed by the grounds on which they are employed, the vehicles in which they are used, the siccatives and colours with which they are mixed, and the varnishes by which they are covered. And as there is no exact and constant agreement in different specimens of like pigments, so there is no exact and constant result in their use. Artists vary as much as the [182] pigments they employ: some resemble the old masters in the delicacy with which they treat their colours, the cleanliness with which they surround them, and the care with which they compound them: in the hands of such artists pigments have every chance. Some, however, are characterized by a careless manipulation, a dirty mode of working, an utter disregard for all rules of admixture: with such painters the best colours may be ruined. And here, indeed, it may be asked, whether these latter are not more properly termed painters than artists, chiefly belonging as they do to that slap-dash school which manufactures pictures simply to sell them. Duly subordinated, the commercial side of art has a value which it were affectation to ignore; but to paint merely for the present, heedless of the future, is to sink art to the level of a trade, not the most honest. For it is the purchaser who suffers from the want of thought bestowed on the materials, the sloppy manipulation, the careless compounding; sins of omission and commission that cause him, on finding his picture becoming chaos, to join the detractors of modern pigments. In classifying colours therefore, those also should be classified who use them:—into artists, whose love for art would render it more lasting than themselves; and into painters, whose motto is *Vita brevis est, Ars quoque*.

CHAPTER X. [183]

ON THE PRIMARY, BLUE.

THE third and last of the primary or simple colours is *blue*, which bears the same relation to shade as yellow to light. Hence it is the most retiring and diffusive of all colours, except purple and black; and all colours have the power of throwing it back in painting, to a greater or less extent, in proportion to the intimacy of their relations to light—first white, then yellow, orange, red, &c.

Blue alone possesses entirely the quality technically called 'coldness' in colouring, and it communicates this property variously to all other colours with which it happens to be compounded. Most powerful in a strong light, it seems to become neutral and pale in a declining light, owing to its ruling affinity with black or shade, and its power of absorbing light. Consequently, the eye of the artist is liable to be deceived when painting with blue in too low a light, or toward the close of day, to the endangering of the warmth and harmony of his picture. [184] Entering into combination with yellow in the composition of all *greens*, and with red in all *purples*, blue characterizes the tertiary *olive*, and is also the prime colour or archeus of the neutral *black*, &c., as well as of the semi-neutral *gray*, &c.: it therefore is changed in hue less than any other colour by mixture with black, as it is likewise by distance. Blue is present subordinately in all tertiary and broken colours, and being nearest in the scale to black, breaks and contrasts powerfully and agreeably with white, as in pale blues, skies, &c. Being less active than the other primaries in reflecting light, it is sooner lost as a local colour by assimilation with distance. There is an ancient doctrine that the azure of the sky is a compound of light and darkness, and some have argued hence that blue is not a primary colour, but a mixture of black and white; but pure or *neutral* black and white compound in infinite shades, all of which are neutral also, or *grey*. It is true that a mixture of black and white is of a *cool* hue, because black is not a primary colour, but a compound of the three primary colours in which blue predominates, a predominance which is rendered more sensible when black is diluted with white. As to the colour of the sky, in which light and shade are combined, that is likewise neutral, and never blue except by contrast; thus, the more the light of the sun partakes of a golden or orange hue, and the more [185] parched and burnt the earth is, the bluer appears the sky, as in Italy and all hot countries. In England, where the sun is cooler, and a perpetual verdure reigns, infusing blue latently into the landscape, the sky is warmer and nearer to neutrality, partaking of a diversity of greys, which beautifully melodize with blue as their key, and harmonize with the light and landscape. Therefore the colour of the sky is always a contrast to the direct and reflected light of the scene: if this light were of a rose colour, the neutral of the sky would be converted into green, or if purple, the sky would become yellow. Similarly would it be in all cases, according to the laws of chromatic equivalence and contrast, as may be often seen in the openings of coloured clouds at the rising and setting of the sun.

In art, blue is apt to be discordant in juxtaposition with green, and less so with purple, both which are cool colours; consequently blue requires its contrast, *orange*, in equal proportion whether of surface or intensity, to compensate or resolve its dissonances and correct its coldness. In nature, however, blue is not discordant with either green or purple, nor are any two colours (as we have said before) ever found so. On the palette of nature each *colour* is an example of *colouring*: no colour is too absolute or defined, no perfectly pure blue appears beside a perfectly [186] pure green. A blue flower nestled in its green leaves does not offend the nicest eye, but the blue and green are not blue and green alone. There is, perhaps, but a single gleam of pure colour in each: the rest is composed of such varied hues and tints and shades, so broken and blended and beautifully harmonized, that no jarring discord is possible. Hue melts into hue, tint into tint, shade into shade; and thus does the simplest weed teach a lesson in colouring the proudest painter may stoop to learn.

We have spoken of blue, which is termed a cold colour, as retiring; and of yellow and red, which are called warm colours, as advancing. By this we must not be understood to mean that blue, as blue, expresses distance; or that yellow and red, as yellow and red, express nearness. Colours are advancing or retiring in their *quality*—as depth, delicacy, &c., not in their hue. A blue object set side-by-side a yellow one will not look an inch farther off, but a red or orange cloud, in the upper sky, will always seem to be beyond a blue cloud close to us, as it is in reality. We grant that in certain objects, blue is a *sign* of distance, but that is not because blue, as a mere colour, is retiring; but because the mist in the air is blue, and therefore any warm colour which has not strength of light enough to pierce the mist is lost or subdued in its blue. Blue in itself, however, is [187] no more, on this account, retiring, than brown is retiring, because when stones are seen through brown water, the deeper they lie, the browner they appear. Neither blue nor yellow nor red possesses, as such, the smallest power of expressing either nearness or distance; they merely express themselves under the peculiar circumstances which render them at the moment, or in that place, signs of nearness or distance. Thus, purple in a violet is a sign of nearness, because the closer it is looked at the more purple is seen; but purple in a mountain is a sign of distance, because a mountain close at hand is not purple, but green or grey. It may, indeed, be generally assumed that a tender or pale colour will more or less denote distance, and a powerful or dark colour nearness; but even this is not always so. Heathery hills will usually give a pale and tender purple near, and an intense or dark purple far away: the rose colour of sunset on snow is pale on the snow at one's feet, but deep and full on the snow in the distance; and the green of a Swiss lake is pale in the clear waves on the beach, but intense as an emerald in the sunstreak, six miles from shore. And in any case, when the foreground is in strong light, with much water about it or white surface, casting intense reflections, all its colours may be perfectly delicate, pale, and faint; while the distance, when it is in shadow, may relieve the whole foreground with deepest shades of purple, blue green, or ultramarine blue. [188]

There is one law, however, about distance, which has some claims to be considered constant, namely, that dulness and heaviness of colour are more or less indicative of nearness. All distant colour is pure colour: it may not be bright, but it is clear and lovely, not opaque nor soiled; for the air and light coming between us and any earthy or imperfect colour, purify or harmonize it; hence a bad colourist is peculiarly incapable of expressing distance. It is not of course meant that bad colours are to be used in the foreground by way of making it come forward; but only that a failure in colour there will not put it out of its place. A failure in colour in the distance will at once do away with its remoteness; a dull-coloured foreground will still be a foreground, though coloured badly; but an ill-painted distance will not be merely a dull distance, it will be no distance at all.

This seeming digression is not out of place, as it will enable the artist better to understand that it is in their quality, not in their hue, that colours are advancing or retiring; and that he must rely on the depth, delicacy, &c., of his pigments, and not simply on their colours, to produce effects of distance.

Of all colours, except black, blue contrasts white most powerfully. In all harmonious combinations of colours, whether of mixture or neighbourhood, blue is the natural, prime, or [189] predominating power. Accordingly, blue is universally agreeable to the eye in due relation to the composition, and may more frequently be repeated therein, pure or unbroken, than either of the other primaries; whence the employment of ultramarine by some masters throughout the colouring of a picture.

Blue pigments, like blue flowers, are more rare than those of the other primary colours. In permanent blues the palette is very deficient, the list being exhausted when the native and artificial ultramarines and the cobalts have been mentioned. That there is room for new blues, durable and distinct, cannot therefore be denied. A good addition has been made of late years in the German *Coëlin*, known here as Cerulian Blue and Cœruleum. What is chiefly wanted, however, is a colour combining the wonderful depth, richness, and transparency of Prussian blue with the strict stability of ultramarine. A permanent Prussian blue would be the most valued gift the palette could receive.

COBALT BLUES

comprise *Cerulian Blue* or *Cœruleum*, *Cobalt Blue*, *Smalt*, *Royal Blue*, *Dumont's Blue*, *Saxon Blue*, *Thénard's Blue*, *Leithner's Blue*, *Hungary Blue*, *Dutch Ultramarine*, *Zaffre or Enamel Blue*, [190] *Vienna Blue*, *Paris Blue*, *Azure*, &c., and are obtained by the action of heat on mixtures of earthy or metallic bases with cobalt. They are divisible into three classes—the stannic cerulian blue, the aluminous cobalt blues, and the siliceous smalts. Of these, the first possesses the least depth; the second hold a middle position; while the third are marked by exceeding richness. Although not to be ranked with ultramarine, the stannic and aluminous blues may be described as durable, or at least as durable rather than semi-stable. There are, as we have before observed, different degrees of permanence, and the blues in question are not readily affected. With regard to smalts, they are, as artist's pigments, inferior in stability to other blues of cobalt.

123. CERULIAN BLUE,

or *Cœruleum*. Under the name Coëlin there has of late years been imported from Germany the cobalt blue with a tin base to which reference has just been made. This comparatively new pigment—which likewise contains or is mixed with gypsum, silica, and sometimes magnesia—has the distinctive property of appearing a pure blue by artificial light, tending neither to green on the one hand nor to purple on the other. This advantage, added to its permanence, has conferred a popularity upon cœruleum which its mere colour would scarcely have gained for it. A light and [191] pleasing blue, with a greenish-grey cast by day, it possesses little depth or richness, and is far excelled in beauty by a good aluminous cobalt. A certain chalkiness, moreover, somewhat detracts from its transparency, and militates against its use in water. It is in oil, and as a night colour, that cœruleum becomes of service, as our present system of lighting picture galleries by gas affects the purity of blues generally. If those galleries were illuminated by means of the electric light, we have it on the authority of Chevreul that all colours and shades would show as well as by day: the same purpose would be answered by the magnesium light. Some artificial lights are the ruin of colours; in the soda flame (alcohol and salt) for instance, yellow chromate of lead appears white, while red ochre and aniline blue appear black.

Like other blues of cobalt, cœruleum assumes a greenish obscurity in time, but like them it resists for a lengthened period both the action of light and impure air, although chemically it is more open to the influence of the latter, owing to its tin base. In admixture it may safely be employed, as well as in fresco or enamel. For stage skies, &c., in high-art scenery, the blue is admirably adapted. Now that there are so many scene-painters who are artists—and so many artists who are scene-painters—in bringing Nature to the foot-lights the effect of gas on colours [192] is of importance.

124. COBALT BLUE,

to which the various appellations have been given of *Thénard's Blue*, *Vienna Blue*, *Paris Blue*, *Azure*, *Cobalt-Ultramarine*, &c., is the name now exclusively confined to that preparation of cobalt which has a base of alumina. It may, therefore, be not improperly called a blue lake, the colour of which is brought up by fire, in the manner of enamel blues. The discovery of this important pigment was made in 1802 by M. Thénard, who obtained it by calcining a well-combined mixture of alumina and crystals of cobalt. There may be employed with the aluminous base, either the arseniate, the borate, or the phosphate of cobalt; but the latter in preference, as it produces the purest colour. The arseniate has always a violet tinge, more visible by gas-light than by day; while, on account of the arsenic, the blue is more apt to be greened by impure air, by reason of the formation of yellow sulphide of arsenic. The purity of the colour, however, does not altogether depend on the compound of cobalt used; in a great measure—as with other pigments—it rests on the purity of the materials. To obtain a perfect blue, neither inclining to purple nor green, the cobalt and alumina should be freed from iron, and the former, as much as possible, from nickel also. With the absence of these and proper skill, a true and brilliant blue [193] may be produced, almost rivalling the finest ultramarine. Apart, too, from its increased beauty, a cobalt blue containing no iron or nickel is of greater permanence than the ordinary products, being less liable to that greenness and obscurity which time confers.

Though not possessing the body, transparency, and depth of ultramarine, nor its natural and modest hue, commercial cobalt blue works better in water than that pigment in general does; and is hence an acquisition to those who have not the management of the latter. Resisting the action of strong light and acids, its beauty declines by time, while impure air greens and ultimately blackens it. Nevertheless, these changes are not readily effected, especially in well made samples full of colour, and sometimes the green tone is mechanically imparted. What wheat is to a loaf, colour is to a pigment—it has to be ground and made up for use; in the one vehicle to be mixed with gums, in the other with oils. It often happens that colours have an antipathy to the latter, and refuse to compound kindly therewith. Occasionally this repugnance manifests itself in a few days, occasionally not for months. We know of a green which flatly declines to have anything to do with oils, sinking and separating therefrom in the course of a week, and leaving the clear oil [194] on the top. Repeatedly have colours to be coaxed to behave themselves as pigments, coaxed not to 'run,' to work well, to dry well, &c.; and in the humouring of their likes and dislikes the skill and patience of the artist-colourman are sometimes severely taxed. Given a colour, it might puzzle most chemists to convert it into a pigment; luckily Commerce lends her aid. Lasting success, it is true, does not always follow, and oils will rise to the surface now and then, giving green hues to blues, orange hues to reds, and buff hues to yellows. Hence changes of colour have been imputed before now to chemical alteration, when in reality the results have been physical, caused by the subsidence of the pigments, and the floating of the vehicles employed.

Cobalt blue dries well in oil, does not injure or suffer injury from pigments in general, and may be used with a proper flux in enamel, as well as in fresco. It affords clear bright tints in skies and distances, but is apt to cause opacity if brought too near the foreground, and to assume a violet tinge by artificial light. With madder brown it yields a range of fine pearly neutrals; and with light red, in any proportion, gives beautiful cloud tints. In combination with aureolin and sepia, or rose madder, cobalt furnishes most agreeable and delicate tints for distant trees, when under the influence of a soft light, or hazy state of the atmosphere. In water-colour painting, [195] cobalt is tolerably firm on paper, and consequently answers better for some purposes than French blue. In middle distances, if the cobalt possess a tendency to chalkiness, the addition of a little indigo is a good corrective, especially where the blue tone is required to be sombre and dark: it should, however, be observed that the change is but temporary, indigo being a fugitive pigment. In marine painting in water-colours, cobalt is most useful for the remotest parts of seas and headlands. When dry, it can be changed by going over it with a slight wash of vermilion or light red, whereby a prismatic character is realized. Any strength of tone can be obtained by repeating the washes, and should the colour be too powerful, it may be reduced by pouncing it with a soft wet sponge; or if too cold and blue, by a thin wash of burnt Sienna, merely the water stained.

The blues of cobalt, on whatever base they may be prepared, are distinguished from native and artificial ultramarines by not being decolorised by acids.

125. SMALT,

Invented about the year 1540, in Saxony, is a vitreous compound of cobalt and silica, in fact a blue glass. Since the fifteenth century, cobalt has been used in different parts of Europe to tinge [196] glass; and so intense is the colouring power of its oxide, that pure white glass is rendered sensibly blue by the addition of one thousandth part, while one twenty-thousandth part communicates a perceptible azure tint. In common with cobalt blue, the name *Azure* has sometimes been given to it. Varying exceedingly in quality and colour, the rougher kinds have been employed by the laundress, and in the making of porcelain, pottery, stained glass, encaustic tiles, &c.; as well as to cover the yellow tinge of paper. For this last purpose, however, smalt is not perfectly adapted, the colour being difficult to lay on uniformly, and the paper when written on blunting the nibs of pens. Hence it has been superseded to a great extent by artificial ultramarine, the presence of which may be detected by the yellow spot which a drop of acid leaves on the paper.

A coarse gritty texture is peculiar to smalt, whether it be the *Powder Blue* of the washtub and *Blue Sand* of the pottery, or the *Dumont's* and *Royal Blue* of the artist and high-class manufacturer. But the strict stability which is a feature in smalt when used for painting on glass and enamel does not follow it to the studio: both in water and oil its beauty soon decays, as is often the case with other vitrified pigments; nor is it in other respects eligible, being, notwithstanding its richness and depth, very inferior to the cobalts preceding. It may seem a [197]
paradox that the same colour should be at once so durable and so fugitive, but we may briefly explain it by saying *when vitreous pigments are reduced to that extreme state of division which the palette requires, they lose the properties they possess in a less finely divided state*. The best smalt in lumps appears black, yields a blue powder on grinding, becomes paler on further grinding, and may be almost decolourised by continued and excessive grinding. Smalt, it has been stated, is merely a blue glass; and when a piece of blue glass, or a blue crystal of sulphate of copper, is reduced to the fineness of flour, the blue is lost. In vitrified and crystallised compounds, colour depends on cohesion: sufficiently separate the particles, and the colour more or less disappears. Not only, moreover, does grinding effect an optical change in vitreous pigments, but it imposes further alteration. That colour which was safe when locked up in a mass, crushed to minute atoms is no longer so: imbedded in glass or enamel it will endure for ages, but ground to impalpable powder becomes as liable to influence as though it had never been subjected to heat at all. To sum up, vitreous pigments are durable in a coarse or compact form, but are not more stable than others when reduced to extreme division. As far as regards artists' colours, therefore, vitrification does *not* impart permanence. [198]

The grittiness to which we have referred is one of the defects of smalt, which cannot, consistently with preserving its colour be entirely freed from that drawback—an objection which pertains to vitreous pigments in general. Hence it does not wash well, and in mural decoration is sometimes applied to work by strewing the dry powdered colour upon a flat ground of white or blue oil paint immediately after the latter is laid on, whilst it yet remains wet. Of little body, it is a vivid and gorgeous blue; bright, deep, and transparent, bordering on the violet hue. It is chiefly employed in illumination and flower painting. The inferior kinds of smalt are occasionally adulterated with chalk.

126. CYANINE.

Beckmann is fully convinced that the *cyanus* of Theophrastus and the *cœruleum* of Pliny were a blue copper earth. However that may be, in these days both names signify cobalt compounds, cœruleum being a stannate of cobalt, and cyanine a mixture of cobalt and Prussian blue. Unlike the former, cyanine, being composed of two old colours, can lay no claim to originality. In the fourth chapter it was observed, "it is quite possible for the artist to multiply his pigments unnecessarily. Colours are sometimes brought out under new names which have no claim to be regarded as new colours, being, indeed, mere mixtures. Compound pigments like these may most [199]
frequently be dispensed with, in favour of hues and tints composed extemporaneously of original colours upon the palette." Whether these remarks are applicable to cyanine or not is a question for artists to decide: in our opinion, with so many semi-stable original pigments, the introduction of semi-stable compounds is to be deprecated. Cyanine is a rich, deep, transparent blue, but its richness and depth, as well as to a great extent its transparency, depend upon Prussian blue, which is not strictly stable. Hence the peculiar properties of cyanine remain unchanged only so long as the Prussian blue itself, the pigment losing its colour by degrees on exposure to air and light, and gradually assuming the tint of the paler but more permanent cobalt. A mixture, be it remembered, necessarily partakes of the qualities of its constituents, and if one of these be fugitive, the compound cannot preserve its original hue.

Within the last few years, a compound similar to cyanine has appeared, under the name of *Leitch's Blue*.

127. INDIGO,

or *Indian Blue*, was known to the ancients under the name of *Indicum*, whence its present [200]
appellation. In modern Europe, it first came into extensive use in Italy; but about the middle of the sixteenth century, the Dutch began to import and employ it in considerable quantity. Present in the woad plant, which is a native of Great Britain, indigo is chiefly derived from a genus of leguminous plants called *Indigofera*, found in India, Africa, and America. The colouring matter of these is wholly in the cellular tissue of the leaves, as a secretion or juice; not, however, in the blue state in which one is accustomed to see indigo, but as a colourless substance, which continues white only so long as the tissue of the leaf remains perfect: when this is by any means

destroyed, oxygen is absorbed from the atmosphere, and the principle becomes blue. The best indigo is so light as to swim upon water, but the commercial article seldom contains more than 5050 per cent. of blue colouring matter or true indigo, the remainder consisting of either accidental or intentional impurities.

In painting, indigo is not nearly so bright as Prussian blue, but it is extremely powerful and transparent, and may be described as a Prussian blue in mourning. Of great body, it glazes and works well both in water and oil. Its relative permanence as a dye has obtained it a false character of extreme durability as a pigment, a quality in which it is nevertheless very inferior [201]
even to Prussian blue. By impure air it is injured, and in glazing some specimens are firmer than others, but not durable; while in tint with white lead they are all fugitive. Employed in considerable body in shadow, it is more permanent, but in all respects Prussian blue is superior.

Despite this want of stability, indigo is a favourite colour with many artists, who sacrifice by its use future permanence to present effect. It is so serviceable a pigment for so many purposes, especially in admixture, that its sin of fugacity is overlooked. Hence we find indigo constantly mentioned in works on painting, their authors forgetting or not caring to remember that wholesome axiom, a fugitive colour is not rendered durable by being compounded. Artistically, it is adapted for moonlights, and when mixed with a little lamp black, is well suited for night clouds, distant cliffs, &c. With a little raw umber and madder it is used for water in night effects. With the addition of a little madder it forms a good gray; and with madder and burnt Sienna is useful for dark rocks, this combination, with raw Sienna, being also eligible for boats. For these and other mixed tints, however, Prussian blue saddened by black with a suspicion of green in it, is equally fitted, and is more permanent. Indeed, it would be perhaps justifiable to introduce such a [202]
compound, under the name say, of Factitious Indigo.

Indigo in dust, or in small bits, is often adulterated with sand, pulverized slate, and other earthy substances. That indigo is best which is lightest, brightest, most copper-coloured, most fine-grained, and inodorous.

128. INTENSE BLUE

is indigo refined by solution and precipitation. By this process, indigo becomes more durable, and, being separated from impurities, is rendered much more powerful, transparent, and deep. It washes and works admirably in water; in other respects it possesses the common properties of indigo. It is apt, however, to penetrate the paper on which it is employed, if not well freed by washing from the acid and saline matter used in its preparation. This is not always easily effected, and we cannot help thinking that in the manufacture of intense blue a dry method would be preferable. Indigo may, by cautious management, be volatilized, and therefore be most thoroughly purified without the aid of acids and alkalies. The best mode of subliming this substance is to mix one part of indigo with two parts of plaster of Paris, make the whole into a paste with water, spread it upon an iron plate, and, when quite dry, heat it by a spirit lamp. The [203]
volatilization of the indigo is aided by the vapour of water disengaged from the gypsum, and the surface of the mass becomes covered with beautiful crystals of pure indigo, which may be readily removed by a thin spatula. At a higher temperature, charring and decomposition take place.

129. PRUSSIAN BLUE,

otherwise called *Berlin Blue*, *Paris Blue*, *Prussiate of Iron*, *Ferrocyanide of Iron*, &c., was accidentally discovered in 1710 by Diesbach, a colour-maker at Berlin. It is a compound of iron and cyanogen, of varying composition, formed by adding yellow prussiate of potash to a persalt of iron, or by oxidizing the precipitate obtained from the prussiate and a protosalt. The finest blue is furnished by sesquinitrate of iron, but the salt almost exclusively employed is the protosulphate, the freedom of which from copper is essential to the colour of the blue. As is the case with other pigments, Prussian blue differs considerably in colour, in depth, and in permanence, according to the purity of the materials, the mode of manufacture, and the absence of adulterants. Like smalt, it is known in the washtub as well as in the studio; and in the cheaper varieties, alumina, starch, chalk, oxide of iron, &c., are often largely present. A good unsophisticated sample in the dry state [204]
is intense blue, almost black, hard and brittle, much resembling in appearance the best indigo, and having a similar copper-red fracture. It does not effervesce with acids, as when adulterated with chalk; nor become pasty with boiling water, as when sophisticated with starch. Further, it feels light in the hand, adheres to the tongue, is inodorous, tasteless, not poisonous, and is insoluble in water. Forming a bulky mass while moist, Prussian blue shrinks to a comparatively small compass when well washed and dried by gentle heat; and, when once dried, being difficult to reduce again to the state of extreme division which it possessed while wet, it is frequently sold and used in paste for common purposes. We have said that a good sample of Prussian blue is insoluble in water, and for artistic use it should certainly be so, as otherwise it has a tendency to stain the fabric on which it is employed, a defect formerly very prevalent. All Prussian blues, however, are not insoluble, and these are not only liable to the drawback named, but are less to be depended on for permanence. Improper proportions, for instance, of sesquichloride of iron and potash-ferrocyanide will yield a blue which, when washed even with cold water, continually

imparts to it a yellow or green colour, through the partial solution of the prussiate. All commercial Prussian blue, and indeed that which is prepared by careful chemical processes, give [205] up the ferrocyanide to boiling water, thereby colouring it greenish yellow; but a sample which parts with its prussiate to *cold* water is quite unfitted for the palette, for which the most perfect specimen is none too stable.

In spite of the learned researches of Professor Williamson, whose name is as closely connected with the pigment as are the names of Schunck and De La Rue with madder and cochineal, Prussian blue is not yet entirely understood. Complex and uncertain in composition, uncertain too in its habitudes, our best course perhaps will be not to attempt a complete survey, but to state briefly those facts which bear on the artist's craft.

Prussian blue is a colour of vast body and wonderful transparency, with a soft velvety richness, and of such intense depth as to appear black in its deepest washes. Notwithstanding it lasts a long time under favourable circumstances, its tints fade by the action of strong light; becoming white, according to Chevreul, in the direct rays of the sun, but regaining its blue colour in the dark; hence that subdued light which is favourable to all colours is particularly so to this blue. Its colour has the singular property of fluctuating, or of coming and going, under certain conditions; and which it owes to the action and reaction by which it acquires or relinquishes [206] oxygen alternately. It also becomes greenish sometimes by a development of the oxide of iron; and is purpled, darkened, or otherwise discoloured by damp or impure air. Time has a neutralizing tendency upon its colour, which forms tints of much beauty with white lead, though they are not equal either in purity, brilliancy, or permanence to those of cobalt and ultramarine. When carefully heated, Prussian blue gives off water and assumes a pale green hue; its colour, therefore, depending on the presence of water, must not be exposed to a high temperature. And as it is likewise injured or destroyed by alkalis, which decompose it into oxide of iron and a soluble prussiate, the blue should be avoided in fresco, on account of the lime; neither should it be employed with pigments of an alkaline nature, nor with hard water containing bicarbonate of lime in solution, but with clean rain or distilled water, either of which is preferable for colours generally.

Prussian blue dries and glazes well in oil, but its great and principal use is in painting deep blues, in which its body helps to secure its permanence, and its transparency gives force to its depth. It is also valuable in compounding deep purples with lake, and is a powerful neutralizer and component of black, to the intensity of which it adds considerably. Prussian blue borders [207] slightly on green, a quality which militates against its use in skies and distances. In spite, however, of its want of, or deficiency in, durability, the old water-colour painters so employed it, neutralized by the addition of a little crimson lake. It is serviceable in mixed tints of greens, affording with light red a sea-green neutral. Dissolved in oxalic acid, the blue is available as an ink, or for tinting maps.

Besides the preceding, there is a *Basic Prussian Blue*, formed by simply submitting to the air the bluish-white precipitate which falls on adding yellow prussiate of potash to green vitriol. This compound dissolves entirely by continued washing with water, yielding a beautiful deep blue solution, from which the colour may be thrown down in a solid form by the addition of any salt. Probably it was this basic preparation, so cheaply and easily made, that conferred upon Prussian blue the character of staining paper. In name, there is also another variety of this pigment, known as *Native Prussian Blue*; which is really a native phosphate of iron, occurring as a blue earthy powder, or as a white powder that becomes blue by exposure.

130. ANTWERP BLUE,

Haerlem Blue, *Berlin Blue*, *Mineral Blue*, is a lighter and somewhat brighter Prussian blue, [208] with less depth and less permanence. It is a species of lake, having a considerable proportion of aluminous base, to which its paler tint is due. As the stability of Prussian blue rests in a great measure on the marvellous amount of latent colour the pigment contains, when its particles of colour are set farther apart by the intervention of the alumina, the permanence of its hue is endangered. It was remarked, with respect to vitrified pigments, that colour depends on cohesion. More or less, this holds good as regards all pigments; but not only, as was also observed, does colour rest on cohesion, in many instances durability depends likewise. It is only when a colour is stable in itself that its particles will bear separating: native ultramarine, for example, may be weakened almost to white, and will still preserve its hue. If, however, a colour be naturally fugitive, and rely chiefly on its extreme depth for what permanence it possesses, that colour cannot with impunity be paled: witness the cochineal lakes, which the deeper they are, the more durable they are found; and so it is with Prussian blue. Antwerp blue is distinguished from the latter by its more earthy fracture.

131. TURNBULL'S BLUE,

Or *Ferricyanide of Iron*, is formed by adding the red prussiate of potash to a protosalt of iron. [209] This blue is lighter and more delicate than ordinary Prussian blue, and is believed to resist the action of alkalies longer. It is a question whether the common Prussian blue obtained by oxidizing the precipitate yielded by green vitriol and the yellow prussiate is not in reality this variety. However that may be, there is, as far as permanence goes, little or no difference between the two kinds.

ULTRAMARINES.

ARTIFICIAL ULTRAMARINES

comprise the varieties known as *French Ultramarine*, *French Blue*, *Brilliant Ultramarine*, *Factitious Ultramarine*, *Guimet's Ultramarine*, *New Blue*, *Permanent Blue*, *Gmelin's German Ultramarine*, *Bleu de Garance*, *Outremer de Guimet*, &c. The unrivalled qualities of native ultramarine prepared from the lapis lazuli rendered it most desirable to obtain an artificial compound which, while possessing similar properties, could be produced in quantity, and at a less costly rate. In demolishing some furnaces employed in making soda, by means of decomposing sulphate of soda, some earth had been found impregnated with a light blue, which was proved to have so close a resemblance to ultramarine as to foster hopes of success. As a stimulus, there was offered a prize of six thousand francs or £500 for the production of artificial ultramarine by the *Société d'Encouragement* of Paris, which was won in 1828 by M. Guimet. It is [210] fitting that the discoverer of a colour should excel in its manufacture, and to this day Guimet's ultramarine is the finest made. As an instance of how the researches of different men may, almost simultaneously, lead to the same results, it is curious that very shortly after the problem was also solved by Gmelin.

The cause of the blue colour of ultramarine was long a matter of controversy, but was believed generally to be due to iron. When, however, the discovery of artificial ultramarine was made, this assumption was shown to be false, by the fact that a blue could be obtained with materials perfectly free from iron. The absolutely necessary constituents of ultramarine are silica, alumina, sulphur, and soda; and there is little doubt that the colouring matter consists of hyposulphite of soda and sulphide of sodium: it is certain that the blue colour is dependant on the soda, inasmuch as potash yields an analogous compound which is purely white. A number of substances, such as iron, lime, magnesia, and potash, may be present as impurities, and were, in part at least, purposely added to the earlier manufactures; but they are found to be superfluous. Nevertheless, as regards iron, it is probable that a very small portion, such as is usually contained in the ingredients, greatly facilitates the production of the blue, and may even be [211] essential in some cases.

The colour of ultramarine is brought out by successive heatings. Green portions, more or less in quantity, are often formed in the crucibles, especially on the first ignition. On repeated heating they pass into a blue tint. Artificial ultramarines are said to be seldom entirely freed from all traces of the green modification, and are therefore less beautiful than the natural varieties, having a shade of green or grey. This defect, however, is certainly not discernible in Guimet's products, which sometimes incline so much to purple as to require neutralizing with a little Prussian blue. Depth for depth, the artificial are darker and less azure than the natural varieties, but the superiority of the latter consists not so much in their greater purity of hue, although this is considerable, as in their far greater transparency. The finest French ultramarine is never so transparent as the native; it is brilliant, it is powerful, it is permanent, it is nearly—but only nearly—transparent. Possessing in a subdued degree the characteristics and qualities of the genuine, it works, washes, and dries well; and is useful either in figures, draperies, or landscape. Rivalling in depth, although not equalling in colour, the pure azure of native ultramarine, it answers to the same acid tests, but is sometimes distinguished therefrom by the effervescence [212] which ensues on the addition of an acid. Not a bubble escapes in such case from the natural blue; unless, indeed, as occasionally happens, it retain a portion of alkali, with which it may have been combined in the preparation, but from which it should have been freed. Darkened as a rule by fire, factitious ultramarine becomes dingy blue, and at last white, when strongly ignited for a long time; and is, like the true variety, decolourised by ignition in an atmosphere of hydrogen gas. At a high temperature, this effect is even produced by silica, whence the unfitness of ultramarine for painting on glass or porcelain; and simply by a prolonged red heat the blue is rendered white. Being unaffected by alkalis, it is eligible in mural decoration, and is particularly adapted to siliceous painting, on account of the silica and alumina which it contains, two substances with which a soluble silicate readily unites. If artificial ultramarine be mixed with a soluble silicate, for example silicate of potash, and be laid on a properly prepared ground, it will become so firmly fixed, says Mr. Barff, that no amount of washing nor the slow action of moisture will remove it, or affect its brilliancy. Judging from the behaviour of ultramarine, therefore, if the colours employed in siliceous painting contain silica and alumina, they should adhere as firmly to [213] the surface on which they are placed; and this is really the case. It is possible to produce a mixed solution of aluminate and silicate of potash which will remain liquid for twenty-four hours. If, while in the liquid state, colours are saturated with this solution and allowed to dry, their particles will be very intimately mixed with silica and alumina chemically combined with potash. According to the author quoted, the admixture of silica and alumina does not interfere with the brilliancy or depth of the colours, and the method may be used for all those which are not injured by potash, and are in themselves adapted to the art.

With respect to permanence, the finer varieties of artificial ultramarines may, undoubtedly, be pronounced stable; but, like all other colours, these blues are apt to vary in quality, and inferior kinds are liable to lose their purity in a measure, and become grayer. Moreover, they are made by different processes, and the mode adopted for the manufacture of a pigment not only tells upon the colour, but may influence to some extent its durability. From the following experiment of an ingenious artist and friend of the author, it is evident that the production of artificial ultramarine was not carried in its early days to that state of perfection at which it has now arrived. He took a picture, the sky of which had been recently painted in the ordinary [214] manner with Prussian blue and white; and having painted over the clear part of the sky uniform portions with tints formed of the best factitious ultramarine, cobalt blue, and genuine ultramarine, so as to match the ground of the sky, and to disappear to the eye thereon by blending with the ground, when viewed at a moderate distance, he set the picture aside for some months. Upon examination, it appeared that the colour of these various blue pigments had taken different ways, and departed from the hue of the ground: the factitious ultramarine had *blackened*, the cobalt blue *greened*, the genuine ultramarine remained a *pure azure*, like a spot of light, while their ground, the Prussian blue sky, seemed by contrast with the ultramarine of a *grey* or *slate colour*.

Other things being equal, those artificial ultramarines are most durable which possess the most colour; and all are, perhaps, most permanent in water. If used in that vehicle, care should be taken to employ a gum free from acid; also, whether in water or oil, not to compound the blue with a pigment which may possibly contain acid, such as constant white. Acid, as we have said, is the great test for ultramarine; whence if a sample be sophisticated with cobalt, its blue colour will not be entirely destroyed. With high-class artistic pigments, however, adulteration is the exception and not the rule. It is as a powder-blue for the washtub that ultramarine gets [215] disguised, when it is ground up with soda-ash, chalk, gypsum, &c., and sold sometimes under its own name, but more frequently as superfine Saxon smalts.

132. BRILLIANT ULTRAMARINE,

lately called *Factitious Ultramarine*, is a specially fine preparation of M. Guimet, presenting the nearest approach to the natural product of any artificial ultramarine, both in transparency, purity of hue, and chemical characteristics. Equalling in depth and power the ordinary French ultramarine, it possesses greater clearness, beauty, and brightness; and has, in a subdued degree, that quality of light in it, and of the tint of air, which forms so distinguishing a feature in the native blue.

133. FRENCH ULTRAMARINE,

or *French Blue*, is a rich deep colour, but less transparent and vivid than the preceding variety, which is preferable in unmixed tints. For compound hues, French blue is sufficiently well adapted, and is extremely useful. With aureolin and burnt Sienna, or Vandyke brown, it affords valuable autumn greens; and with lamp black, or lamp black and light red, good stormy clouds. A sombre gray for distant mountains is furnished by French blue and madder brown, with a very [216] little gamboge; and a deep purple for sunsets, by the blue and purple madder, or Indian red and rose madder. With cadmium and orient yellows, sepia, viridian, and many other colours, this ultramarine is of service.

134. NEW BLUE

Is confined to water-colour painting, and is an artificial ultramarine, holding a middle position between French blue and permanent blue, being less deep than the one and less pale than the other. It may be said to hover in tint between a rich ultramarine and cobalt.

135. PERMANENT BLUE

Is a pale ultramarine, with a cobalt hue; and, in spite of its name, less permanence than belongs to the richer and deeper sorts. What Antwerp blue is to Prussian blue, this is to French blue—that is, as regards colour. With respect to durability, however, permanent and Antwerp blues cannot be compared; the former being a weakened variety of a stable, and the latter a weakened variety of a semi-fugitive, pigment. Hence permanent blue justifies its name, although that name would be more suited to the brilliant, or French, ultramarine.

136. GENUINE ULTRAMARINE,

Native Ultramarine, *Natural Ultramarine*, *Real Ultramarine*, *True Ultramarine*, *Ultramarine*, *Pure* [217] *Ultramarine*, *Azure*, *Outremer*, *Lazuline*, *Lazulite Blue*, and *Lazurstein*. This most costly, most

permanent, and most celebrated of all pigments, is obtained by isolating the blue colouring matter of the *lapis lazuli*, a stone chiefly brought from China, Thibet, and the shores of Lake Baikal. About the antiquity of the stone, and its colour, much has been written, and many conflicting statements have been made; but there is little doubt that our lapis lazuli was the sapphire of the ancients; and that the first certain mention of ultramarine occurs in a passage of Arethas, who lived in the eleventh century, and who, in his exposition of a verse in the book of Revelation, says, the sapphire is that stone of which *lazurium*, as we are told, is made. It has been common to confound ultramarine with the *cyanus* and *cœruleum* of the ancients; but their cyanus, or Armenian blue, was a kind of mineral or mountain blue, tinged with copper; and their cœruleum, although it may sometimes have been real ultramarine, was properly and in general a copper ochre. That ultramarine was known to the ancients there seems every probability, for it is certain they were acquainted with the stone; and modern travellers describe the brilliant blue painting still remaining in the ruins of temples of Upper Egypt as having all the appearance of ultramarine. Whether it is so or not, however, could only be proved by analysis; for, be it [218]
recollected, although the colour had preserved its hue during so many centuries, it had been completely buried, and therefore most perfectly secluded from light and air. Mr. Layard, in his 'Nineveh,' referring to some painted plaster, remarks that "The colours, particularly the blues and reds, were as brilliant and vivid when the earth was removed from them as they could originally have been; but, on exposure to the air, they faded rapidly." In all likelihood, these were of organic, or semi-organic, origin, prepared in some such manner as that mentioned by Pliny, who speaks of an earth which, when boiled with plants, acquired their blue colour, and was in some measure inflammable. As a pigment, cobalt was unknown to the ancients; but to these vegetable and copper blues of theirs, a third blue may perhaps be added. Experiments made upon blue tiles, found in a Roman tesselated foot-pavement at Montbeillard, showed that the colour was due to iron. M. Gmelin has proved that a blue tint can be imparted to glass and enamel by means of iron; and it is probable that the ancients were first induced by the blue slag of their smelting-houses to study the colouring of glass with iron; that in this art they acquired a dexterity not possessed at present, and that they employed their iron-smalt as a pigment, as we do our smalt of cobalt. To sum up, there are grounds for believing that the ancients were [219]
acquainted with copper blues, vegetable blues, and iron blues; and that, consequently, the blue described by travellers as having all the appearance of ultramarine may, or may not, be that pigment.

Lapis lazuli, or lazulite, is usually disseminated in a rock, which contains, among other substances, a fine white lazulite. In the *Musée Minéralogique* of Paris are two splendid specimens of the stone, in which is seen the transition from the azure to the white. According to the quantity and quality of blue present, the lapis varies from an almost uniform tint of the deepest indigo-blue to grayish-white, dotted and streaked at intervals with pale blue. The exceeding beauty of good samples has caused the lazulite to be much sought after, both as a gem for adorning the person, and for inlaid works in ornamental decoration. In China the stone is highly esteemed, being worn by mandarins as badges of nobility conferred only by the Emperor; and in the apartments of a summer palace near St. Petersburg, the walls are covered with amber, interspersed with plates of this costly lapis. Besides the colouring principle of the lazulite, there are always more or less mica and iron pyrites, the latter a lustrous yellow bisulphide of iron, which has often been mistaken for pellets of gold. Having chosen portions of the stone most free from these impurities, it is simply requisite to reduce them to an impalpable powder to obtain a [220]
blue pigment; and probably this was the original mode of preparing it before the discovery of the modern process. This curious method, which is mechanical rather than chemical, depends for its success on the character and proportions of the materials employed, as well as on the nicety of working. When well carried out, it perfectly isolates the blue from all extraneous matter, yielding the colour at first deep and rich, then lighter and paler, and lastly of that gray tint which is known by the name of Ultramarine Ash. The refuse, containing little or no blue, furnishes the useful pigment, Mineral Gray.

The immense price of ultramarine—or, as it was at first called, azurrum ultramarinum, blue beyond-the-sea—was almost a prohibition to its use in former times. It is related that Charles I. presented to Mrs. Walpole, and possibly to Vandyke also, five hundred pounds worth of ultramarine, which lay in so small a compass as only to cover his hand. Even in these days, despite the introduction of artificial ultramarines, the native product continues costly, commanding in proportion to its intensity and brightness, from two to eight guineas an ounce. To say, however, that the merits of the blue at least equal its expense, is to give the genuine ultramarine no more than its due. It has, indeed, not earned its reputation upon slight pretensions, being, when of fine quality, and skilfully prepared, of the most exquisitely beautiful [221]
blue, ranging from the utmost depth of shadow to the highest brilliancy of light and colour,—transparent in all its shades, and pure in all its tints. A true medial blue, when perfect, partaking neither of purple on the one hand, nor of green on the other, it sustains no injury either by damp and impure air, or by the intensest action of light, and is so eminently durable, that it remains unchanged in the oldest paintings. Drying well, working well in oil and fresco, ultramarine may be safely compounded with pigments generally, excepting only an acid sulphate of baryta or constant white. The blue has so much of the property of light in it, and of the tint of air—is so purely a sky-colour, and hence so singularly adapted to the direct and reflex light of the sky, and to become the antagonist of sunshine—that it is indispensable to the painter. Moreover, it is so pure, so true, so unchangeable in its tints and glazings, as to be no less essential in imitating the marvellous colouring of nature in flesh and flowers. To this may be added that it enters so admirably into purples, blacks, greens, grays, and broken hues, that it has justly obtained the

character of clearing or carrying light and air into all colours, both in mixture and glazing, as well as gained a sort of claim to universality throughout a picture.

Nevertheless, ultramarine is not always entitled to the whole of this commendation. [222] Frequently it is coarse in texture, in which case it is apparently more deep and valuable; yet such blue cannot be used with effect, nor ground fine without injuring its colour. Again, it is apt to be separated in an impure state from the lapis lazuli, which is an exceedingly varying and compound mineral, abounding with earthy and metallic parts in different states of oxidation and composition: hence ultramarine sometimes contains iron as a red oxide, when it has a purple cast; and sometimes the same metal as a yellow oxide, when it is of a green tone; while often it retains a portion of black sulphuret of iron, which imparts a dark and dusky hue. Occasionally, it is true, artists have preferred ultramarine for each of these tones; still are they imperfections which may account for various effects and defects of this pigment in painting. Growing deeper by age has been attributed to ultramarine; but it is only such specimens as would acquire depth in the fire that could be subject to the change; and it has been reasonably supposed that in pictures wherein other colours have faded, it may have taken this appearance by contrast. Ultramarine, prepared from calcined lapis, is not liable to so deepen; but this advantage may be purchased at some sacrifice of the vivid, warm, and pure azure colour of the blue produced from unburnt stone. We have frequently found ultramarine to be darkened, dimmed, and somewhat purpled by [223] ignition; and the same results ensue, in many instances, when the lazulite is calcined. In burning the stone, the sulphur of the pyrites is in a great measure expelled, and during its expulsion has probably a deteriorating influence on the beauty of the colour: our belief in this being so is strengthened by the fact that certain samples of ultramarine, ignited with sulphur, were not improved thereby. Similar effects are likewise caused by a careless or improper mode of treatment, for the finest lapis may yield dingy blues, containing particles of mica, metal, &c., and possessing a dull green, black, or purple hue. Of course the perfection of the pigment is dependant to a large extent upon the quality of the stone itself.

Though unexceptionable as an oil-colour, both in solid painting and glazing, it does not work so well as some other blues in water; nor is it, unless carefully prepared, so well adapted for mixed tints, on account of a gritty quality, of which no grinding will entirely divest it, and which causes it to separate from other pigments. When extremely fine in texture, however, or when a considerable portion of gum, which renders it transparent, can be employed to give connexion or adhesion while flowing, it becomes no less valuable in water than in oil; but when its vivid azure [224] is to be preserved, as in illuminated manuscripts and missals, little gum must be used. The fine greens, purples, and grays of the old masters, are often unquestionably compounds of ultramarine; and formerly it was the only blue known in fresco. Pure ultramarine varies in shade from light to dark, and in hue from pale warm azure to the deepest cold blue.

Native ultramarine consists of silica, alumina, sulphur, and soda; its colouring matter seeming to be due to hyposulphite of soda and sulphide of sodium. In these respects, as well as in that of being decolourised by acids, the natural product resembles the artificial. As a precious material, the former has been subject to adulteration; and it has been dyed, damped, and oiled to enrich its appearance; attempts of fraud, however, which may be easily detected. In the preceding edition of this work the author adds—"and the genuine may be as easily distinguished from the spurious by dropping a few particles of the pigment into lemon-juice, or any other acid, which almost instantly destroys the colour of the true ultramarine totally, and without effervescence." With this statement, so far as it pretends to be a test for the two kinds, we are not inclined to agree. Genuine ultramarine is always decolourised by acids; but it depends on the mode and nicety of its preparation whether it is decolourised without effervescence: that this is the case the author himself admits in his article on artificial ultramarine. Moreover, the "violent [225] effervescence" which he describes as ensuing on the latter being dropped into an acid, does not of necessity take place: in M. Guimet's finest variety, the brilliant ultramarine, acid produces little or no effervescence. Seeing, therefore, that both sorts are decolourised by acids, and that both may or may not effervesce therewith, the acid test must be considered fallacious. Experiments made with different samples of each, showed that native ultramarines offered greater resistance to acid than the artificial, taking longer to decolourise; and that the residues of the first were in general of a purer white than those of the last. It was also found that the brilliant ultramarine, above referred to, was less readily decolourised than other French or German kinds.

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137. *Blue Carmine.*

In a former edition of this work there appeared the following:—"Blue carmine is a blue oxide of molybdenum, of which little is known as a substance or as a pigment. It is said to be of a beautiful blue colour, and durable in a strong light, but is subject to be changed in hue by other substances, and blackened by foul air: we may conjecture, therefore, that it is not of much value in painting." In his estimate of this colour the author was certainly right. It is formed when a [226] solution of bichloride of molybdenum is poured into a saturated, or nearly saturated, solution of molybdate of ammonia. A blue precipitate falls, which is a molybdate of molybdic oxide, hydrated, and abundantly soluble in water. When dried, it furnishes a dark blue powder, resembling powdered indigo, having a bitter, rough, metallic taste, and reddening litmus strongly. The solubility of this hydrated oxide is alone fatal to its employment as a pigment. It may, indeed, be rendered comparatively insoluble in water by ignition; but the anhydrous oxide so obtained is nearly black, and as a colour worthless.

A more eligible preparation is the molybdate of baryta, produced by mixing solutions of molybdate of potash and acetate of baryta. A white, flocculent precipitate results, which rapidly condenses to a crystalline powder, and turns blue on ignition. It is, however, a costly compound, of little merit, and not likely to come into use. It is insoluble in water.

138. *Blue Ochre,*

which has been improperly called Native Prussian Blue, is a native hydrated phosphate of iron of rare occurrence, found with iron pyrites in Cornwall, and also in North America. What Indian red is to the colour red, and Oxford ochre to yellow, this pigment is to the colour blue, being sober [227]
and subdued rather than brilliant. It has the body of other ochres, more transparency, and is of considerable depth. Both in water and oil it works well, dries readily, and does not suffer in tint with white lead, nor change when exposed to the action of strong light, damp, or impure air. As far as its powers extend, therefore, it is an eligible pigment, though not generally employed nor easily procured; it may, however, be artificially prepared. Answering to similar acid tests as ultramarine, it is distinguished therefrom by assuming an olive-brown hue on exposure to a red heat.

139. *Cobalt Prussian Blue.*

Gmelin states that yellow prussiate of potash yields with a solution of oxalate of sesquioxide of cobalt a blue resembling Prussian blue—that, in fact, there can be obtained a Prussian blue with a base of cobalt instead of iron. In the moist state, the similarity is sufficiently great, but when washed and dried, the product is, with us, a dingy slate colour. Possibly, if such a blue could be produced, it might exceed in permanence the ferro- and ferri-cyanides of iron. Of course the compound would be much more expensive.

Copper Blues

are now seldom or never employed as artists' pigments. The following are the principal varieties:— [228]

140. *Bice,*

Blue Bice, Iris, Terre Bleu, was prepared, when true, from the Armenian stone, which is a calcareous kind of stone coloured with copper. It was of a light bright hue, but is completely superseded by pale ultramarine. The Persian lazur appears to have been a similar pigment, being a sort of copper ore, which, when the stone was pounded and sifted, furnished a fine paint, very bright and pleasant. It could not, however, stand the effects of the atmosphere like the Tartarian lazur or lapis lazuli, in the course of time becoming of a dark and dismal colour.

Ground smalts, blue verditer, and other pigments, have passed under the name of bice.

141. *Blue Ashes*, or *Mountain Blue,*

are both hydrated carbonates of copper, the first being artificially prepared, and the second found native in Cumberland. Neither is durable, especially in oil; and, as pigments, both are precisely of the character of verditer. By treating the natural malachite green with an alkali, it may be converted into blue.

142. *Blue Verditer,*

or Verditer, is an oxide of copper, formed by precipitating nitrate of copper with lime. It is of a [229]
beautiful light blue colour, little affected by light, but greened and ultimately blackened by time, damp, and impure air—changes which ensue even more rapidly in oil than in water. It is mostly confined to distemper painting and paper-staining.

143. *Egyptian Blue,*

called by Vitruvius, Cœruleum, is frequently found on the walls of the temples in Egypt, as well as on the cases enclosing mummies. Count Chaptal, who analysed some of it discovered in 1809 in a shop at Pompeii, found that it was blue ashes, not prepared in the moist manner, but by calcination. He considers it a kind of frit, of a semi-vitreous nature; and this would appear to be the case from Sir H. Davy obtaining a similar colour by exposing to a strong heat, for two hours, a mixture of fifteen parts of carbonate of soda, twenty of powdered flints, and three of copper. The colour is very brilliant when first made, and retains its hue well in distemper and decorative painting; but it has the common defect of copper blues of turning green in oil, when ground impalpably for artistic use. One remarkable effect of this copper smalt—for it is nothing else—is, that by lamp-light it shows somewhat greenish, but shines by day with all the brightness of azure. Mérimée believes that Paul Veronese employed this sort of blue in many of his pictures where the [230]
skies have become green.

144. *Saunders Blue,*

a corrupt name from *Cendres Bleues*, the original denomination probably of ultramarine ashes, is of two kinds, the natural and artificial. The first is a blue mineral found near copper mines, while the last is simply a verditer.

145. *Schweinfurt Blue,*

or Reboulleau's Blue, is prepared by fusing together equal weights of ordinary arseniate of protoxide of copper and arseniate of potash, and adding one-fifth its weight of nitre to the fused mass. The result is, so to speak, a sort of blue Scheele's green, into which latter colour it soon passes when rubbed with oil.

146. *Cotton Seed Blue.*

Cotton seed oil is bleached by treatment with either carbonate of soda or caustic lime. In both cases, a considerable residue is left after drawing off the bleached oil. This residue is treated with sulphuric acid, and distilled at a high temperature, when there is left a compact mass of a deep greenish-blue colour. On further treatment of this mass with strong sulphuric acid, the green tint disappears, and a very intense pure blue colour is produced. The blue mass is [231]
a mixture of the coloured substance with some sulphuric acid, sulphate of soda, and fats. The two former may be removed by washing with water; the latter by treatment with naptha. Alcohol now dissolves the blue colour, and water precipitates it from the solution chemically pure.

This blue has not been introduced as a pigment; and of its permanence, and other attributes, we know nothing.

147. *Gold Blue.*

Gold purple, under the name of Purple of Cassius, was once very well known: a like compound of tin and gold may be made to yield a blue. Resembling indigo, the colour is not remarkably brilliant, and, unless several precautions are carefully observed, is rather violet than blue. When obtained, the colour must be quickly washed by decantation, or it changes first to violet and then to purple. Its costliness, lack of brightness, and tendency to redden, are against its employment on the palette. In enamelling it would doubtless preserve its colour, and in exceptional cases might be useful.

148. *Iodine Blue.*

It is curious that iodine, which gives a yellow with lead, should also afford a blue with the
same metal. When a solution of iodine in aqueous soda (carbonate of soda is not so good) is [232]
added to nitrate or acetate of lead-oxide, a transient violet-red precipitate falls, which decomposes spontaneously under water, yielding iodine and a beautiful blue powder. The colour, however, is exceedingly fugitive, even the carbonic acid of the air separating iodine from it and forming a lead salt. Bearing in mind the scarlet iodide of mercury, iodine is capable of furnishing the three primary colours, distinguished alike by their brilliancy and fugacity.

149. *Iridium Blue.*

The rare metal iridium affords a blue which is a mixture of the oxide and the sesquioxide. But being slightly soluble in water and decolourised by sulphuretted hydrogen, it would not, other considerations apart, be an acquisition.

150. *Manganese Blue.*

An aqueous solution of permanganate of potash yields with baryta-water a violet mixture, which afterwards becomes colourless, and deposits a blue precipitate. This retains its colour after washing and drying, but cannot be recommended as a pigment, being liable to suffer in contact with organic substances, which deoxidize and decolourize the manganates and permanganates.

151. *Platinum Blue.* [233]

With mercurous nitrate, the platinocyanide of potassium forms a thick smalt blue, and the platinidcyanide a dark blue precipitate. The compound is a mixture of platino- or platinidcyanide of mercury and mercurous nitrate. Upon the presence of the latter the colour seems to depend, for on washing with cold water containing nitric acid, the nitrate is not removed nor the blue affected; but boiling water extracts the nitrate and leaves a white residue. A blue containing mercurous nitrate must necessarily be injured by impure air, and be otherwise objectionable.

152. *Tungsten Blue*

is an oxide formed by the action of various deoxidizing agents on tungstic acid. It remains unaltered in the air at ordinary temperatures, is opaque, and of a blackish indigo-blue colour. As a pigment, there is little to recommend it.

153. *Wood-Tar Blue.*

The colours obtained from coal-tar have become household words, and it is not impossible that those from wood-tar may be some day equally familiar. At present wood-tar is comparatively unexplored, but the fact that picamar furnishes a blue is at least as suggestive and hopeful as that transient purple colouration by which aniline was once chiefly distinguished. As aniline is a [234] product of coal-tar, so picamar is a product of wood-tar; and as the former gives a purple with hypochlorites, so the latter yields a blue with baryta-water. Both are distinguished by coloured tests, but there is this advantage in the picamar blue—it is comparatively permanent.

Picamar blue is produced when a few drops of baryta-water are added to an alcoholic solution of impure picamar, or even to wood-tar oil deprived of its acid. The liquor instantly assumes a bright blue tint, which in a few minutes passes into an indigo colour. From πιττα pitch, and καλλος ornament, the blue is named *Pittacal*.

The mode of separating pittacal has not been clearly described. Dumas states, that when precipitated in a flocculent state from its solutions, or obtained by evaporation, it closely resembles indigo, and, like it, acquires a coppery hue when rubbed. It is inodorous, tasteless, and not volatile; and is abundantly soluble in acetic acid, forming a red liquid, which, when saturated by an alkali, becomes of a bright blue. It is represented as a more delicate test of acid and alkalis than litmus. With acetate of lead, protochloride of tin, ammonio-sulphate of copper, and acetate of alumina, it yields a fine blue colour with a tint of violet, said not to be affected by air or light, and therefore recommended for dyeing.

Like indigo, pittacal is believed to contain nitrogen, but its ultimate composition has not been [235] accurately determined. Dumas considers it identical with a blue product obtained in 1827 from coal-tar by MM. Barthe and Laurent. If this be the case, its greater stability over coal-tar blues and colours generally admits of doubt. That, however, has yet to be ascertained. Our object in noticing this blue has been two-fold: first, to direct attention to wood-tar as a possible source of colour; and secondly, to point to pittacal as a possible substitute for indigo, possessing greater durability.

154. *Zinc-Cobalt Blue.*

Cobalt, as furnishing a blue colour, is usually associated with alumina, silica, or tin; and, as furnishing a green colour, with zinc. But there is obtainable a compound of zinc and cobalt which gives a blue not only free from green, but inclining rather to red. It is made by adding to a solution of ordinary phosphate of soda in excess a solution first of sulphate of zinc and then of sulphate of cobalt, and washing and igniting the precipitate. The result is a vitreous blue with a purple cast, of little body, and exceedingly difficult to grind. Altogether, it is not unlike smalt, over which it has no advantages as an artistic pigment either in colour or permanence. For tinting porcelain, however, it is admirably adapted, imparting thereto a very pure dark blue of [236] extraordinary beauty. This blue is distinguished from smalt by dissolving in acetic acid.

Compared with the wide range of yellows, or even with reds, the artist finds the number of his blues limited. The perfect native and excellent artificial ultramarines, the good blues of cobalt, the fair Prussian blue, and the doubtful indigo, are the four varieties he has for years been in the habit of using, and is still mainly dependent on. Our division, therefore, into permanent, semi-stable, and fugitive, is easily effected.

In the front rank, pre-eminent among blues as among pigments generally, stands genuine ultramarine. Behind it, are the artificial ultramarines; and behind them again, cobalt and cerulian blue. To a greater or less extent, all these are durable.

Among the semi-stable, must be classed cyanine or Leitch's blue, smalt, and Prussian blue.

To the fugitive, belong indigo and the somewhat more permanent intense blue, Antwerp blue, and the copper blues.

In this list of blues, which grace or disgrace the palette of the present day, there is one colour which, although not permanent, is almost indispensable. As yet, the chemist cannot in all cases lay down the law as to what pigments may or may not be employed. The painter who unnecessarily uses fugitive colours must have little love for his craft, and a poor opinion of the [237] value of his work; but, even with the best intentions and the utmost self-esteem, the artist cannot always confine himself to strictly stable pigments. He has no right to use orpiment instead of cadmium yellow, or red lead instead of vermilion, or copper blue instead of cobalt: he has no business to employ indigo when Prussian blue saddened by black will answer his purpose; but—what pigment can he substitute for Prussian blue itself? None. In its wondrous depth, richness, and transparency, it stands alone: there is no yellow to compare with it, no red to equal it, no blue to rival it. In force and power it is a colour among colours, and transparent beyond them all. The great importance of transparent pigments is to unite with solid or opaque colours of their own hues, giving tone and atmosphere generally, together with beauty and life; to convert primary into secondary, and secondary into tertiary colours, with brilliancy; to deepen and enrich dark colours and shadows, and to impart force and tone to black itself. For such effects, no pigment can vie with Prussian blue. What purples it produces, what greens it gives, what a matchless range of grays; what velvety glow it confers, how it softens the harshness of colours, and how it subdues their glare. No; until the advent of a perfect palette, the artist can scarcely [238] part with his Prussian blue; nor can the chemist, who has nothing better to offer, hold him to blame. It is for Art to copy Nature with the best materials she possesses: it is for Science to learn the secrets of Nature, and turn them to the benefit of Art.

CHAPTER XI. [239]

ON THE SECONDARY, ORANGE.

Orange is the first of the secondary colours in relation to light, being in all the variety of its hues composed of *yellow* and *red*. A true or perfect orange is such a compound of red and yellow as will neutralize a perfect blue in equal quantity either of surface or intensity; and the proportions of such compound are five of perfect red to three of perfect yellow. When orange inclines to red, it takes the names of *scarlet*, *poppy*, &c.: in gold colour, &c., it leans towards yellow. Combined with green it forms the tertiary *citrine*, and with purple the tertiary *russet*: it also furnishes a series of warm semi-neutral colours with black, and harmonizes in contact and variety of tints with white.

Orange is an advancing colour in painting:—in nature it is effective at a great distance, acting powerfully on the eye, diminishing its sensibility in accordance with the strength of the light in which it is viewed. It is of the hue, and partakes of the vividness of sunshine, as it likewise does [240] of all the powers of its components, red and yellow. Pre-eminently a *warm* colour, being the equal contrast of or antagonist to blue, to which the attribute of *coolness* peculiarly belongs, it is discordant when standing alone with yellow or with red, unresolved by their proper contrasts or harmonizing colours, purple and green. As an archeus or ruling colour, orange is one of the most agreeable keys in toning a picture, from the richness and warmth of its effects. If it predominate therein, for the colouring to be true, the violet and purple should be more or less red, the red more or less scarlet, the yellow more or less intense and orange, and the orange itself be intense and vivid. Further, the greens must lose some of their blue and consequently become yellower, the light blues be more or less light grey, and the deep indigo more or less marrone.

Although the secondary colours are capable of being obtained by admixture of the primaries in an infinitude of hues, tints, and shades; yet simple original pigments of whatever class—whether secondary, tertiary, or semi-neutral—are, it has been said before, often superior to those compounded, both in a chemical and artistic sense. Hence a thoroughly good original orange is only of less value and importance than a thoroughly good original yellow, a green than a blue, or [241] a purple than a red. To produce pure and permanent compound hues requires practice and knowledge, and we too often see in the works of painters combinations neither pleasing nor stable. Colours are associated with each other which do not mix kindly, and compounds formed of which one or both constituents are fugitive. As a consequence, mixed tints are frequently wanting in clearness, and, where they do not disappear altogether, resolve themselves into some primary colour; orange becoming red by a fading of the yellow, green yellow by a fading of the blue, and purple blue by a fading of the red. Again, with regard to compound tints, there is the danger of one colour reacting upon and injuring another, as in the case of greens obtained from chrome yellow and Prussian blue, where the former ultimately destroys the latter. Of course a mixture of two permanent pigments which do not react on each other will remain permanent; the green, for instance, furnished by aureolin and native ultramarine lasting as long as the ground itself. To produce, however, the effects desired, the artist does not always stop to consider the fitness and stability of his colours in compounding, even if he possess the needed acquaintance with their physical and chemical properties. At all times, therefore, but especially when such knowledge is slight, good orange, &c., pigments are of more or less value, as by their use the employment of [242] inferior mixtures is to a great extent avoided. In mingling primary with primary, if one colour does not compound well with the other, or is fugacious, the result is failure; but a secondary is not so easily affected by admixture: a green, for example, is seldom quite ruined by the injudicious addition of blue or yellow; and even if either of the latter be fugitive, the green will remain a green if originally durable. Thus the secondaries, if they are not already of the colour required, may be brightened or subdued, deepened or paled, with comparative impunity. The artist who, from long years of experience, knows exactly the properties and capabilities of the colours he employs, may in a measure dispense with secondary pigments, and obtain from the primaries mixed tints at once stable, beautiful, and pure; but even he must sometimes resort to them, as when a green like emerald or viridian is required, which no mixture of blue and yellow will afford. The primaries, by reason of their not being able to be composed of other colours, occupy the first place on the palette, and are of the first importance; but the secondaries are far too useful to be disregarded, and have a value of their own, which both veteran and tyro have cause to acknowledge.

The list of original orange pigments was once so deficient, that in some old treatises on the [243] subject of colours, they are not even mentioned. This may have arisen, not merely from their paucity, but from the unsettled signification of the term orange, as well as from improperly calling these pigments reds, yellows, &c. In these days, however, orange pigments are sufficiently numerous to merit a chapter to themselves; they indeed comprise some of the best colours on the palette.

155. BURNT SIENNA,

or *Burnt Terra di Sienna*, is calcined raw Sienna, of a rich transparent brown-orange or orange-russet colour, richer, deeper, and more transparent than the raw earth. It also works and dries better, has in other respects the qualities of its parent colour, and is a most permanent and serviceable pigment in painting generally. For the warm tints in rocks, mud banks, and buildings, this colour is excellent. When mixed with blue it makes a good green; furnishing a bright green with cobalt, and one much more intense with Prussian blue. For the foresea, whether calm or broken by waves, it may be employed with a little madder; while compounded with a small portion of the latter and lamp black, it meets the hues of old posts, boats, and a variety of near objects, as the tints may be varied by modifying the proportions of the component colours. Used with white, it yields a range of sunny tones; and with aureolin or French blue and aureolin will be [244] found of service, the last compound giving a fine olive green. Similar but fugitive greens are afforded by admixture of burnt Sienna with indigo and yellow or Roman ochre, or raw Sienna; tints which may be saddened into olive neutrals by the addition of sepia, and rendered more durable by substituting for indigo Prussian blue and black. Mixed with viridian, it furnishes autumnal hues of the utmost richness, beauty, and permanence; and, alone, is valuable as a glaze over foliage and herbage. For the dark markings and divisions of stones a compound of Payne's gray and burnt Sienna will prove serviceable; while for red sails the Sienna, either by itself, with brown madder, or with Indian red, cannot be surpassed. For foregrounds, banks and roads, cattle and animals in general, burnt Sienna is equally eligible, both alone and compounded. It has a slight tendency to darken by time.

156. CADMIUM ORANGE

was first introduced to the art-world at the International Exhibition of 18621862, where it was universally admired for its extreme brilliancy and beauty, a brilliancy equalled by few of the colours with which it was associated, and a beauty devoid of coarseness. We remember well the power it possessed of attracting the eye from a distance; and how, on near approach, it threw [245] nearly all other pigments into the shade. It has in truth a lustrous luminosity not often to be met with, added to a total absence of rankness or harshness. A simple original colour, containing no base but cadmium, it is of perfect permanence, being uninjured by exposure to light, air or damp, by sulphuretted hydrogen, or by admixture. Having in common with cadmium sulphides a certain amount of transparency, it is invaluable for gorgeous sunsets and the like, either alone or compounded with aureolin. Of great depth and power in its full touches, the pale washes are marked by that clearness and delicacy which are so essential in painting skies. As day declines, and blue melts into green, green into orange, and orange into purple, the proper use of this pigment will produce effects both glowing and transparent. Transparency signifies the quality of being seen through or into; and in no better way can it be arrived at than by giving a number of thin washes of determined character, each lighter than the preceding one. With due care in preserving their forms, from the commencement to the termination, such washes of orange will furnish hues the softest and most aerial. For bits of bright drapery, a glaze over autumn leaves, and mural decoration, this colour is adapted; while in illumination it supplies a want formerly much felt. "With the exception of scarlet or bright orange," said Mr. Bradley, nine or ten years [246] since, in his Manual of Illumination, "our colours are everything we could wish." As an original pigment, a permanent scarlet does not yet exist; but the brilliancy of cadmium orange cannot be disputed, nor its claim to be the only unexceptionable bright orange known. It even assists the formation of the other colour: remarks the author mentioned, "Brilliancy is obtained by gradation. Suppose a scarlet over-curling leaf, for example. The whole should be painted in pure orange, with the gentlest possible after-touch of vermilion towards the corner under the curl. When dry, a firm line—not wash—of carmine, (of madder, preferable.—*Ed.*), passed within the outline on the shade side only of the leaf, will give to the whole the look of a bright scarlet surface, but with an indescribable superadded charm, that no merely flat colour can possess." In the same branch of art, illumination, cadmium orange, opposed to viridian, presents a most dazzling contrast, especially if relieved by purple.

157. CHINESE ORANGE

belongs to the coal-tar colours, and ought strictly to have been classed therewith. We have preferred, however, to keep it separate, because, as Chinese Orange, it was introduced as a pigment, and has not been employed as a dye. In colour, it somewhat resembles burnt Sienna, [247] enriched, reddened, brightened, and made more transparent, by admixture with crimson lake. From its behaviour, it would seem to be composed of yellow and red, such a compound as magenta and aniline yellow would afford. Its pale washes are uncertain, being apt to resolve themselves into red and yellow, of which the latter appears the most permanent; for, on exposure to light and air, the red more or less flies, leaving here a yellow, and there a reddish-yellow ground: in places both red and yellow disappear. Like all fugitive colours, it is comparatively stable when used in body; but even then it entirely loses its depth and richness, and in a great measure its redness, becoming faded and yellowish. In thin washes or glazing it is totally inadmissible; and, being neither a red, an orange, nor a brown, is unsuited to pure effects. Nevertheless, where it need not be unduly exposed; in portfolio illuminations, for instance, the richness, subdued brilliancy, and transparency of this pigment, justify its adoption. It is not affected by an impure atmosphere.

Aniline colours may be adapted for oil painting by dissolving them in the strongest alcohol, saturating the solution with Dammar resin, filtering the tincture, and pouring the filtrate either on pure water or solution of common salt, stirring well all the time. The water or brine solution [248] must be at least twenty times the bulk of the tincture. The colour after being collected on a filter, washed, and dried, can be ground with linseed oil, poppy oil, or oil varnishes.

158. CHROME ORANGE,

Orange Chrome, or *Orange Chromate of Lead*, is a sub-chromate of lead of an orange-yellow colour, produced by the action of an alkali on chrome yellow. Like all the chromates of lead, it is characterized by power and brilliancy; but also by a rankness of tone, a want of permanence, and a tendency to injure organic pigments. By reason of its lead base it is subject to alteration by impure air, but is on the whole preferable to the chrome yellows, being liable in a somewhat less degree to their changes and affinities. As, however, a colour has no business to be used if a better can be procured, the recent introduction of cadmium orange renders all risk unnecessary.

159. MARS ORANGE,

Orange de Mars, is a subdued orange of the burnt Sienna class, but without the brown tinge that distinguishes the latter. Marked by a special clearness and purity of tone, with much transparency, it affords bright sunny tints in its pale washes, and combines effectively with white. [249] Being an artificial iron ochre it is more chemically active than native ochres, and needs to be cautiously employed with pigments affected by iron, such as the lakes of cochineal and intense blue.

160. MIXED ORANGE.

Orange being a compound colour, the place of original orange pigments can be supplied by mixtures of yellow and red; either by glazing one over the other, by stippling, or by other modes of breaking and intermixing them, according to the nature of the work and the effect required. For reasons lately given, mixed pigments are apt to be inferior to the simple or homogeneous both in colour, working, and other properties; yet some pigments mix and combine more cordially and with better results than others; as is the case with liquid rubiate and gamboge. Generally speaking, the compounding of colours is easier in oil than in water; but in both vehicles trouble will be saved by beginning with the predominating colour, and adding the other or others to it.

Perhaps in this, our first chapter on the secondary colours, and consequently on colours that can be compounded, a few remarks on mixed tints from a chemical point of view will not be deemed superfluous.

There are two ways, we take it, of looking at a picture—from a purely chemical, and from a [250] purely artistic, point of view. Regarded in the first light, it matters little whether a painting be a work of genius or a daub, provided the pigments employed on it are good and properly compounded. The effects produced are lost sight of in a consideration of the materials, their permanence, fugacity, and conduct towards each other. Painting is essentially a chemical operation: with his pigments for reagents, the artist unwittingly performs reaction after reaction, not with the immediate results indeed of the chemist in his laboratory, but often as surely. As colour is added to colour, and mixture to mixture, acid meets alkali, metal animal, mineral vegetable, inorganic organic. With so close a union of opposite and opposing elements, the wonder is not so much that pictures sometimes perish, but that they ever live. It behoves the artist, then, not only to procure the best and most permanent pigments possible, but to compound them in such a manner that his mixed tints may be durable as well as beautiful. To effect or aid in effecting this, although he may not always be able to act upon them, the following axioms should be borne in mind:—

1. If they do not react on each other, a permanent pigment added to a permanent pigment yields a permanent mixture.
2. If they do react on each other, a permanent pigment added to a permanent pigment yields a [251] semi-stable or fugitive mixture.
3. A permanent pigment added to a semi-stable pigment yields a semi-stable mixture.
4. A permanent pigment added to a fugitive pigment yields a fugitive mixture.

Consequently—

5. A permanent pigment may be rendered fugitive or semi-stable by improper compounding.
6. A semi-stable or fugitive pigment is not rendered durable by being compounded.
7. As a chain is only as strong as its weakest link, so a mixture is only as permanent as its least durable constituent.

To give illustrations—

1. Ultramarine added to Chinese white yields a permanent mixture.
2. Ultramarine added to an acid constant white yields a semi-stable or fugitive mixture.
3. Ultramarine added to Prussian blue yields a semi-stable mixture.
4. Ultramarine added to indigo yields a fugitive mixture.

Except in the second instance, where the blue is either partially or wholly destroyed—in time, be it remembered, not at once—according to the quantity and strength of the acid in the white, the ultramarine remains unchanged. Hence at first sight our third and fourth conclusions may [252] appear wrong; inasmuch as, it may be argued, a blue mixture cannot be semi-stable or fugitive when blue is left. To this we reply, unless both constituents are fugitive, a mixture will always more or less possess colour; but, if even one constituent be semi-stable or fugitive, a mixture will slowly but surely lose *the* colour for which it was compounded, and be *as a mixture* semi-stable or fugitive.

It need hardly be observed that the number of permanent orange, green, and purple hues which the artist can compound, depends mainly on the number of permanent yellows, reds, and blues at his disposal. In mixed orange, therefore, a selection of durable yellows and reds is of the first importance. It should, however, be remarked that mixed orange, more sober and less decided, is obtainable by the use of citrine and russet; in the former of which yellow predominates, and in the latter, red: consequently orange results when yellow is added to russet, red to citrine, or citrine to russet.

PERMANENT YELLOWS.	**PERMANENT REDS.**
Aureolin.	Cadmium Red.
Cadmium, deep.	Liquid Rubiate.
Cadmium, pale.	Madder Carmine.
Lemon Yellow.	Rose Madder.
Mars Yellow.	Mars Red.
Naples Yellow, modern.	Ochres.
Ochres.	Vermilions.
Orient Yellow.	
Raw Sienna.	

None of these pigments react on each other, and from them can be produced the most [253]
durable mixed orange that yellow and red will afford.

161. NEUTRAL ORANGE,

or *Penley's Neutral Orange*, is a permanent compound pigment composed of yellow ochre and the russet-marrone known as brown madder: it is chiefly valuable in water-colour. Paper, being white, is too opaque to paint upon, without some wash of colour being first passed over it; otherwise the light tones of the sky are apt to look crude and harsh. It must, therefore, be gone over with some desirable tint, that shall break, in a slight degree, the extreme brilliancy of the mere paper. For this purpose, a thin wash of the orange is to be put over the whole surface of the paper with a large flat brush, care being taken never to drive the colour too bare, *i.e.* never to empty the brush too closely, but always to replenish before more is actually required. This first wash of colour not only gives a tone to the paper, but secures the pencil sketch from being rubbed out.

The reason why, in this compound, yellow ochre, as a yellow, is preferred to any of the others, is, that it is a broken yellow, that is, a yellow slightly altered by having another hue, such
as red, or brown, in its composition. It is somewhat opaque too, and hence, from this quality, is [254]
especially adapted for distances. Brown madder also is a subdued red, which, when in combination with the former, produces a neutral orange, partaking of the character of soft light. As a general rule, yellow ochre is to predominate in broad daylight, and brown madder in that which is more sombre and imperfect: hence the pigment can be yellowed or reddened, by the addition of one or the other. For a clear sunset, the neutral orange must be repeated, with a preponderance of ochre at the top, assisted by a little cadmium yellow near the sun; the madder being added downwards.

In treating of distant mountains, a distinction is to be made between them and the clouds, the former requiring solidity, while the latter are only to be regarded as vapour and air. Mountains, being opaque bodies, are acted upon by atmosphere more or less, according to their position, their distance, and the state of the weather. To express this distinction, recourse must be had to an under tint, except where the tone is decidedly blue—an uncommon case. No mixture can give this with such truth as the neutral orange. A wash, therefore, should be passed over the mountains, with nearly all yellow in the high lights, or in the gleams of sunshine, and, on the contrary, almost all brown madder for the shadows. These two degrees of tone must be run into
each other while the drawing is wet. A beautiful and soft under tone will thus be given to receive [255]
the greys.

162. ORANGE, OR BURNT ROMAN OCHRE,

called also *Spanish Ochre*, is a very bright yellow or Roman ochre burnt, by which operation it acquires warmth, colour, transparency, and depth. Moderately bright, it forms good flesh tints with white, dries and works well both in water and oil, and is a very good and eligible pigment. It may be used in enamel painting, and has all the properties of its original ochre in other respects.

A redder hue is imparted by mixing the ochre with powdered nitre before ignition, the orange red being subsequently washed with hot water.

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163. *Anotta,*

Annotto, Annatto, Arnotto, Arnotta, Terra Orellana, Rocou, &c., is met with in commerce under the names of cake anotta, and flag or roll anotta. The former, which comes almost exclusively from Cayenne, should be of a bright yellow colour: the latter, which is imported from the Brazils, is brown outside and red within. It is prepared from the pods of the *bixa orellana*, and appears generally to contain two colouring matters, a yellow and a red, which are apt to adhere to each other and produce orange. Anotta dissolves with difficulty in water, but readily in alcohol and [256] alkaline solutions, from which last it may be thrown down as a lake by means of alum. Being, however, exceedingly fugitive and changeable, it is not fit for painting; but is chiefly employed in dyeing silk, and colouring varnishes and cheese. Very red cheese should be looked upon with suspicion, for although the admixture of anotta is in no way detrimental to health provided the drug be pure, it is commonly adulterated with red lead and ochre. Several instances are on record that Gloucester and other cheeses have been found contaminated with red lead, through having been coloured with anotta containing it, and that this contamination has produced serious consequences.

Bixine is a purified extract of anotta made in France, and used by dyers.

164. *Antimony Orange,*

Golden Sulphur of Antimony, or Golden Yellow, is a hydro-sulphuret of antimony of an orange colour, which is destroyed by the action of strong light. It is a bad dryer in oil, injurious to many pigments, and in no respect eligible either in water or oil.

165. *Chromate of Mercury*

has been improperly classed as a red with vermilion, for though it is of a bright ochrous red in [257] powder, when ground it becomes a bright ochre-orange, and affords with white very pure orange tints. Nevertheless it is a bad pigment, since light soon changes it to a deep russet colour, and foul air reduces it to extreme blackness.

166. *Damonico,*

or Monicon, is an iron ochre, being a compound of raw Sienna and Roman ochre burnt, and having all their qualities. It is rather more russet in hue than the pigment known as orange or burnt Roman ochre, has considerable transparency, is rich and durable in colour, and furnishes good flesh tints. As in orange ochre, powdered nitre may be employed in its preparation. Notwithstanding its merits, it is obsolete or nearly so; doubtless because burnt Sienna mixed with burnt Roman ochre sufficiently answers the purpose.

167. *Gamboge Orange.*

On adding acetate of lead to a potash solution of gamboge, a rich bright orange is precipitated, which may be washed on a filter till the washings are colourless, and preserves its hue with careful drying. The orange which we thus obtained stood well in a book, but it cannot be recommended as an artistic pigment. Perhaps in dyeing, the lead and gamboge solutions might be worth a trial.

168. *Laque Minérale* [258]

is a French pigment, a species of chromic orange, similar to the orange chromate of lead. This name is likewise given to orange oxide of iron.

169. *Madder Orange,*

or Orange Lake. It has been said that the yellows so-called produced from madder are not remarkable for stability, differing therein from the reds, purples, russets, and browns. Like them, this 'orange' is of doubtful colour and permanence, and not to be met with, brilliant and pure, on the palette of to-day. The russet known as Rubens' madder has a tendency to orange.

170. *Orange Lead,*

of a dull orange colour, is an orange protoxide of lead or massicot. Like litharge, it may be employed in the preparation of drying oils, and, being a better drier than white lead, may be substituted for it in mixing with pigments which need a siccative, as the bituminous earths.

Minium sometimes leans to orange; and there is made from ceruse a peculiar red, *Mineral Orange*.

Orange Orpiment,

or Realgar, has also been called Red Orpiment, improperly, since it is a brilliant orange, inclining [259] to yellow. There are two kinds, a native and an artificial, of which the former is the *sandarac* of the ancients, and is rather redder than the latter. They possess the same qualities as pigments, and as such resemble yellow orpiment, to which the old painters gave the orange hue by heat, naming it alchemy and burnt orpiment. Orange orpiment contains more arsenic and less sulphur than the yellow, and is of course highly poisonous. It is often sophisticated with brickdust and yellow ochre.

172. ***Thallium Orange***

is produced when bichromate of potash is added to a neutral salt of the protoxide of thallium, as an orange-yellow precipitate. The scarcity of the metal precludes their present introduction as pigments, but if the chromates of thallium were found to resist the action of light and air, and not to become green by deoxidation of the chromic acid, they might possibly prove fitted for the palette. It is a question whether their *very* slight solubility in water would be a fatal objection; and, although they would be liable to suffer from a foul atmosphere, we are inclined to think the effects would not be so lasting as in the chromates of lead. Like lead sulphide, the sulphide of thallium ranges from brown to brownish-black, or grey-black; and, like it too, is subject to [260] oxidation and consequent conversion into colourless sulphate. It is, however, much more readily oxidized than sulphate of lead; and hence the thallium chromates would doubtless soon regain their former hue on exposure to a strong light.

Mr. Crookes, who discovered this new metal in 1861, believes that the deep orange shade observable in some specimens of sulphide of cadmium is due to the presence of thallium. He has frequently found it, he says, in the dark-coloured varieties, and considers the variations of colour in cadmium sulphide to be owing to traces of thallium. That thallium affects the colour is most probable, but it is not necessarily the cause of the orange hue. The tint of cadmium sulphide is a mere matter of manufacture, seeing that from the same sample of metal there can be obtained lemon-yellow, pale yellow, deep yellow, orange-yellow, and orange-red. With deference to the opinion of a chemist so distinguished, we hold that thallium rather impairs the beauty of cadmium sulphide than imparts to it an orange shade, the thallium being likewise in the form of sulphide, and therefore more or less black. On chromate of cadmium, made with bichromate of potash, thallium would naturally confer an orange hue.

173. ***Uranium Orange***

is obtainable by wet and dry methods as a yellowish-red, or, when reduced to powder, an orange- [261] yellow, uranate of baryta. It is an expensive preparation, superfluous as a pigment.

174. ***Zinc Orange.***

When hydrochloric acid and zinc are made to act on nitro-prusside of sodium, a corresponding zinc compound is formed of a deep orange colour, slightly soluble in water, and not permanent.

For a secondary colour, orange is well represented on the modern palette, and can point to some pigments as good and durable as any to be found among the primaries. Burnt Sienna, cadmium orange, Mars orange, neutral orange, and orange or burnt Roman ochre, are all strictly permanent. The so-called orange vermilions were, it will be remembered, classed among the reds.

As semi-stable, must be ranked chrome orange; and as fugitive, Chinese orange, orange orpiment, and orange lead.

From the foregoing division, the predominance of eligible orange pigments over those less trustworthy is manifest. Unfortunately, with many painters it is not so manifest that their secondary and compound colours should receive as much attention as the primaries, and that it is their duty, not only to the art which they practice, but to the patrons for whom they practice it, [262] that their orange and green and purple hues, should be as durable as their yellows, reds, and blues. For such, the introduction of a new permanent pigment is of little interest, unless its colour be primary; so wedded are they to that passion for compounding which the chemist views with dismay. With dismay, because he knows that the rules of mixture are severe, and cannot with impunity be altered; that, although disguised in oil or gum, each pigment is a chemical compound, with more or less of affinity and power, more or less likely to act or be acted upon. Because he knows that, except with the most experienced artists, compounding leads to confusion; and that in it the temptations to use semi-stable or fugitive colours are strong. Look at those tables of mixed tints of which artist-authors are so fond, and tell us whether they always bear scrutiny—surely not. Admirable, perfect as these tints may be in an artistic sense, how often is their beauty like the hectic flush of consumption, which carries with it the seeds of a certain death. Will that orange where Indian yellow figures ever see old age, or that green with indigo, or purple with cochineal lake? Will they not rather spread over the picture the Upas-tree of fugacity, and kill it as they die themselves!

CHAPTER XII. [263]

ON THE SECONDARY, GREEN.

Green, which occupies the middle station in the natural scale of colours and in relation to light and shade, is the second of the secondary colours. It is composed of the extreme primaries, *yellow* and *blue*, and is most perfect in hue when constituted in the proportions of three of yellow to eight of blue of equal intensities; because such a green will exactly neutralize and contrast a perfect red in the ratio of eleven to five, either of space or power. Of all compound colours, green is the most effective, distinct, and striking, causing surprise and delight when first produced by a mixture of blue and yellow, so dissimilar to its constituents does it appear to the untutored eye. Compounded with orange, green converts it into the one extreme tertiary *citrine*; while mixed with purple, it becomes the other extreme tertiary *olive*: hence its relations and accordances are more general, and its contrasts more agreeable with all colours, than those of any other individual colour. Accordingly it has been adopted very wisely in nature as the common garb of [264] the vegetal creation. It is, indeed, in every respect a central or medial colour, being the contrast, compensatory in the proportion of eleven to five, of the middle primary *red*, on the one hand, and of the middle tertiary *russet*, on the other; while, unlike the other secondaries, all its hues, whether tending to blue or yellow, are of the same denomination.

These attributes of green, which render it so universally effective in contrasting colours, cause it also to become the least useful in compounding them, and the most apt to defile other colours in mixture. Nevertheless it forms valuable semi-neutrals of the olive class with *black*, for of such subdued tones are those greens by which the more vivid tints of nature are opposed. Accordingly, the various greens of foliage are always more or less semi-neutral in hue. As green is the most general colour of vegetal nature and principal in foliage; so red, its harmonizing colour, with compounds of red, is most general and principal in flowers. Purple flowers are commonly contrasted with centres or variegations of bright yellow, as blue flowers are with like relievings of orange; and there is a prevailing hue, or character, in the green colour of the foliage of almost every plant, by which it is harmonized with the colours of its flowers.

The chief discord of green is blue; and when they approximate or accompany each other, they [265] require to be resolved by the opposition of warm colours. It is in this way that the warmth of distance and the horizon reconciles the azure of the sky with the greenness of a landscape. Its less powerful discord is yellow, which needs to be similarly resolved by a purple-red, or its principles. In tone, green is cool or warm, sedate or gay, either as it inclines to blue or to yellow; yet in its general effects it is cool, calm, temperate, and refreshing. Having little power in reflecting light, it is a retiring colour, and readily subdued by distance: for the same reason, it excites the retina less than most colours, and is cool and grateful to the eye. As a colour individually, green is eminently beautiful and agreeable, but it is more particularly so when contrasted by its compensating colour, red, as it often is in nature, even in the green leaves and young shoots of plants and trees. "The autumn only is called the painter's season," remarks Constable, "from the great richness of the colours of the dead and decaying foliage, and the peculiar tone and beauty of the skies; but the spring has, perhaps, more than an equal claim to his notice and admiration, and from causes not wholly dissimilar,—the great variety of tints and colours of the living foliage, accompanied by their flowers and blossoms. The beautiful and [266] tender hues of the young leaves and buds are rendered more lovely by being contrasted, as they now are, with the sober russet browns of the stems from which they shoot, and which still show the drear remains of the season that is past."

The number of pigments of any colour is in general proportioned to its importance; hence the variety of greens is very great, though the classes of those in common use are not very numerous. Of the three secondaries, green is the colour most often met with, and, consequently, the most often compounded: for this last reason, perhaps, the palette is somewhat deficient in really good original greens—more deficient than there is any necessity for.

CHROME OXIDES.

By numerous methods both wet and dry, oxides of chromium are obtainable pale and deep, bright and subdued, warm and cool, opaque and transparent: sometimes hydrated, in which case they cannot be employed in enamelling; and sometimes anhydrous, when they are admissible therein. But whatever their properties may be, chemical, physical, or artistic, they are all strictly stable. Neither giving nor receiving injury by admixture, equally unaffected by foul gas and exposure to light, air, or damp, these oxides are perfectly unexceptionable in every respect. For [267] the most part they are eligible in water and oil, drying well in the latter vehicle, and requiring in the former much gum. They have long been known as affording pure, natural, and durable tints; but, until within the last few years, have been rather fine than brilliant greens. Lately, however, processes have been devised, yielding them almost as bright, rich, and transparent, as the carmine of cochineal itself.

175. OXIDE OF CHROMIUM,

Opaque Oxide of Chromium, *Green Oxide of Chromium*, *Chrome Oxide*, *True Chrome Green*, *Native Green*, *&c.*, is found native in an impure state as Chrome Ochre, but is always artificially prepared for artistic use. Obtained anhydrous by dry modes, this is the only chrome oxide available in enamelling, and is the one seen on superior porcelain. It is a cold, sober sage green, deep-toned, opaque, and, although dull, agreeable to the eye. Its tints with white are peculiarly delicate and pleasing, possessing a silvery luminous quality, and giving the effect of atmosphere. Being very dense and powerful, it must be employed with care to avoid heaviness, and is preferably diluted with a large quantity of white, or compounded with transparent yellow. In the hands of a master, this gray-green furnishes lustrous hues with brown pink, Italian pink, and Indian yellow; three beautiful but fugitive pigments, of which the two last may be replaced by [268] aureolin. Of this Mr. Penley observes, "as adapted for the colouring of foliage and herbage, it is impossible to say too much in its praise. It imparts the vividness and freshness of nature to every colour with which it is combined;" and he brackets oxide of chromium with aureolin as a compound hue "extremely useful." In flat tints, the oxide sometimes does not wash well in water.

176. TRANSPARENT OXIDE OF CHROMIUM

being deficient in body, is only eligible in oil. A very pale greyish-white green in powder, it gives an agreeable yellowish green of some depth in oil, moderately bright, but not very pure or clear.

We are acquainted with another transparent chrome oxide of far greater beauty, brightness, purity, and clearness than the above. Of a bluish green hue, a difficulty in getting it to mix with oil renders it at present unavailable.

177. VERONESE GREEN,

or *French Veronese Green*, is a comparatively recent introduction, similar in colour and general properties to the following; beside which, however, it appears dull, muddy, and impure. It is often adulterated with arsenic to an enormous extent, which interferes with its transparency, mars its [269] beauty, and renders it of course rankly poisonous.

178. VIRIDIAN

is a still later addition to the palette, and the only permanent green which can be described as gorgeous, being not unlike the richest velvet. Pure and clear as the emerald, it may be called the Prussian Blue of Greens, of such richness, depth, and transparency is it. In hue of a bluish-green, its deepest shades verge on black, while its light tints are marked by transparent clearness unsurpassed. No compound of blue and yellow will afford a green at once so beautiful and stable, so gifted with the quality of light, and therefore so suited for aerial and liquid effects. Used with aureolin, it gives foliage greens sparkling with sunshine; and, fitly compounded, will be found invaluable for the glassy liquidity of seas, in painting which it becomes incumbent to employ pigments more or less transparent. "The general failing in the representation of the sea is, that

instead of appearing liquid and thin, it is made to bear the semblance of opacity and solidity. In order to convey the idea of transparency, some object is often placed floating on the wave, so as to give reflection; and it is strange that we find our greatest men having recourse to this stratagem. To say it is not true in all cases, is saying too much; but this we do assert, that as a [270]
general principle it is quite false, and we prove it in this way: water has its motion, more or less, from the power of the wind; it is acted upon in the mass, and thus divided into separate waves, and these individually have their surface ruffled, which renders them incapable of receiving reflection. The exception to this will be, where the heaving of the sea is the result of some gone-by storm, when the wind is hushed, and the surface becomes bright and glassy. In this state, reflections are distinctly seen. Another exception will be in the hollow portion of the waves, as they curl over, and dash upon the shore."

As viridian, like the sea, is naturally "liquid and thin, bright and glassy," the extract we have quoted from Mr. Penley, points to this green as a pigment peculiarly adapted for marine painting; in which, it may be added, its perfect permanence and transparency will be appreciated in glazing. Its fitness for foliage has been remarked; but in draperies the colour will prove equally useful, and in illumination will be found unrivalled. In the last branch of art, indeed, viridian stands alone, not only through its soft rich brilliancy, but by the glowing contrast it presents with other colours: employed as a ground, it throws up the reds, &c., opposed to it, in a marvellous manner. Like the three preceding oxides of chromium, viridian neither injures nor is injured by [271]
other pigments; is unaffected by light, damp, or impure air; and is admissible in fresco. In enamelling it cannot be used; the colour, depending on the water of hydration, being destroyed by a strong heat.

COPPER GREENS

are commercially known as *Emerald Green*, *Malachite Green*, *Scheele's Green*, *Schweinfurt Green*, *Verdigris*, *Green Bice*, *Green Verditer*, *Brunswick Green*, *Vienna Green*, *Hungary Green*, *Green Lake*, *Mineral Green*, *Patent Green*, *Mountain Green*, *Marine Green*, *Saxon Green*, *French Green*, *African Green*, *Persian Green*, *Swedish Green*, *Olympian Green*, *Imperial Green*, *Mitis Green*, *Pickle Green*, &c.

The general characteristics of these greens are brightness of colour, well suited to the purposes of house-painting, but seldom adapted to the modesty of nature in fine art; considerable permanence, except when exposed to the action of damp and impure air, which ultimately blacken most of them; and good body. They have a tendency to darken by time, dry well as a rule in oil, and are all more or less poisonous, even those not containing arsenic.

179. EMERALD GREEN,

Schweinfurt Green, *Vienna Green*, *Imperial Green*, *Brunswick Green*, *Mitis Green*, &c., is a
cupric aceto-arsenite, prepared on the large scale by mixing arsenious acid with acetate of [272]
copper and water. It differs from Scheele's Green, or cupric arsenite, in being lighter, more vivid, and more opaque. Powerfully reflective of light, it is perhaps the most durable pigment of its class, not sensibly affected by damp nor by that amount of impure air to which pictures are usually subject: indeed it may be ranked as permanent both in itself and when in tint with white. It works better in water than in oil, in which latter vehicle it dries with difficulty. Bearing the same relation to greens generally as Pure Scarlet bears to reds, its vivid hue is almost beyond the scale of other bright pigments, and immediately attracts the eye to any part of a painting in which it may be employed. Too violent in colour to be of much service, it has the effect, when properly placed, of toning down at once, by force of contrast, all the other greens in a picture. If discreetly used, it is occasionally of value in the drapery of a foreground figure, where a bright green may be demanded; or in a touch on a gaily painted boat or barge. When required, no mixture will serve as a substitute. Compounded with aureolin, it becomes softened and semi-transparent, yielding spring tints of extreme brilliancy and beauty.

180. SCHEELE'S GREEN,

or *Swedish Green*, resembles the preceding variety in being a compound of copper and arsenic, [273]
and therefore rankly poisonous; but differs from it in containing no acetic acid, in possessing less opacity, and in having a darker shade. It is a cupric arsenite, with the common attributes of emerald green, under which name it is sometimes sold. Of similar stability, it must not be employed with the true Naples yellow or antimoniate of lead, by which it is soon destroyed.

Upon the lavish use of this dangerous pigment in colouring toys, dresses, paper-hangings, artificial leaves, and even cheap confectionery, it is not our province to enlarge: the constant-recurring diseases and deaths, which, directly or indirectly, result from the employment of arsenical pigments, are such every-day facts that they are merely deplored and forgotten. With arsenic on our heads, our clothes, our papers, our sweets, our children's playthings, we are so accustomed to live—and die—in a world of poison, that familiarity with it has bred contempt. Into the fatal popularity, therefore, of arsenical colours for decorative purposes, we shall not further enter; but it behoves us to deprecate their presence, and the presence of all poisonous pigments, in colour-boxes for the young. It is one of the pleasures of childhood to suck anything attractive that comes in its way, openly if allowed, furtively otherwise: and as in early life we have a preference for brilliancy, so vivid a pigment as Scheele's green is an object of special attention. [274] Artistically, it matters little whether a pigment is noxious or not, but we hold that poison should not be put into the hands of the young; and indeed are of opinion that a box of colours is about the worst present a child can receive.

181. MALACHITE GREEN,

or *Mountain Green*, is met with in Cumberland, and is also found in the mountains of Kernhausen, whence it is sometimes called *Hungary Green*. It is prepared from malachite, a beautiful copper ore employed by jewellers, and is a hydrated dicarbonate of copper, combined with a white earth, and often striated with veins of mountain blue, to which it bears the same relation that green verditer bears to blue verditer. The colour, which may be extracted from the stone by the process followed for native ultramarine, varies from emerald-green to grass-green, and inclines to grey. It has been held in great esteem by some, and considered strictly stable, on the assumption, probably, that a pigment obtained from a stone like ultramarine, and by the same method, could not be otherwise than permanent. That it is so, with respect to light and air, there is no denying; but the green, when separated from the ore and purified for artistic use, is merely a carbonate of copper, and therefore subject to the influence of damp and impure air, in [275] common with other non-arsenical copper colours. As a pigment, native malachite green has the same composition, or very nearly the same, as that which can be artificially produced, and answers to the same tests. Water-rubs of the two varieties which we exposed to an atmosphere of sulphuretted hydrogen became equally blackened by the gas. Practically, there is little or no difference between them: both preserve their colour if kept from damp and foul air, both are injured by those agents, and both are liable to darken in time, especially when secluded from light. The artificial, however, can be obtained of a much finer colour than the natural, which it may be made to resemble by admixture with mineral gray. On the whole, they can scarcely be recommended for the palette, and are certainly inferior in durability to Scheele's and Schweinfurt greens. In fresco painting they have been pronounced admissible; but, apart from the question of damp, we should deem the conjunction of lime with carbonate of copper not favourable to permanence. By the action of alkalies, even the native green malachite may be converted into blue; and it becomes a question whether the dingy greenish-blue on some ancient monuments was not originally malachite green.

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182. VERDIGRIS, [276]

or *Viride Æris*, is of two kinds, common or impure, and crystallized or *Distilled Verdigris*, or, more properly, refined verdigris. The best is made at Montpellier in France, and is a sub-acetate of copper of a bright green colour inclining to blue. The least durable of the copper greens, it soon fades as a water-colour by the action of light, &c., and becomes first white and ultimately black by damp and foul gas. In oil, verdigris is permanent with respect to light and air, but moisture and an impure atmosphere change its colour, and cause it to effloresce or rise to the surface through the oil. It dries rapidly, and is exceptionally useful with other greens or very dark colours. In varnish it stands better; but cannot be considered safe or eligible, either alone or compounded. Vinegar dissolves it, forming a solution used for tinting maps, and formerly much employed for colouring pickles, &c.

The painters, who lived at the time when the arts were restored in Italy, used this pigment; and the bright greens seen in some old pictures are made by glazings of verdigris. It is often largely adulterated with chalk and sulphate of copper. [277]

183. MIXED GREEN

Green, being a compound of blue and yellow, may be got by combining those colours in the several ways of working—by mixing, glazing, hatching, or otherwise blending them in the proportions of the various hues required. To obtain a *pure* green, which consists of blue and yellow only, a blue should be chosen tinged with yellow rather than with red, and a yellow tinged with blue. If either a blue or a yellow were taken, tinged with red, this latter colour would go to produce some grey in the compound, which would tarnish the green. The fine nature-like greens, which have lasted so well in some of the pictures of the Italian schools, appear to have been compounded of ultramarine, or ultramarine ashes and yellow. Whatever pigments are employed on a painting in the warm yellow hues of the foreground, and blue colouring of the distance and

sky, are advantageous for forming the greens in landscape, &c., because they harmonize better both in colouring and chemically, and impart homogeneity to the whole: a principle conducive to a fine tone and durability of effect, and applicable to all mixed tints. In compounding colours, it is desirable not only that they should agree chemically, but that they should have, as far as possible, the same degree of durability. In these respects, aureolin and ultramarine, gamboge [278]
and Prussian blue, Indian yellow and indigo, are all judicious mixtures, although not all to be recommended.

PERMANENT YELLOWS.	**PERMANENT BLUES.**
Aureolin.	Cerulian Blue.
Cadmium Yellow, pale.	Cobalt Blue.
Cadmium Yellow, deep.	Genuine Ultramarine.
Lemon Yellow.	Brilliant Ultramarine.
Mars Yellow.	French Ultramarine.
Naples Yellow, modern.	New Blue.
Ochres.	Permanent Blue.
Orient Yellow.	
Raw Sienna.	

The foregoing yellows and blues are in no wise inimical to each other, and yield the best mixed greens, chemically considered, the palette can afford. In an artistic sense, we confess, the result is not so satisfactory: the list of blues, it must be admitted, being somewhat scant. Among the latter there is no pigment with the wonderful depth, richness, and transparency of Prussian blue, and none consequently which will furnish with yellow a green of similar quality. That the artist, therefore, will dispense with Prussian blue, it would be too much to expect. There is, however, less necessity for it since the introduction of viridian, a green resembling that which is produced by admixture of Prussian blue and yellow, and which may be varied in hue by being compounded with aureolin or ultramarine. Our object in this work is to give precedence to the [279]
chemical rather than the artistic properties of pigments, to separate the strictly stable from the semi-stable, and the semi-stable from the fugitive. A colour or a mixture may be chemically bad but artistically good, and vice versâ; but the chemist looks upon no pigment or compound with favour unless it be perfectly permanent, and ignores its mere beauty when void of durability. Hence, all artistic considerations are set aside in our lists of permanent pigments: if it be possible to use them alone, so much the better for the permanence of painting; if not, so much the worse will it be, according to the degree of fugacity of the colours employed.

184. BRONZE,

and the three succeeding varieties, are greens resembling each other in being semi-stable, and more or less transparent. Bronze is a species of Prussian green, of a dull blue-black hue. In its deep washes it appears a greenish-black with a coppery cast. It is used in ornamental work, and sometimes as a background tint for flower pieces.

185. CHROME GREENS,

commonly so called, are compounds of chromate of lead and Prussian blue, a mixture which is
also known as *Brunswick Green*. Fine bright greens, they are suited to the ordinary purposes of [280]
mechanic painting, but are quite unfit for the artist's craft, chrome yellow reacting upon and ultimately destroying Prussian blue when mixed therewith. For the latter, cheap cobalts and ultramarines are preferably substituted, although they do not yield greens of like power and intensity.

Under the names of English Green, Green Cinnabar, &c., 'new' green pigments have been from time to time introduced, which have turned out mixtures of Prussian blue and chromate of lead; not made, however, by compounding the two, but directly by processes similar to the following:—A mixed solution of the acetates of lead and iron is added to a mixed solution of the yellow prussiate and chromate of potash, the necessary acetate of iron being obtained by precipitating a solution of acetate of lead by sulphate of iron, and filtering the supernatant liquid. Or; to a solution of Prussian blue in oxalic acid, first chromate of potash is added, and then acetate of lead.

By the last process, superior and more permanent chrome greens may be produced, free from lead, by using chloride of barium or nitrate of bismuth in place of the acetate of lead. Chromate of baryta, or chromate of bismuth is then formed, neither of which acts on the Prussian blue.

It should be added that where the latter pigment is present, no green will serve for painting [281]
walls containing lime, as its action alters the tint of the Prussian blue.

186. HOOKER'S GREEN

is a compound of Prussian blue and gamboge, two pigments possessing a like degree of stability, and perfectly innocuous to each other. It is a mixture more durable and more transparent than chrome greens made with chromate of lead. There are two varieties in common use—No. 11, a light grass green, in which the yellow predominates; and No. 22, a deeper and more powerful green, with a larger amount of blue.

187. PRUSSIAN GREEN,

like the preceding, is composed of Prussian blue and gamboge; but contains a very great excess of the former, and is therefore a bluish-green of the utmost depth and transparency, verging on black in its deep washes. Yellow ochre may be employed instead of gamboge, but is not so eligible.

A true Prussian green, which has been recommended as a pigment, can be produced as a simple original colour, with a base wholly of iron. It is got by partially decomposing the yellow oxalate of protoxide of iron with red prussiate of potash. We have made this green and given it a fair trial, but our verdict is decidedly against it. In colour it is far from being equal to a good [282] compound of Prussian blue and gamboge, and it assumes a dirty buff-yellow on exposure to light and air, the film of blue on the oxalate more or less disappearing.

Another Prussian green, with a base of cobalt, is obtained by precipitating the nitrate of that metal with yellow prussiate of potash. According to the mode adopted, and the degree of heat, either a light or dark green results; but this also is inferior in colour, and presents no advantage as to permanence.

188. SAP GREEN,

Verde Vessie, or *Iris Green*, is a vegetal pigment prepared from the juice of the berries of the buckthorn, the green leaves of the woad, the blue flowers of the iris, &c. It is usually preserved in bladders, and is thence sometimes called *Bladder Green*. When good, it is of a dark colour and glossy fracture, extremely transparent, and a fine natural yellowish green. This gummy juice, inspissated and formed into a cake, is occasionally employed in flower painting. It is, however, a very imperfect pigment, disposed to attract the moisture of the atmosphere, and to mildew; while, having little durability in water and less in oil, it is not eligible in the one and is totally useless in the other.

Similar pigments, obtained from coffee-berries, and named Venetian and Emerald Greens, [283] are of a colder colour, equally defective and fugitive, and now obsolete.

189. TERRE VERTE,

or *Green Earth*, is a sober bluish green with a grey cast. It is a species of ochre, containing silica, oxide of iron, magnesia, potash, and water. Not bright and of little power, it is a very durable pigment, being unaffected by strong light or impure air, and combining with other colours without injury. It has not much body, is semi-transparent, and dries well in oil. Veins of brownish or reddish ochre are often found mixed with terre verte, to the detriment of its colour; and there are varieties of this pigment with copper for their colouring matter, which, although generally brighter, are inferior in other respects, and not true terre vertes. Verona Green and Verdetto or Holy Green, are ferruginous native pigments of a warmer hue. These are met with in the Mendip Hills, France, Italy, and the island of Cyprus, and have been used as pigments from the earliest times. Rubens has availed himself much of terre verte, not in his landscapes merely, but likewise in the carnation tints in his figures of a dead Christ. It is evident that much of the glazing is done with this colour: it is, in fact, most useful in glazing; because, having only a thin substance, it can [284] be rendered pale by a small portion of white; although in the end it becomes darker by a concentration of its molecules. Mérimée states that in the greater part of Alexander Veronese's works—in his Death of Cleopatra, in the Louvre, for instance—there are some demi-tints which are too green, and which it is certain were not so originally. Terre verte, therefore, must be employed with caution; and it would be well to ascertain beforehand whether a mineral colour will in time become darker than when first laid on the picture, by putting a drop of oil on the powder in its natural state. If the tone this gives to it be more intense than that which it acquires by being ground up, it may fairly be assumed that it will attain to the same degree of strength whenever, having completely dried, its molecules shall have re-united as closely as it is possible. Umber and terra di Sienna are of this class.

In combination with Indian red and Naples yellow, terre verte forms a series of mild russet greens, of much use in middle distance.

190. *Chrome Arseniate*

is an agreeable apple-green colour, prepared from arseniate of potash and salts of chromic oxide. It is durable, but possesses no advantages over the chrome oxides, and is of course poisonous.

191. *Cobalt Green,* [285]

Rinman's Green, Vert de Zinc or Zinc Green. True cobalt green is made by igniting a very large quantity of carbonate of zinc with a very small quantity of carbonate of cobalt. To give a green tint to an enormous proportion of the former, an inappreciable amount of the latter will suffice. Some samples which were analysed, consisted almost entirely of zinc, there being only two or three per cent. of cobalt present. This green presents an example of a pigment being chemically good and artistically bad, or at least indifferent. It is a moderately bright green, apt to vary in hue according to the mode of manufacture, permanent both alone and compounded, but so sadly deficient in body and power, as to have become almost obsolete. With other physical defects, and a colour inferior to the chrome oxides, cobalt green has never been a favourite with artists, though justly eulogised by chemists.

192. *Copper Borate*

is obtained by precipitating sulphate of copper with borax, washing the residue with cold water, and, after drying, igniting it, fusion being carefully avoided. In this manner, a pretty yellowish green is produced, which upon longer ignition assumes a dark green shade: the mass is levigated [286] for use. The compound has the objection of being glassy, and possessing little body, but is preferable to verdigris as to permanence.

193. *Copper Chrome*

may be prepared by several methods, but the colour is in no case so fine as Scheele's or Schweinfurt green, nor is it as stable.

194. *Copper Stannate,*

or Tin-Copper Green, equals in colour any of the copper greens free from arsenic. The cheapest way of making it is to heat 59 parts of tin in a Hessian crucible with 100100 parts nitrate of soda, and dissolve the mass when cold in a caustic alkali. To the clear solution, diluted with water, a cold solution of sulphate of copper is added: a reddish-yellow precipitate falls, which on being washed and dried, becomes a beautiful green. On the palette it would be superfluous, but for common purposes might be found of service.

195. *Elsner's Green*

is also a combination of tin and copper. It is made by adding to a solution of sulphate of copper a decoction of fustic, previously clarified by a solution of gelatine. To this mixture are added ten or [287] eleven per cent. of protochloride of tin, and lastly an excess of caustic potash or soda. The precipitate is then washed and dried, whereupon it takes a green colour tinged with blue, but without the brightness or durability of the preceding stannate.

196. *Green Bice,*

or Green Verditer, is the same in substance as blue verditer, which is converted into green verditer by boiling. This pigment is one of the least eligible of copper greens.

197. *Green Ochre.*

By partially decomposing yellow ochre with prussiate of potash, we have produced a fine dark blue-green, resembling Prussian green, of great depth and transparency. There are, however, difficulties in the process; and the results do not warrant us in pronouncing this green superior or equal to a mixture of the ochre and Prussian blue.

198. *Green Ultramarine*

is French or artificial ultramarine before the final roasting. It is a somewhat bright bluish-green, becoming a dull greenish-blue on continued exposure. Chemically, it is not a bad colour; but artists generally have decided against it.

199. *Manganese Green*, [288]

or Cassel Green. By several methods, manganate of baryta may be obtained either as an emerald-green, a bluish-green, or a pale green. The manganates, however, are decomposed by contact with organic matter; and hence the green would be liable to suffer from the vehicles employed, as well as by being compounded with animal or vegetal pigments.

200. *Mineral Green*

is the commercial name of *Green Lakes*, prepared from sulphate of copper. These vary in hue and shade, have all the properties of the common non-arsenical copper-greens, and, not being subject to change of colour by oxygen and light, stand the weather well, and are excellent for the use of the house-painter, &c. Having a tendency to darken and blacken by time and foul air, they are not eligible in the nicer works of fine art.

Another Mineral Green adopted in Germany as a substitute for the poisonous Schweinfurt green, is composed of chromate of lead, carbonate of copper, oxide of iron, and chalk. Valueless for the palette, it has not the beauty of Schweinfurt green, but is recommended as being free from arsenic. It is not, however, altogether harmless, and should not be used in confectionery or [289] the like.

201. *Molybdenum Green.*

A clear malachite green colour, when dried, is produced from molybdate of soda and potash-chrome-alum, or from the molybdate and alum with ammonia. Being more expensive than the chrome oxides and not better, its introduction, for use by artists, would be attended with no advantage.

There is likewise obtainable a copper molybdate, by adding neutral molybdate of soda in excess to sulphate of copper. The precipitate is a very pale green colour, flocculent at first, but crystalline after washing. Like the chrome molybdate it would be superfluous as a pigment.

202. *Quinine Green*

is rather adapted for a dye than an artist-colour. It is furnished by acting on quinine with hypochlorite of lime, hydrochloric acid, and ammonia, successively. Thus prepared, the green resembles a resin, insoluble in water, but soluble in alcohol, and turned blue by acetic acid. Its alcoholic solution dyes silk green, and also woollen and cotton when mordanted with albumen.

203. *Roman Green*, [290]

brought from Rome some years back by a President of the Royal Academy, appeared to be a mixture of Prussian blue and Dutch or Italian pink. It was a fugitive compound, which became blue in fading.

204. *Silicate of Baryta.*

One part of silica heated to whiteness with three parts of baryta, yields a pale green solid mass, permanent, but deficient in colour when ground. It might be employed in enamelling.

205. *Titanium Green*

has been proposed as a substitute for the green arsenical pigments in common use; but, apart from its expense, the colour is very inferior to Scheele's green, &c. Titanium green is a ferrocyanide of that metal, produced by adding yellow prussiate of potash to a solution of titanic acid in dilute hydrochloric acid, and heating the mixture to ebullition rapidly. The dark green precipitate is washed with water acidulated with hydrochloric acid, and dried with great care, since it decomposes at temperatures above 100100°.

206. *Uranium Green* [291]

is an oxide of a deep dull green colour, inclining to olive, and nearly black when in lumps. A durable but unattractive preparation, equalled in permanence and far surpassed in beauty by many cheaper compounds.

207. *Vanadium Green*

falls when ferrocyanide of potassium is added to vanadic acid dissolved in a strong acid. It is a beautiful green precipitate, but at present simply a curiosity, owing to the rarity of the metal vanadium.

Adopting our usual custom of separating the wheat from the chaff, we point to the opaque and transparent oxides of chromium, Veronese green, viridian, emerald green, Scheele's green, and terre verte, as more or less worthy of being dubbed durable.

As semi-stable, malachite green, bronze, Hooker's green, and Prussian green, must be classed.

Verdigris, chrome greens, and sap green, should be branded as fugitive: the chrome greens, because they are always commercially composed of chromate of lead and Prussian blue, two compounds which are semi-stable in themselves, but become fugacious when compounded. [292]

A reference to the numbered italicised greens will show that there are many not known to the palette, which are nevertheless very greatly superior, as regards permanence, to some that disgrace it. Why these latter are suffered to hold their position is a mystery not easily explained: it is hard to reconcile the deplored degeneracy of modern pigments with the popularity of semi-stable and fugitive colours. Pictures do not stand, is the common cry; therefore, says the public, there are no good pigments now-a-days. To which we answer, newly built houses are constantly falling down; therefore there are no good bricks in these times. Of a truth, one conclusion is as reasonable as the other: in either case, if rotten materials be used, the result cannot be lasting; but in neither case does it follow, because such materials are employed, that there are no better obtainable. A well-built house implies a conscientious builder, and a well-painted picture implies a conscientious artist. It is because, we fear, that there are so few conscientious artists, that there are so few permanent paintings; not, certainly, because there are no good pigments. In this last belief, however, the public is encouraged by certain painters, who seek thereby to excuse their own shortcomings, forgetting that it is a bad workman who finds fault with his tools. It has [293]
been well observed that when artists speak regrettingly of lost 'systems,' or pigments enjoyed by the mediævalists and unattainable now, it would be far better were they to make the best use of existing materials, and study their further development. There is no need for this cant cry of fugacity, which casts such a blight on modern art. Durable pigments are not yet obsolete, they have only to be employed and employed properly to furnish paintings equal in permanence to those of the old masters. "Titian," says Haydon, "got his colours from the colour shops on the Rialto, as we get ours from Brown's; and if Apelles or Titian were living now, they would paint just as good works with our brushes and colours as with their own."

CHAPTER XIII. [294]

ON THE SECONDARY, PURPLE.

Purple, the third and last of the secondary colours, is composed of *red* and *blue*, in the proportions of five of the former to eight of the latter; proportions which constitute a perfect purple, or one of such a hue as will neutralize and best contrast a perfect yellow, in the ratio of thirteen to three, either of surface or intensity. When mixed with its co-secondary colour, green, purple forms the tertiary *olive*; and, when compounded with the remaining secondary, orange, it constitutes in like manner the tertiary *russet*. Of the three secondary colours it is the coolest, as well as the nearest in relation to *black* or shade; in which respect, and in never being a warm colour, it resembles blue. In other respects also, purple partakes of the properties of blue, which is its archeus, or ruling colour; hence it is to the eye a retiring colour, that reflects light little, and loses rapidly in power in a declining light, and according to the distance at which it is viewed. By [295] reason of its being the mean between black and blue it becomes the most retiring of all positive colours. Nature employs this hue beautifully in landscape, as a sub-dominant, in harmonizing the broad shadows of a bright sunshine ere the light sinks into deep orange or red. Girtin, who saw Nature as she is, and painted what he saw, delighted in this effect of sunlight and shadow. As a ruling colour, whether in flesh or otherwise, purple is commonly too cold, or verges on ghastliness, a fault which is to be as much avoided as the opposite extreme of viciousness in colouring, stigmatized as foxiness.

Yet, next to green, purple is the most generally pleasing of the consonant colours; and has been celebrated as a regal or imperial colour, as much perhaps from its rarity in a pure state, as from its individual beauty. Romulus wore it in his trabea or royal mantle, and Tullus Hostilius, after having subdued the Tuscans, assumed the pretexta or long robe, broadly striped with purple. Under the Roman emperors, it became the peculiar emblem or symbol of majesty, and the wearing of it by any who were not of the Imperial family, was deemed a "treasonable usurpation," punishable by death. At the decline of the empire, the Tyrian purple was an important article of commerce, and got to be common in the clothing of the people. Pliny says, "Nepos Cornelius, who died in the reign of Augustus Cæsar, when I was a young man, assured me that the light violet [296] purple had been formerly in great request, and that a pound of it usually fetched 100 denaria (about £4 sterling): that soon after the tarentine or reddish purple came into fashion; and that this was followed by the Tyrian dibapha, which could not be bought for less than 1000 denaria (nearly £40 sterling) the pound; which was its price when P. Lentulus Spinter was Ædile, Cicero being then Consul. But afterwards, the double-dyed purple became less rare, &c." The Tyrian purple alluded to was obtained from the purpuræ, a species of shell-fish adhering to rocks and large stones in the sea adjoining Tyre. On account, probably, of its extreme costliness, it was frequently the custom to dye the cloth with a ground of kermes or alkanet, previous to applying the Tyrian purple. This imparted to the latter a crimson hue, and explains doubtless the term, double-dyed. The Greeks feigned the ancient purple to be the discovery of Hercules Tyrius, whose dog, eating by chance of the fish from which it was produced, returned to him with his mouth tinged with the dye. Alexander the Great is said to have found in the royal treasury, at the taking of Susa, purple to the enormous value of 5000 talents,[A] which had lain there one hundred [297] and ninety-two years, and still preserved its freshness and beauty.

When inclining to red, purple takes the name of *crimson*, &c.; and when leaning to blue, the names of *violet*, *lilac*, *mauve*, *&c.* Blue is a colour which it serves to mellow, or follows well into shade. The contrast or harmonizing colour of purple is yellow on the side of light and the primaries; while purple itself is the harmonizing contrast of the tertiary *citrine* on the side of shade, and less perfectly so of the semi-neutral *brown*. As the extreme primaries, blue and yellow, when either compounded or opposed, afford, though not the most perfect harmony, yet the most pleasing consonance of the primary colours; so the extremes, purple and orange, yield the most pleasing of the secondary consonances. This analogy extends likewise to the extreme tertiary and semi-neutral colours, while the mean or middle colours furnish the most agreeable contrasts or harmonies.

In nature pure purple is not a common colour, and on the palette purple pigments are singularly few. They lie under a peculiar disadvantage as to apparent durability and beauty of colour, owing to the neutralizing power of yellowness in the grounds upon which they are laid; as well as to the general warm colour of light, and the yellow tendency of almost all vehicles and varnishes, by which the colour of purple is subdued.

208. BURNT CARMINE [298]

is the carmine of cochineal partially charred till it resembles in colour the purple of gold, for which, in miniature and water-painting, it is substituted. It is a magnificent reddish purple of extreme richness and depth, eligible in flower-painting and the shadow of draperies. As it is generally impossible, however, to alter the nature of a pigment by merely changing its colour, burnt carmine is scarcely more permanent than the carmine from which it is produced. If used, therefore, it should be in body, and not in thin washes or as a glaze. Durable pigments are admissible in any form; but semi-stable pigments (gamboge excepted) should only be employed in body.

209. BURNT LAKE

holds the same relation to crimson lake as burnt carmine to ordinary carmine; and is hence a weaker variety of the preceding, with less richness, and likewise less permanence.

210. INDIAN PURPLE

is prepared by precipitating an extract of cochineal with sulphate of copper. It is a very deep-toned but rather cold and subdued purple, neither so red nor so brilliant as burnt carmine; and is chiefly of service in draperies. It is apt to lose its purple colour in a great measure on exposure to [299] light and air, and assume an inky blackness; a defect which becomes less apparent when the pigment is used in bulk.

211. MARS VIOLET,

Violet de Mars, *Purple Ochre*, or *Mineral Purple*, is a dark ochre, native of the Forest of Dean in Gloucestershire. It is of a murrey or chocolate colour, and forms cool tints of a purple hue with white. It is of a darker colour than Indian red, which has also been classed among purples, but has a similar body and opacity, and generally resembles that pigment. It may be prepared artificially, and some natural red ochres burn to this colour. Being difficult and sometimes impossible to procure, Mars violet is often compounded; in which case it is liable to vary both in hue and stability. As, however, Indian red is always taken for its basis, the mixture is never wholly fugitive, nor exhibits any very glaring contrast on exposure.

212. MIXED PURPLE.

Purple being a secondary colour, composed of *blue* and *red*, it follows of course that any blue and red pigments, which are not chemically at variance, may be employed in producing mixed purples of any required hue, either by compounding or grinding them together ready for use, or by combining them in the various modes of operation in painting. In such compounding, the more [300] perfect and permanent the original colours are, the more perfect and permanent will be the purple obtained. To produce a pure purple, neither the red nor the blue must contain or incline to yellow; while to compound a durable purple, both the red and the blue must be durable also. Ultramarine and the reds of madder yield beautiful and excellent purples, equally stable in water or oil, in glazing or tint, whether under the influence of light or impure air. Cobalt blue and madder red likewise afford good purples; and some of the finest and most delicate purples in ancient paintings appear to have been composed of ultramarine and vermilion, which furnish tints equally permanent, but less transparent than the above, and less easily compounded. Facility of use, and other advantages, are obtained at too great a sacrifice by the employment of perishable mixtures, such as the lakes of cochineal with indigo.

PERMANENT REDS.	**PERMANENT BLUES.**
Cadmium Red.	Cerulian Blue.
Liquid Rubiate.	Cobalt Blue.
Madder Carmine.	Genuine Ultramarine.
Rose Madder.	Brilliant Ultramarine.
Mars Red.	French Ultramarine.
Ochres.	New Blue.
Vermilions.	Permanent Blue.

It should be noted that all the above reds do not afford pure purples with blue; those which [301] contain more or less yellow, as cadmium red and orange vermilion, furnish purples partaking more or less of olive, which is a compound of purple and green. To those reds may be added the russet Rubens Madder and the marrone Madder Brown, two pigments which are alike eligible for mixed purple and mixed orange. No purple, it will be remarked, equal in gorgeous richness to that produced from crimson lake and Prussian blue is obtainable from the colours given; just as no mixed green is of such depth and power if that blue be wanting as a constituent. But, as our compound tints are given rather as examples of durability than beauty, all semi-stable or fugitive mixtures are of necessity ignored.

213. PURPLE MADDER,

Field's Purple, or *Purple Rubiate*, is the only durable organic purple the palette possesses. Marked by a soft subdued richness rather than by brilliancy, it leans somewhat towards marrone, and affords the greatest depth of shadow without coldness of tint. Unfortunately, in the whole range of artistic pigments there is no colour obtainable in such small quantity as madder purple; hence its scarcity and high price cause it to be confined to water-colour painting, in which the clearness and beauty of its delicate tones render it invaluable in every stage of a drawing. With raw Sienna and indigo or Prussian blue, subdued by black, it gives beautiful shadow tints, and [302] will be found useful in sky and other effects compounded with cobalt, rose madder, French blue and sepia, yellow ochre and cobalt, lamp black and cobalt, light red, Vandyke brown, burnt Sienna, or aureolin. With great transparency, body, and depth, it is pure and permanent in its tints, neither gives nor sustains injury on admixture, dries and glazes well in oil, works well, and is altogether most perfect and eligible. For fresco it is admirably adapted, being quite uninjured by lime.

There is a lighter and slightly brighter sort, containing less colouring matter and more base, which has all the properties of the above with less intensity of colour. For the sake of cheapness, the purple is sometimes compounded in oil, generally of brown madder and a blue. Provided the latter be stable, transparent, and mix kindly, no greater objection can be taken to this than to the neutral orange of brown madder and yellow ochre.

214. VIOLET CARMINE

is a brilliant bluish purple of much richness, employed in draperies and the like. It is prepared by precipitating an alcoholic extract of the root of the *Anchusa tinctoria*, commonly known as alkanet, a plant growing in the Levant, and some other warm countries. It was used by the ancients as a dye, or as a groundwork to those stuffs which were to be dyed purplish-red: the [303] ladies in ancient times also employed it as a paint. Its colouring matter or *anchusin* has the character of a resin, and is dark-red, softened by heat, insoluble in water, soluble in alcohol and alkalis, and freely so in ether, fats, and volatile oils, to all of which it imparts a brilliant red hue. To obtain anchusin, all the soluble matters are first abstracted from the bruised root by water: it is then digested in a solution of carbonate of potash, from which it may be readily precipitated by an acid. Its alcoholic solution yields with different reagents crimson, flesh-coloured, blue, and violet precipitates, none of which, however, can be classed as durable. The variety under notice, violet carmine, resembles the other colours afforded by alkanet in not being able to withstand the action of light. On continued exposure, it loses its beauty and brightness, together with much of its colour, and, like Indian purple, assumes an inky blackness. Hence it is unsuited to permanently pure effects, and should only be used in body.

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215. *Archil Purple.*

Archil may be regarded as the English, cudbear as the Scotch, and litmus as the Dutch name for one and the same substance, extracted from several species of lichens by various processes. [304] These lichens, which are principally collected on rocks adjacent to the sea, are cleaned and ground into a pulp with water, treated from time to time with ammoniacal liquor, and exposed with frequent agitation to the action of the atmosphere. Peculiar principles existing in the lichens are, by the joint instrumentality of the air, water, and ammonia, so changed as to generate colouring matter, which, when perfect, is expressed. Soluble in water and alcohol, this colouring principle yields by precipitation with chloride of calcium a compound known as 'Solid French Purple', a pigment more stable than the archil colours generally, but all too fugitive for the palette.

216. *Bismuth Purple.*

A purple powder is capable of being produced from bismuth by passing chlorine gas through the hydrated oxide suspended in a saturated solution of potash. As soon as the oxide becomes brown-red, the mixture is boiled and the liquid decanted off at once, the residue being immediately washed first with alcohol and then with water. On the whole, the result is not, for an artistic pigment, worth the trouble involved in the preparation.

217. *Burnt Madder* [305]

is obtained by carefully charring madder carmine until it becomes of the hue required. Bearing the same relation to madder carmine as burnt carmine to the carmine of cochineal, burnt madder is a permanent and perfectly unexceptionable pigment. By reason, probably, of its great price, it is not mentioned in trade catalogues, and must be held as commercially unknown.

218. *Cobalt Purples*

are obtainable ranging from the richest crimson purple to the most delicate violet. We have produced them by wet and dry methods, varying in brilliancy and beauty, but characterised generally by want of body, and frequently by a smalt-like grittiness. Chemically, good and stable colours, they are not received with favour on the palette, and certainly may be very well replaced by mixtures of cobalt blue and madder red. When a permanent compound is obtainable equal in colour to an original pigment, and superior in its physical attributes, no objection can fairly be taken to its artistic preference. There are other things to be considered in a pigment besides permanence, or even permanence and colour combined. The two together do not constitute a perfect pigment, that is, a material of practical utility and value. In the last chapter, allusion was [306]
made to a green which possesses both the one and the other, and yet is—at present, at least—quite unfitted for artistic use. Hence, with a strong partiality for simple original pigments, we are bound to confess there are cases where mixtures are justifiably preferred. All we contend for is, that each constituent of such mixtures should be stable, and neither give nor receive injury by being compounded.

219. *Gold Purple,*

Purple of Cassius, or Cassius's Purple Precipitate, was discovered in 1683 by Cassius of Leyden. It is a compound of tin and gold, best formed by mixing aqueous perchloride of iron with aqueous protochloride of tin, till the colour of the liquid has a shade of green, and then adding this liquid, drop by drop, to a solution of perchloride of gold, which is free from nitric acid and very dilute: after twenty-four hours the purple is deposited. When recently prepared, the colour is brightened by boiling nitric acid. Not brilliant, but rich and powerful, this purple varies in hue according to the mode of manufacture from deep crimson to murrey or dark purple: it also differs in degrees of transparency. Working well in water, it is an excellent though costly pigment, once popular in miniatures, but at present rarely, if ever used, as purple madder is cheaper, and perfectly well [307]
supplies its place. Retaining its colour at a high red heat, it is now confined to enamel and porcelain painting, and to tinging glass of a fine red. If, whilst in its hydrated state, it be washed with ammonia, a bright purple liquid results, from which a violet colour, somewhat less expensive, can be produced, by combining the gold purple with alumina, and calcining the product in the same way that is practised with cobalt. This compound may be exposed to the action of the sun's rays for a year without being sensibly affected.

220. *Prussian Purple.*

A prussiate of iron is obtainable of a violet hue, affording good shadow tints and clear pale washes. It has not, however, been introduced as a pigment, as ordinary Prussian blue tinged with red furnishes a similar colour.

221. *Sandal Wood Purple.*

Sandal wood contains about 1616 per cent. of colouring matter, soluble with difficultly in water, but readily dissolved by alcohol. From the latter solution, chloride of tin throws down a purple, and sulphate of iron a deep violet precipitate; neither of which is remarkable for permanence.

222. *Tin Violet.* [308]

By heating chromate of stannic oxide to bright redness, a dark violet mass is obtained, which is better adapted to enamel painting than to the palette. It communicates in glazings a variety of tints, from rose-red to violet.

So scant is the number of good purples in common use, that there are but two which can be classed as durable, namely, purple madder and the true Mars violet.

Foremost in the second group stands burnt carmine. As there are different degrees both of permanence and fugacity, so are there different degrees of semi-stability. Burnt carmine, burnt lake, Indian purple, and violet carmine, all belong to this division; but the first certainly is more permanent than the rest.

Rich and beautiful as it is, purple madder cannot be called brilliant; while Mars violet is, of course, ochrous. Unlike green and orange, therefore, purple can point to no original pigment at once vivid and durable: as regards purple, brilliancy implies a semi-stability that borders more or less closely on fugacity. Until the advent of a perfect palette, however, brilliancy and semi-stability will doubtless hold their own. Their present popularity may be seen by a glance at the lists of artist-colours—lists compiled, be it remembered, in obedience to the law of demand and [309] supply. If art were really so much honoured as some of its disciples pretend, none but durable colours would be employed. In our opinion, if a picture be worth painting at all, it is worth painting with permanent pigments; but many evidently think otherwise. Deploring an error neither flattering to the craft they practise nor to themselves, we would urge such to bear in mind this axiom, semi-stable pigments become fugitive when used in thin washes. Even in body they do not preserve their primitive hue, but in glazing and the like, their colour altogether flies or is wholly destroyed.

It is this semi-stability, recommended to the thoughtless and indifferent by the beauty which generally accompanies it, that is the bane of modern art. Even our greatest painters have yielded to its fascination. Who has not gazed upon one of Turner's fading pictures with still more of sadness than enjoyment, that anything so grand, so beautiful, so true, should slowly but surely be passing away? A feeling akin to pity is conjured up at the sight of the helpless wreck, abandoned amid the treacherous materials employed, and sinking deeper and deeper. Mournful, indeed, is that mighty ruin of mind amid matter; mournful the thought that in years to come, the monument sought for will not be found.

FOOTNOTES:

[A] A talent of money, *i.e.*, a talent's weight of silver, was equal to nearly £244.

CHAPTER XIV. [310]

ON THE TERTIARY, CITRINE.

Citrine, or the colour of the citron, is the first of the tertiary class of colours, or ultimate compounds of the primary triad, yellow, red, and blue; in which yellow is the archeus or predominating colour, and blue the extreme subordinate. For citrine being an immediate compound of the secondaries, *orange* and *green*, of both which yellow is a constituent, the latter colour is of double occurrence therein, while the other two primaries enter singly into its composition. The mean or middle hue comprehends eight blue, five red, and six yellow, of equal intensities.

Hence citrine, according to its name, which is that of a class of colours and used commonly for a dark yellow, partakes in a subdued degree of all the powers of its archeus yellow. In estimating, therefore, its properties and effects in painting, it is to be regarded as participating of all the relations of yellow. By some this colour is improperly called brown, as almost all broken [311] colours are. The harmonizing contrast of citrine is a *deep purple*, which may be seen beautifully opposed to it in nature, when the green of summer declines. As autumn advances, citrine tends towards its orange hues, including the colours termed aurora, chamoise, and others before enumerated under the head of yellow. It is the most advancing of the tertiary colours, or nearest in relation to light; and is variously of a tender, modest, cheering character.

To understand and relish the harmonious relations and expressive powers of the tertiary colours, require a cultivation of perception and a refinement of taste for which study and practice are needed. To a great extent the colourist, like the poet, is born not made; but although he must have an innate sense of the beautiful and the true, hard work alone, with his head, his eyes, and his hands, will enable him to learn and turn to account the complex beauties and relations of tertiary colours. They are at once less definite and less generally evident, but more delightful—more frequent in nature, though rarer in common art, than the like relations of the secondaries and primaries. There is very little pure colour in the world: now and then a gleam dazzles us, like a burst of sunshine through grey mists; but as a rule, nature prefers broken colours to absolute hues. Most pure in spring, most full in summer, most mellow in autumn, most sober in winter, [312] her tints and shades of colour are always more or less interlaced, from white and the primaries to the semi-neutral and black.

Of original citrine-coloured pigments there are only a few, unless we include several imperfect yellows which might not improperly be called citrines. The following are best entitled to this appellation:—

223. BROWN PINK,

Brown Stil de Grain, *Citrine Lake*, or *Quercitron Lake* is usually prepared from the berries of Avignon (ramnus infectorius), better known as French, Persian, or Turkey berries; but a more durable and quicker drying species is obtained from the quercitron bark. If produced from the former, it must be branded as fugitive, but if from the latter, it may be termed semi-stable. In either case it is a lake, precipitated from the alkaline decoction by means of alum, in such proportions that the alkali shall not be more than half saturated. The excess of soda or potash employed imparts a brown hue; but the lake being in general an orange broken by green, falls into the class of citrine colours, sometimes inclining to greenness, and sometimes towards the warmth of orange. It works well both in water and oil, in the latter of which it is of great depth and transparency, but its tints with white lead are very fugitive, and in thin glazing it does not [313] stand: the berry variety dries badly. A fine rich colour, more beautiful than eligible, it is popular in landscape for foliage in foregrounds. Modified by admixture with burnt Sienna or gamboge, it yields a compound which, with the addition of a small quantity of indigo, gives a warm though not very durable green. In many of the Flemish pictures the foliage has become blue from the yellowish lake, with which the ultramarine was mixed, having faded.

It has been remarked that the alteration made by time in semi-stable pigments is not so observable when they are employed in full body. Their use generally has been deprecated, but in shadows such vegetable colours as brown pink are sometimes of advantage, as they are transparent, lose part of their richness by the action of the air, and do not become black. Moreover, if mixed with pigments which have a tendency to darken, they mitigate it very much. This last, indeed, is the most legitimate purpose to which semi-stable pigments whose colour fades on exposure can be put.

224. MARS BROWN,

or *Brun de Mars*, is either a natural or artificial ochre containing iron, or iron and manganese. Of much richness and strict permanence, it resembles raw umber in being a brown with a citrine [314] cast, but is generally marked by a flush of orange which is not so observable in the latter pigment.

225. MIXED CITRINE.

What has been before remarked of the mixed secondary colours is more particularly applicable to the tertiary, it being more difficult to select three homogeneous substances of equal powers as pigments than two, that shall unite and work together cordially. Hence the mixed tertiaries are still less perfect and pure than the secondaries; and as their hues are of extensive use in painting, original pigments of these colours are proportionably estimable to the artist. Nevertheless there are two evident principles of combination, of which he may avail himself in producing these colours in the various ways of working; the one being that of combining two original secondaries; and the other, of uniting the three primaries in such a manner that the archeus shall predominate. Thus in the case of citrine, either orange and green may be directly compounded; or yellow, red, and blue be so mixed that the yellow shall be in excess.

These colours are, however, obtained in many instances with best and most permanent effect, not by the intimate combination of pigments upon the palette, but by intermingling them, in the manner of nature, on the canvas, so as to produce the appearance at a proper distance of a [315] uniform colour. Thus composed is the *citrine* colour of fruit and foliage, on inspecting which we distinctly trace the stipplings of orange and green, or of yellow, red, and green. The truth and beauty resulting from such stipplings in art may be seen in the luscious fruit-pieces of the late W. Hunt, where the bloom on the plum, the down of the peach, &c., are given with wondrous fidelity to nature. In the *russet* hues of autumn foliage, where purple and orange have broken or superseded the summer green, this interlacing of colour appears; and also in the *olive* foliage of the rose-tree, formed in the individual leaf by the ramification of purple in green. Besides the durable yellows, reds, and blues, the following orange and green pigments are eligible for mixed citrines. They may likewise, however, be safely and simply compounded by slight additions, to an original brown, of that primary or secondary tone which is requisite to give it the required hue.

PERMANENT ORANGE.	**PERMANENT GREEN.**
Burnt Roman Ochre.	Oxide of Chromium, opaque.
Burnt Sienna.	Oxide of Chromium, transparent.
Cadmium Orange.	Veronese Green.
Mars Orange.	Viridian.

Neutral Orange.	Emerald Green.
	Scheele's Green.
	Terre Verte.

226. RAW UMBER,

or Umber, is a natural ochre, chiefly composed of oxide of manganese, oxide of iron, silica, and alumina. [316] It is said to have been first brought from ancient Ombria, now Spoleto, in Italy. Found in England, and in most parts of the world, that which comes from Cyprus, under the name of Turkish or Levant umber, is the best. Of a quiet brown-citrine colour, semi-opaque, it dries rapidly, and injures no other good pigment with which it may be mixed. By time it grows darker, a disadvantage which may be obviated by compounding it with colours which pale on exposure. For light shadow tones and delicate grays it is extremely useful, and yields with blue most serviceable neutral greens. To mud walls, tints for stone, wood, gray rocks, baskets, yellow sails, and stormy seas, this citrine is suited. Some artists have painted on grounds primed with umber, but it has penetrated through the lighter parts of the work. Mérimée states that there are several of Poussin's pictures so painted; that fine series, "The Seven Sacraments," being clearly among the number.

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227. *Cassia Fistula*

is a native vegetal pigment, though it is more commonly employed as a medicinal drug. It is brought from the East and West Indies in a sort of cane, in which it is naturally produced. As a pigment it is deep, transparent, of an imperfect citrine colour, inclining to dark green, and [317] diffusible in water without grinding, like gamboge and sap green. Once sparingly used in water as a sort of substitute for bistre, it is not now to be met with on the palette.

228. *Citrine Brown.*

From boiling, hot, or cold solutions of bichromate of potash and hyposulphite of soda in excess, we have obtained an agreeable citrine-brown colour, varying in hue and tint according to the mode of preparation and proportions of materials employed. It is a hydrated oxide of chromium which, when washed and carefully dried, yields a soft floury powder. Transparent, and affording clear, delicate pale washes, the oxide has not been introduced as a pigment; partly owing to certain physical objections, and partly to a tendency to greenness. This tendency is peculiar to all the brown chrome oxides of whatever hue, whether hydrated or anhydrous; and indeed distinguishes more or less nearly all the compounds of chromium. Green, in fact, is the natural colour of such compounds, the colour which they are constantly struggling to attain; and hence it is that the green oxides of chromium, being clothed in their native hue, are of such strict stability. The inclination to green which the citrine under notice possesses, may be seen by washing the precipitate with boiling water. It has been supposed that hydrated brown oxide of [318] chromium is not a distinct compound of chromium and oxygen, but a feeble union of the green oxide with chromic acid. If this be the case, the citrine cast of the brown oxide is easily explained, as well as the gradual addition to its green by the deoxidation of the chromic acid.

In mixed tints for autumn foliage and the like, the tendency to green of this citrine brown would be comparatively unimportant; but whether the oxide be adapted to the palette or not, we believe the colour might be utilized. In dyeing, for instance, the solutions of bichromate of potash and hyposulphite of soda would be worth a trial, the liquids of course being kept separate, and the brown washed with cold water. Various patterns could be printed with the bichromate on a ground previously treated with hyposulphite.

Several other browns, and ochrous earths, partake of a citrine hue, such as Cassel Earth, Bistre, &c. But in the confusion of names, infinity of tones and tints, and variations of individual pigments, it is impossible to arrive at an unexceptionable or universally satisfactory arrangement. We have therefore followed a middle and general course in distributing pigments under their proper heads.

Of the three citrines in common use, Mars brown and raw umber are strictly stable; while [319] brown pink, the purest original citrine the palette possesses, is either semi-stable or fugitive, according to the colouring substance used in its preparation.

CHAPTER XV. [320]

ON THE TERTIARY, RUSSET.

Russet, the second or middle tertiary colour, is, like citrine, constituted ultimately of the three primaries, red, yellow, and blue; but with this difference—instead of yellow as in citrine, the archeus or predominating colour in russet is red, to which yellow and blue are subordinates. For *orange* and *purple* being the immediate constituents of russet, and red being a component part of each of those colours, it follows that red enters doubly into russet, while yellow and blue appear but once therein. The proportions of its middle hue are eight blue, ten red, and three yellow, of equal intensities. Thus composed, russet takes the relations and powers of a subdued red; and many pigments and dyes of the latter denomination are strictly of the class of russet colours. In fact, nominal distinction of colours is only relative; the gradation from hue to hue, as from tint to tint, and shade to shade, being of such unlimited extent, that it is impossible to pronounce [321]
absolutely where one hue, tint, or shade ends, and another begins.

The harmonizing, neutralizing, or contrasting colour of russet, is a *deep green*; or when the russet inclines to orange, a *gray* or *subdued blue*. These are often beautifully opposed in nature, being medial accordances or in equal relation to light, shade and other colours, and among the most agreeable to sense.

Russet, as we have said, partakes of the relations of red, but it is a hue moderated in every respect, and qualified for greater breadth of display in the colouring of nature and art; less so, perhaps, than its fellow-tertiaries in proportion as it is individually more beautiful. The powers of beauty are ever most effective when least obtrusive; and its presence in colour should be chiefly evident to the eye that seeks it—not so much courting as being courted.

Of the tertiary colours, russet is the most important to the artist; and there are many pigments classed as red, purple, &c., which are of russet hues. But there are few true russets, and only one original pigment of that colour is now known on the palette, to wit—

229. RUBENS' MADDER,

Orange Russet, *Russet Rubiate*, or *Field's Russet*. This is a very rich crimson russet with a flush
of orange; pure, transparent, and of a middle hue between orange and purple. Prepared from the [322]
madder root, it is not subject to change by the action of light, time, or mixture of other pigments. Although not so much employed as the marrone Madder Brown, it is serviceable both as a local and auxiliary colour in compounding and producing with yellow the glowing hues of autumnal foliage, &c.; and with blue, the beautiful and endless variety of grays in skies, flesh, &c. A good glazing colour, its thin washes afford fine flesh tints in water: as an oil pigment it dries indifferently, and requires to be forced by the addition of a little gold size or varnish. Cappah brown and burnt umber sadden it to the rich tones adapted for general use in shadows. So saddened, this lake meets admirably the dark centres of the upper petals of certain fancy geraniums, while alone its pale washes are equally well suited to the lower leaves.

230. MIXED RUSSET.

What has been remarked in the preceding chapter upon the production of mixed citrine colours, is likewise applicable to mixed russet. By the immediate method of producing it materially from its secondaries, good and durable colours are obtained by compounding the following orange and purple pigments—

PERMANENT ORANGE.	**PERMANENT PURPLE.**	[323]
Burnt Roman Ochre.	Mars Violet, true.	
Burnt Sienna.	Purple Madder.	
Cadmium Orange.		
Mars Orange.		
Neutral Orange.		

Many other less eligible duple and triple compounds of russet are obvious upon principle, and it may be produced by adding red in due predominance to some browns; but these, like most mixtures, are inferior to original pigments. To the orange colours there may be added cadmium red and the orange vermilions, pigments which were classed among the reds, but which contain sufficient yellow to render them adapted for either compound russets or compound citrines. And as of original purple pigments there are two only which are stable, such mixtures as madder red and French blue will help to swell the list of available permanent purples. Rubens' madder itself may be changed in hue by being first mixed with blue and then with orange.

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231. *Prussiate of Copper*

differs chemically from Prussian blue only in having copper instead of iron for its basis. It varies in hue from russet to purple brown, is transparent and deep, but, being very liable to change in colour by the action of light and by other pigments, has never been much used, and is now [324] obsolete. The compound has the objection of containing free prussiate of potash, not removable by continued washing—sometimes as much as five per cent.

There are several other pigments which enter imperfectly into, or verge upon, the class of russet, which, having obtained the names of other classes to which they are allied, will be found under other heads; such are some of the ochres, as Indian red. Burnt carmine is often of the russet hue, or convertible to it by due additions of yellow or orange; as are burnt Sienna and various browns, by like additions of lake or other reds.

The one pigment in this chapter known to the modern palette, Rubens' madder, is permanent.

CHAPTER XVI. [325]

ON THE TERTIARY, OLIVE.

Olive is the third and last of the tertiary colours, and nearest in relation to shade. Like its co-tertiaries, citrine and russet, it is composed of the three primaries, blue, red, and yellow; but is formed more directly of the secondaries, *purple* and *green*, in each of which blue is a constituent: hence blue occurs twice in the latter mode of forming olive, while red and blue enter therein singly and subordinately. Blue is, therefore, in every instance the archeus or predominating colour of olive; its perfect or middle hue comprehending sixteen of blue to five of red and three of yellow. It partakes in a proportionate measure of the powers, properties, and relations of its archeus: accordingly, the antagonist or harmonizing contrast of olive is a *deep orange*. Like blue, olive is a retiring colour, the most so of all the colours, being the penultimate of the scale, or nearest of all in relation to black, and last, theoretically, of the regular distinctions of colours. [326] Hence its importance in nature and painting is almost as great as that of black; it divides the office of clothing the face of creation with green and blue; with both which, as with black and grey, it enters into innumerable compounds and accordances, changing its name as either hue prevails, into green, gray, ashen, slate, &c. Thus the olive hues of foliage are called green, and the purple hues of clouds are called gray, &c.; but such terms are general only, and unequal to the infinite particularity of nature.

This infinity, or endless variation of hue, tint, and relation, of which the tertiaries are susceptible, gives a boundless license to the revelry of taste, in which the genius of the pencil may display the most captivating harmonies of colouring, and the most chaste and delicate expressions; too subtle to be defined, too intricate to be easily understood, and often too exquisite to be felt by the untutored eye. Nature always melodizes by imperceptible gradations, while she harmonizes by distinct contrasts. At different seasons we have blossoms of all hues, variously subordinated; and when the time of flowers may be considered past, as if she had no further use for her fine colours, or were willing to display her ultimate skill and refinement, Nature lavishes the contents of her palette, not disorderly, but in multiplied relations, over all vegetal creation, in those rich and beautiful accordances of broken and finishing colours with [327] which autumn is decorated ere the year decays and sinks into olive darkness.

As a rule, no colour exists in nature without gradation, which is to colours what curvature is to lines. The difference in mere beauty between a gradated and ungradated colour may be seen by laying an even tint of rose-colour on paper, and putting a rose leaf beside it. The victorious beauty of the rose, as compared with other flowers, depends wholly on the delicacy and quantity of its colour gradations, all other flowers being either less rich in gradation, not having so many folds of leaf; or less tender, being patched and veined instead of flushed. It is not enough, however, that colour should be gradated in painting by being made simply paler or darker at one place than another. Generally, colour changes as it diminishes, and is not only darker at one spot, but also purer at one spot than elsewhere; although it does not follow that either the darkest or the lightest spot should be the purest. Very often the two gradations more or less cross each other, one passing in one direction from paleness to darkness, another in another direction from purity to dulness; but there will almost always be both of them, however reconciled. Hence, every piece of blue, say, laid on should be quite pure only at some given spot, from which it must be gradated into blue less pure—greyish blue, or greenish blue, or purplish blue—over all the rest of [328] the space it occupies. In Turner's largest oil pictures, there is not one spot of colour as large as a grain of wheat ungradated; and it will be found in practice that brilliancy of hue, vigour of light, and even the aspect of transparency in shade, are essentially dependent on this character alone; hardness, coldness, and opacity, resulting far more from equality of colour than from nature of colour. Given some mud off a city crossing, some ochre out of a gravel pit, a little whitening, and some coal-dust, and a luminous picture might be painted, if time were allowed to gradate the mud, and subdue the dust. But not with the red of the ruby, the blue of the gentian, snow for the light, and amber for the gold, could such a picture be produced, if the masses of those colours were kept unbroken in purity, and unvarying in depth.

Olive being usually a compound colour both with the artist and mechanic, there are few olive pigments in commerce.

232. MIXED OLIVE

may be compounded in several ways; directly, by mixing green and purple; or indirectly, by adding to blue a smaller proportion of yellow and red, or by breaking much blue with little orange. Cool black pigments, combined with yellow ochre, afford eligible olives; hues which are [329] called *green* in landscape, and *invisible green* in mechanic painting. It is to be noted that in producing these and other compound colours on the palette or canvass, those mixtures will most conduce to the harmony of the performance which are formed of pigments otherwise generally employed in the picture. Thus, presuming aureolin to be the principal yellow used, the same yellow should be chosen for compounding orange and green, or for obtaining indirectly citrine, russet, and olive.

PERMANENT GREEN.	**PERMANENT PURPLE.**
Oxide of Chromium, opaque.	Mars Violet, true.
Oxide of Chromium, transparent.	Purple Madder.
Veronese Green.	
Viridian.	
Emerald Green.	
Scheele's Green.	
Terre Green.	

As in the case of russet, there may be added to the two original purples, mixtures composed of durable reds and blues. There are so many ways of producing the tertiaries, that no difficulty can be found in compounding them with stable pigments. Each tertiary may be represented as follows:—

Citrine	=	Orange	+	Green.
"	=	(Yellow + Red)	+	(Yellow + Blue).
"	=	2 Yellow + Red	+	Blue.
Russet	=	Orange	+	Purple. [330]
"	=	(Yellow + Red)	+	(Red + Blue.)
"	=	2 Red + Yellow	+	Blue.
Olive	=	Green	+	Purple.
"	=	(Yellow + Blue)	+	(Red +Blue.)
"	=	2 Blue + Yellow	+	Red.

From the above equations, and by consulting the lists given of permanent primary and secondary colours, the artist will at once see how easily and safely he may vary his mode of compounding the tertiaries.

233. OLIVE GREEN,

sometimes called *Dewint's Green*, is an arbitrary compound, or mixed green, of a fine deep olive colour and sober richness. Advisedly or not, it is used in landscape, sketching, &c.; but only in water, olive lake supplying its place in oil. Like many other compound pigments, it is either permanent, semi-stable, or fugitive, according to the constituents of which it is composed. Generally speaking, it is more beautiful than durable, and is often decidedly fugacious, fading on exposure. It is impossible for a writer to pronounce an absolute opinion on the stability of all mixtures sold in a separate form, inasmuch as the compounds of one firm may differ from those of another. We have before expressed our dislike to such pigments, and this uncertainty with regard to their composition serves to strengthen it. Nevertheless, as there are exceptions to [331] every rule, it must be admitted that the palette possesses compounds always to be relied upon.

234. OLIVE LAKE

is in commerce exclusively an oil colour. When true, it is a lake prepared from the green ebony, or laburnum, and is of considerable permanence, transparency, and depth, both in water and oil; in which latter vehicle it dries well. This variety, however, may be said to be obsolete; having given way to a mixture, usually semi-stable, and liable to blacken.

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235. *Burnt Verdigris*

is what its name expresses, and is an olive-coloured oxide of copper deprived of acid. It dries remarkably well in oil, is more durable than the original verdigris, and is in other respects an improved and more eligible pigment, although not to be recommended.

236. *Olive Oxide of Chromium.*

An olive oxide of this metal is obtainable, transparent, of strict stability, and altogether superior to any original or compound olive pigment as yet known. Eligible either in water or oil, it is admirably adapted for autumn foliage, where a quiet, subdued, nature-like green is required. It [332] has not, however, been introduced, partly because of its expense, and partly because a mixture of other pigments with the ordinary chrome oxides sufficiently answers the purpose. There are more good colours in the world than are dreamt of in the palette's philosophy, but either they are not wanted, or are too costly to sell. In a great measure, both art and science are dependent on commerce.

237. *Olive Rinman's Green.*

A compound analogous to cobalt green may be made, of an olive hue, with more body, and equally stable.

238. *Olive Scheele's Green.*

Cupric arsenite, when heated, gives off arsenious acid and water, leaving a residue of arsenide of copper and copper arseniate. A series of olive colours is so afforded, which are as durable as their original pigment, and might with advantage be substituted for the doubtful compounds at present in use.

239. *Olive Schweinfurt Green*

is likewise furnished by gentle calcination. It may be directly prepared by mixing boiling aqueous solutions of equal parts of crystallised verdigris and arsenious acid. An olive-green precipitate is [333] immediately formed, which is apt, without due precaution, to pass into an emerald green. A durable copper colour.

240. *Olive Terre Verte.*

We have obtained a very beautiful olive from terre verte by simply changing its hue. In oil, especially, the colour so produced would be found of service for autumn foliage, or richly painted foregrounds. A simple original pigment, consisting wholly of the earth, it resembles ordinary terre verte in being unaffected by strong light or impure air, and uninjured by admixture; but differs from it in not darkening by time. Semi-transparent, of sober richness and drying well in oil, it is, according to its powers, a perfectly unexceptionable colour, of strict stability.

Of the two olive colours in common use, olive lake and olive green, the first is generally semi-stable, and apt to blacken; while the second is usually fugitive, and liable to fade: both are compounds. The palette, therefore, possesses no original olive pigment, good or bad. A glance at the numbered italicised olives will show that the doubtful mixtures referred to might with advantage be superseded. It is clear that the olive pigments which the palette does not know, are better than those with which it is acquainted.

CHAPTER XVII. [334]

ON THE SEMI-NEUTRAL, BROWN.

As colour, according to the regular scale descending from white, ceases properly with the last of the tertiaries, olive, in theory the neutral black would here form a fitting conclusion. Practically, however, every coloured pigment, of every class or tribe, combines with black as it exists in pigments—not simply being deepened or lowered in tone thereby, but likewise defiled in colour, or changed in class. Hence there arises a new series or scale of coloured compounds, having black for their basis, which, though they differ not theoretically from the preceding order inverted, are yet in practice imperfect or impure. These broken compounds of black, or coloured blacks and greys, we have distinguished by the term, semi-neutral, and divided them into three classes: Brown, Marrone, and Gray. What tints are with respect to white, they are with regard to black, being, so to speak, black tints or shades.

The first of the series is Brown, a term which, in its widest acceptation, has been used to [335] include vulgarly every kind of dark broken colour, and is, in a more limited sense, the rather indefinite name of a very extensive class of colours of warm or tawny hues. Accordingly there are browns of every denomination except blue; to wit, yellow-brown, red-brown, orange-brown, purple-brown, citrine-brown, russet-brown, &c. But there is no such thing as a blue-brown, nor, strictly, any other coloured brown in which blue predominates; such predominance of a cold colour at once carrying the compound into the class of gray, ashen, or slate. Brown comprises the hues called dun, hazel, auburn, feuillemort, mort d'ore, &c.; several of which have been already mentioned as allied to the tertiary colours.

The term *brown*, then, denotes rightly a warm broken colour, of which *yellow* is a chief constituent: hence brown is in some measure to shade what yellow is to light. Hence, also, proper quantities of either the three primaries, the three secondaries, or the three tertiaries, produce variously a brown mixture. Browns contribute to coolness and clearness by contrast when opposed to pure colours, and Rubens more especially appears to have employed them upon this principle; although the same may be said of Titian, Correggio, Paulo Veronese, and all the best colourists. Being a sort of intermedia between positive colours and neutrality, browns equally [336] contrast colour and shade. This accounts for their vast importance in painting, and the necessity of preserving them distinct from other colours, to which they give foulness in mixture; and to this is due their use in backgrounds and in relieving of coloured objects.

The tendency in the compounds of colours to run into brownness and warmth is one of the common natural properties of colours which occasions them to deteriorate or defile each other in mixture. Brown by consequence is synonymous with foul or dirty, as opposed to fair or clean; and hence brown, which is the nearest of the semi-neutrals in relation to light, is to be avoided in mixture with light colours. Yet is it an example of the wisdom of nature's Author that brown is rendered, like green, a prevailing hue, and in particular an earth colour, as a contrast which is harmonized by the blueness and coldness of the sky.

This tendency will likewise explain the use of brown in harmonizing and toning, as well as the great number of natural and artificial pigments and colours so called. It was the fertility and abundance of browns that caused our great landscape-colourist Wilson, when a friend went exultingly to tell him that he had discovered a new brown, to check him in his characteristic way, with—"I'm sorry for it: we have gotten too many of them already." Nevertheless, fine transparent browns are obviously very valuable.

If red or blue in excess be added to brown, it falls into the other semi-neutral classes, [337] marrone or gray. The wide acceptation of the term brown has occasioned much confusion in the naming of colours, since broken colours in which red, &c. predominate, have been improperly called brown. That term, therefore, should be confined to the semi-neutral colours, compounded of, or like in hue to, either the primary *yellow*, the secondary orange, or the tertiary *citrine*, with a *black*. The general contrast or harmonizing colour of such compounds will consequently be more or less purple or blue.

The number of browns is great, as may be seen by the following list. This list, however, is good, and includes a considerable proportion of permanent pigments.

241. ASPHALTUM,

Asphalt, *Bitumen*, *Mineral Pitch*, *Jew's Pitch*, *Antwerp Brown*, *Liquid Asphaltum*, &c., is a sort of mineral pitch or tar which, rising liquid to the surface of the Lacus Asphaltites or Asphaltic Lake (the Dead Sea) concretes there by the natural action of the atmosphere and sun, and, floating in masses to the shores, is gathered by the Arabs. The French give it an additional name from the region of the lake, to wit, Bitumen of Judea; and with the English, from the same cause, it has the alias of Jew's pitch. Asphaltum is not so called, however, after the lake, as is asserted by a writer [338] in the Encyclopædia: it is just the reverse—Pliny says, "The Asphaltic lake produces nothing but bitumen (in Greek, asphaltos); and hence its name."

A substance resembling asphalt is found at Neufchâtel in Switzerland, and in other parts of Europe. A specimen of the native bitumen, brought from Persia, and of which the author made trial, had a powerful scent of garlic when rubbed. In the fire it softened without flowing, and burnt with a lambent flame; did not dissolve by heat in turpentine, but ground easily as a pigment in pale drying oil, affording a fine deep transparent brown colour, resembling that of commercial asphaltum; dried firmly almost as soon as the drying-oil alone, and worked admirably both in water and oil. Asphaltum may be used as a permanent brown in water, for which purpose the native is superior to the artificial. The former, however, is now seldom to be met with, the varieties employed on the palette being the residua of various resinous and bituminous matters, distilled for the sake of their essential oils. These residua are all black and glossy like common pitch, which differs from them only in having been less acted upon by fire, and thence in being softer. At present asphaltum is prepared in excessive abundance as a product of the distillation of coal at the gas manufactories, and is chiefly confined to oil-painting, being first dissolved in [339] turpentine, which fits it for glazing and shading. Its fine brown colour and perfect transparency are lures to its free use with many artists, notwithstanding the certain destruction that awaits the work on which it is much employed, owing to its tendency to contract and crack by changes of temperature and the atmosphere; but for which, and a slight liability to blacken, it would be a most beautiful, durable, and eligible pigment. The solution of asphaltum in turpentine, united with drying oil by heat, or the bitumen torrefied and ground in linseed or drying-oil, acquires a firmer texture, but becomes less transparent and dries with difficulty. If common asphaltum, as usually prepared with turpentine, be used with some addition of Vandyke brown, umber, or Cappah brown ground in drying oil, it will gain body and solidity which will render it much less disposed to crack. Nevertheless, asphaltum is to be regarded in practice rather as a dark varnish than as a solid pigment, and all the faults of a bad varnish are to be guarded against in employing it.

It is common to call the solution in turpentine *Asphaltum*, and the mixture with drying-oil *Bitumen*: the latter is likewise known as *Antwerp Brown*. A preparation for the use of water-colour artists is employed under the name of *Liquid Asphaltum*.

242. BISTRE [340]

is extracted by watery solution from the soot of wood fires, whence it derives a strong pyroligneous scent. It is a very powerful citrine-brown, washes well, and has a clearness suited to architectural subjects. Its use is confined to water-colour painting, in which it was much employed by the old masters for tinting drawings and shading sketches, before the general application of Indian ink to such purposes. Of a wax-like texture, it is perfectly durable, but unfitted for oil, drying therein with the greatest difficulty.

A substance of this kind collects at the back of fire-places in cottages where peat is the constant fuel burnt; which, purified by solution and evaporation, yields a fine bistre, similar to the Scotch. All kinds of bistre attract moisture from the atmosphere.

243. BONE BROWN

and *Ivory Brown* are obtained by roasting bone and ivory until by partial charring they become of a brown colour throughout. Though much esteemed by some artists, they are not quite eligible pigments, being bad driers in oil, the only vehicle in which they are now used. Moreover, their lighter shades are not permanent either in water or oil when exposed to the action of strong [341] light, or mixed in tint with white lead. The palest of these colours are the most opaque: the deepest are more durable, and most so when approaching black. Neither bone nor ivory brown is often employed, but the former may be occasionally applied in forming clear, silvery, warm grays, in combination with zinc white.

244. BURNT UMBER

is what its name denotes, and has a deeper shade with a more russet hue than the raw umber. A quiet brown, it affords clear and warm shadows, but is apt to look rather turbid if used in great depth. It washes and works capitally in water, and dries quickly in oil, in which it is employed as a siccative. Perfectly stable in either vehicle, it may sometimes be substituted for Vandyke brown, is eligible in fresco, and invaluable in buildings. Where the lakes of madder require saddening, the addition of burnt umber increases their powers, and improves their drying in oil. It contains manganese and iron, and may be produced artificially. The old Italians called it *falsalo*.

245. CALEDONIAN BROWN

is a permanent native pigment, the use of which is confined to oil. A magnificent orange-russet brown of considerable transparency, it is marked by great depth and richness, and will be found [342] serviceable where a powerful brown of the burnt Sienna class is required.

246. CAPPAH BROWN,

or *Cappagh Brown*, is likewise a colour peculiar to oil. It is a species of bog-earth or peat, mixed with manganese in various proportions, and found on the estate of Lord Audley at Cappagh, near Cork. The specimens in which the peat earth most abounds are of light weight, friable texture, and dark colour; while those which contain more of the metal are heavy and paler.

As pigments, the peaty Cappah brown is the most transparent and rich in colour. A prompt drier in oil, its surface rivels during drying where it lies thick. The other and metallic sort is a more opaque, a lighter and warmer brown pigment, which dries rapidly and smoothly in a body or thick layer. The first may be regarded as a superior Vandyke brown, the second as a superior umber. The two extreme kinds should be distinguished as light and deep Cappah browns; the former excellent for dead colouring and grounds, the latter for glazing and graining. These pigments work well in oil and varnish; they do not, however, keep their place while drying in oil by fixing the oil, like the driers of lead, but run. Under the names of *Euchrome* and *Mineral Brown*, they have been introduced into commerce for civil and marine painting.

247. CASSEL EARTH, [343]

Terre de Cassel, or, corruptly, *Castle Earth*, is specially an oil pigment, similar to burnt umber but of a more russet hue. It is an earth containing bitumen, a substance which, with pit-coal, lignite or brown coal, jet, petroleum or rock oil, naphtha, &c., is looked upon as a product of the decomposition of organic matter, beneath the surface of the earth, in situations where the conditions of contact with water, and almost total exclusion of atmospheric air, are fulfilled. Deposited at the bottom of seas, lakes, or rivers, and subsequently covered up by accumulations of clay and sand, the organic tissue undergoes a kind of fermentation by which the bodies in question are slowly produced. The true bitumens appear to have arisen from coal or lignite by the action of subterranean heat; and very closely resemble some of the products yielded by the destructive distillation of those bodies.

Rich as is the tone of colour of Cassel earth, it is apt to lose this in some measure on exposure to light. Mérimée remembers to have seen a head, the brown hair of which had been painted partly with the earth alone, and partly with a mixture of the earth and white; yet the hair where the white was employed was darker than that painted solely with the brown, the white having [344] fixed the colour. To compensate for its thus fading, it should be mixed with pigments that are permanent, such as umber and lamp black. Like all bituminous earths, it needs the strongest drying oil. By calcination, a greater degree of intensity may be imparted to the colour, and perhaps a little more solidity. In landscapes it is of much service for the most vigorous portions of foregrounds and the trunks of trees, as well as for painting cavernous rocks or deep recesses in architecture. Compounded with burnt lake and a little Prussian blue, it gives a black the most profound.

248. CHALON'S BROWN

is a water-colour pigment, transparent and inclining to red; deep, full, and very rich. On exposure to light it becomes less russet, but is otherwise strictly stable.

249. COLOGNE EARTH,

incorrectly called *Cullen's Earth*, is a native bituminous earth, containing less bitumen than Cassel earth, and therefore drying more quickly. Darker than that variety, it is less transparent, and covers better. In its general qualities it resembles Vandyke brown, except that in combination with white, it affords a range of cooler brown tints. Useful for the shadows of buildings, it does not wash so well as sepia, and is preferred occasionally on that account. By [345]
some it has been called durable, by others branded as fugacious. According to Bouvier, brown hair represented by this colour has been known to disappear in six months, all the brown vanishing, and nothing remaining but a few black lines of the sketch. As it is similar in composition to Cassel earth, the safest course would be to mix it with umber, and not to employ it alone. Calcined, it acquires a reddish hue.

250. INDELIBLE BROWN INK.

Although this cannot be classed as a pigment, yet, being very useful in water-colours, it may be proper to describe its qualities. The ink is a rich brown fluid, and, as its name imports, is indelibly fixed on the paper as soon as it is dry; thus allowing the artist to work or wash over it repeatedly, without its being disturbed. If diluted with water to its faintest tint, it still continues to retain its indelible properties undiminished. It is generally used with a reed pen, and employed chiefly in architectural details and outlines.

Various brown inks, principally solutions of bistre and sepia, were adopted in sketching by Claude, Rembrandt, and many of the old masters. In modern times, a beautiful transparent brown for water-colour artists, known as *Liquid Prout's Brown*, has been extensively employed. This [346]
contains less fixative than the indelible ink, and is the vehicle with which nearly all Samuel Prout's drawings were executed.

251. LEITCH'S BROWN

is a permanent pigment peculiar to water painting. A most beautiful olive brown, soft and rich, it is admirably adapted for autumnal foliage tints and the like, either alone or compounded with burnt Sienna or cadmium orange. Transparent and clear in its washes, this is a most serviceable colour in landscape generally.

252. MIXED BROWN

can be produced in endless variety, either by adding a warm colour to black, such as yellow, orange, or citrine, or else by combining the three primaries, secondaries, or tertiaries in suitable proportions. By consulting the lists given of permanent pigments belonging to those classes, and by referring to the chapter on Black, it will be seen that no difficulty exists in obtaining durable mixed browns when required. For example, there may be formed from the primaries, a compound of aureolin, rose madder, and ultramarine; or from the secondaries, a mixture of cadmium orange, viridian, and madder purple. Of course, as with other mixed tints, the brown hue can be furnished not only by direct compounding of the colours on the palette, but by laying one colour [347]
over the other on the paper or canvass, or by stippling.

253. MUMMY,

Mummy Brown, or *Egyptian Brown*, is a bituminous product mixed with animal remains, brought from the catacombs of Egypt, where liquid bitumen was employed three thousand years ago in embalming. By a slow chemical change, it has combined during so many ages with substances which give it, as a rule, a more solid and lasting texture than simple asphaltum. Generally resembling the latter in its other properties and uses as a pigment, mummy is often substituted for it, being less liable to crack or move on the canvass. It must be remembered, however, that mummy varies exceedingly both in its composition and qualities; and as from its very nature and origin nothing certain can be said of it, but little reliance should be placed on this brown. Mummy belongs to the class of pigments which are either good or bad, according as they turn out. On the whole, we agree with the American artist, who has been more than once quoted in these pages, that nothing is to be gained by smearing one's canvass with a part, perhaps, of the wife of Potiphar. With a preference for materials less frail and of a more sober character, we likewise hold with Bouvier, that it is not particularly prudent to employ without necessity these crumbled [348]
remains of dead bodies, which must contain ammonia and particles of fat in a concrete state and so be more or less apt to injure the colours with which they may be united. The use of mummy is now confined to oil, in which, says Mr. Carmichael, a mixture of mummy and bitumen will dry

and never crack. If this be the case, the compound would be preferable to either separate.

254. PRUSSIAN BROWN

is an iron oxide, containing more or less alumina, and prepared by calcining an aluminous Prussian blue, or treating an aluminous ferrocyanide of peroxide of iron with an alkali. Possessing the nature and properties of burnt Sienna, it is transparent, permanent, and dries well in oil. Of an orange hue, it is neither so rich nor so powerful as that pigment, and is better employed as a glaze than in body.

255. SEPIA,

Liquid Sepia, *Seppia*, or *Animal Æthiops*, is named after the sepia or cuttle-fish, also called the ink-fish, from its affording a dark liquid, which was used as an ink and pigment by the ancients. All the species of cuttle-fish are provided with a dark-coloured fluid, sometimes quite black, which they emit to obscure the water, when it is wanted to favour their escape from danger, or, [349] by concealing their approach, to enable them with greater facility to seize their prey. The liquid consists of a mass of extremely minute carbonaceous particles, intermixed with an animal gelatine or glue, and is capable of being so widely spread, than an ounce of it will suffice to darken several thousand ounces of water. From this liquid, brought chiefly from the Adriatic, but likewise obtainable from our own coasts, is derived the pigment sepia, as well as, partially, the Indian ink of the Chinese.

Sepia is a powerful dusky brown, of a fine texture, transparent, works admirably in water, combines cordially with other pigments, and is very permanent. It is much used as a water-colour, and for making drawings in the manner of bistre and Indian ink; but is not employed in oil, as it dries therein very reluctantly. Extremely clear in its pale tints, and perhaps the best washing colour known, sepia must be used with caution, or otherwise heaviness will be engendered in the shades, so strong is its colouring property. Mixed with indigo, or, preferably, Prussian blue and black, it is eligible for distant trees, for a general shadow tint in light backgrounds, and for the shade of white linen or white draperies. With madder red it forms a fine hue, somewhat resembling brown madder, and with crimson lake and indigo gives an artistically excellent black. Sometimes alone and sometimes in combination with lamp black, or madder red [350] and Prussian blue saddened by the black, it will be found useful in dark foreground boats, rocks, near buoys, sea-weed, &c. Compounded with aureolin, sepia yields a series of beautiful and durable neutral greens for landscape; and mixed with Prussian blue, affords low olive greens, which may be deepened into very cool dark greens by the addition of black. For hills and mountains in mid-distance, sepia combined with cobalt and brown madder is of service; or, for the dark markings and divisions of stones in brooks and running streams, the same compound without the cobalt. Mixed with purple madder, it furnishes a fine tint for the stems and branches of trees; and with French blue and madder red gives a really good black. Compounds of sepia and yellow ochre, gamboge, raw Sienna, or cobalt and aureolin, are severally useful. A rich and strong brown is formed by the admixture of madder red, burnt Sienna, and sepia; a tint which may be modified by omitting the sepia or the Sienna, or reducing the proportions of either. For Dutch craft, this tint and its variations are of great value. A wash of sepia over green very agreeably subdues the force of the colour.

256. WARM SEPIA

is the natural sepia warmed by mixture with other browns of a red hue, and is intended for drawings where it would be difficult to keep the whole work of the same tint, unless the [351] compound were made in the cake of colour.

257. ROMAN SEPIA

is a preparation similar to the preceding, but with a yellow instead of a red cast.

258. VANDYKE BROWN.

This pigment, hardly less celebrated than the great painter whose name it bears, is a species of peat or bog-earth of a fine, deep, semi-transparent brown colour. The pigment so much esteemed and used by Vandyke is said to have been brought from Cassel; an assertion which seems to be justified by a comparison of Cassel earth with the browns of his pictures. Gilpin in his Essays on Picturesque Beauty, remarks that "In the tribe of browns—in oil-painting, one of the finest earths is known, at the colour shops, by the name of Castle-earth, or Vandyke's brown." The Vandyke brown of the present day is a bituminous ochre, purified by grinding and washing over. Apt to vary in hue, it is durable both in water and oil, but, like all bituminous earths, dries tardily as a rule in the latter vehicle. Clear in its pale tints, deep and glowing in shadows, in water it has sometimes the bad property of working up: for this reason, where it is necessary to lay on a great body of it, the moist tube colour should be preferred to the cake. With madder red, [352] the brown gives a fine tint, most useful as a warm shadow colour; and with Prussian blue, clear, very sober neutral greens for middle distances. In banks and roads, Vandyke brown is the general colour for dragging over the surface, to give roughness of texture: compounded with yellow ochre, it affords a good ground tint, and with purple madder a rich shadow colour. In sunrise and sunset clouds, a mixture of the brown with cobalt yields a cold neutral green, adapted for those clouds at the greatest distance from the sun. For foliage tints, aureolin, French blue, and Vandyke brown, will be found of service; or as a glaze over such tints, the yellow and the brown. With raw Sienna, brown madder, Payne's gray, gamboge, and Roman ochre, this brown is useful. In a water-colour winter scene, when the trees are denuded of foliage, the net work of the small branches at the tops of them may be prettily given with cobalt and Vandyke brown, used rather dry, and applied with a brush having its hairs spread out either by the fingers or by drawing them through a fine-tooth comb before working. Grass is likewise represented readily by this means, and so are small trees on the summit of a cliff or in like positions.

The Campania Brown of the old Italian painters was a similar earth.

259. VERONA BROWN, [353]

a pigment peculiar to oil painting, is a native ferruginous earth. A citrine brown of great service in tender drab greens, it forms with terre verte and the madder lakes rich autumnal tints of much beauty and permanence.

260. YELLOW MADDER,

Cory's Yellow Madder, or *Cory's Madder*, is classed among the browns for the same reason that Italian Pink was ranked among the yellows. It was stated in the eighth chapter that no true madder yellow, brilliant and pure, exists as a pigment at the present day, and certainly this preparation can lay no claim to the title. Except in name, it is an orange-brown of the burnt Sienna hue, and might therefore with more reason have been called Orange Madder. It is a good and permanent colour, rich and transparent, at present used only in oil, we believe, and chiefly as a glaze.

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261. *Cadmium Brown.*

By igniting the white carbonate of cadmium, among other methods, a cinnamon-brown oxide is obtainable, of a very clear and beautiful colour if the process be well conducted. It is, however, [354] not eligible as a pigment, owing to the rapidity with which the oxide is acted upon by the air. In water, especially, we have found this brown so eagerly absorb carbonic acid from the atmosphere as to become in a few months once more a carbonate, and as purely white as before. The same result is observable when the powder is exposed: some shown at the International Exhibition of 1862, on a glass stand, had to be removed, its label marked 'Cadmium Brown' being at last found attached to a sample of cadmium white. In oil, the conversion takes place less readily, that vehicle having the property of protecting, to some extent, pigments from oxidation. It is curious that even in a book a water-rub of the brown slowly but surely changes to white.

262. *Catechu Browns.*

Catechu is an extract of the Khair tree or *acacia catechu* of Bombay, Bengal, and other parts of India. With the exception of such earthy matters as are communicated to it during the preparation, or are added purposely as adulterants, catechu is entirely soluble both in water and alcohol. An aqueous solution has a reddish-brown colour, and gives the following results:—protosalts of iron thrown down olive-brown and persalts greenish-brown precipitates; salts of tin and lead yield brownish-yellow and brick-coloured deposits respectively; while acetate of copper [355] or bichromate of potash furnishes brown residues. To our knowledge, none of these have been introduced as pigments, but a brown prepared by Dr. Lyon Playfair some years back from the catechu bark has been described as exceedingly rich, transparent, and beautiful; and recommended for painting *if not too thinly applied*.

263. *Chrome Browns*

are produced by various methods of several hues, tints, and shades, both by wet and dry processes. We have obtained them by many methods, of different degrees of permanence. Some very intense in colour have stood well, while others paler and more delicate have gradually greened, but none possessed the strict stability of the green oxides. Presuming a paucity of browns, these preparations of chromium would be worth further attention; but, with the objection of being—for browns—somewhat expensive, they have the far more fatal objection of not being wanted.

264. *Copper Brown,*

varying in hue, is obtainable, in the form of prussiate, &c., but cannot be recommended, however made.

265. *French Prussian-Brown.*

According to Bouvier, a colour similar to that of bistre, and rivalling asphaltum in transparency, is produced by partially charring a moderately dark Prussian blue; neither one too intense, which gives a heavy and opaque brownish-red, nor one too aluminous and bright, which yields a feeble and yellowish tint. Yielding to a rapture we cannot wholly share, he describes its qualities in the warmest terms. In his opinion, it has the combined advantages of asphaltum, mummy, and raw Sienna, without their drawbacks. "I cannot," he says, "commend too highly the use of this charming bistre-tint: it is as beautiful and good in water as in oil, perfectly transparent, of a most harmonious tone, and dries better than any other colour suitable for glazing. Closely resembling asphaltum in tint as well as in transparency, this brown is preferable to it in every point of view." As the colour is very quickly and easily obtained, the artist can judge for himself of its proper value. M. Bouvier's process is, to place upon a clear fire a large iron spoon, into which, when red hot, some pieces of the Prussian blue are put about the size of a small nut: these soon begin to crackle, and throw off scales in proportion as they grow hot. The spoon is then removed, and allowed to cool: if suffered to remain too long on the fire, the right colour will not be produced. When the product is crushed small, some of it will be found blackish, and the rest of a yellowish brown: this is quite as it should be. Chemically, the result is a mixture of oxide of iron and partly undecomposed or carbonised prussiate. [356] [357]

266. *Gambogiate of Iron.*

Dr. Scoffern read a paper at the Meeting of the British Association of Science, in 1851, describing this combination as a rich brown, like asphaltum, but richer, as well as more durable in oil. It has not been, however, employed as a pigment, or at least is not at present.

267. *Hypocastanum,*

or Chestnut Brown, is a brown lake prepared from the horse-chestnut. This now obsolete pigment is transparent and rich in colour, warmer than brown pink, and very durable both in water and oil; in the latter of which it dries moderately well.

268. *Iron Browns,*

native or artificial, are well represented on the palette, but nothing would be easier than to increase their number. Of all metals, iron is the richest source of colour, capable of affording all colours with the exception of white. None of them, however, are so numerous as the browns, a description of which would fill this chapter. Suffice it to state they are obtainable of every hue, tint, and shade, and are generally permanent. They are made on a large scale and sold under various names for house-painting, &c. [358]

269. *Manganese Brown*

is an oxide of manganese, which is quite durable both in water and oil, and dries admirably in the latter. A fine, deep, semi-opaque brown of good body, it is deficient in transparency, but might be useful for glazing or lowering the tone of white without tinging it, and as a local colour in draperies, &c.

270. *Nickel Brown.*

A very pleasing yellowish brown is obtainable from nickel, bright and clear in its pale washes, and of some richness in oil. Unless thoroughly washed, it has a tendency to greenness in time.

271. *Ochre Browns.*

The slight affinity of sulphur for yellow ochre, with its merely temporary effect thereon, was observed in the eighth chapter, where allusion was made to the action of sulphuretted hydrogen and sulphide of ammonium on the earth. Sulphur alone, and in the dry state, ignited with yellow or other native ochres converts them into browns, varying in hue, and of greater or less durability. Those browns, however, which we have made by this process, although standing well [359] in a book, have not withstood exposure to light and air. They have all become pale, whitish, or of a drab cast, evidently through the oxidation of the sulphur, or rather the sulphide of iron formed during the calcination. Practically, therefore, ochres have an antipathy to sulphur, moist or dry, by itself or in combination; and are, so to speak, the disinfectants of the palette. Ever waging war against sulphurous vapours, the native earths serve to protect a picture from the damaging influence of impure air, whether they be used alone, or employed in admixture with such pigments as are injured thereby.

272. *Purple Brown*

is a refuse manufacture from Indian red washings. A dull, heavy, coarse colour, it belongs to the class of common pigments which are unexceptionable for decorative painting, but scarcely suited to the higher branches of art. As this work professes simply to treat of artistic pigments, that have been, are, or might be, more than a passing reference to those colours exclusively adopted by house-painters, &c., would be out of place.

273. *Rubens' Brown,*

still in use in the Netherlands under this appellation, is an earth of a lighter colour and more [360] ochrous texture than the Vandyke brown of English commerce: it is also of a warmer or more tawny hue than the latter pigment. Beautiful and durable, it works well both in water and oil, and much resembles the brown employed by Teniers.

274. *Uranium Brown.*

Yellow, red, orange, green, have been previously noticed as being derived from uranium, and to this list of colours may now be added brown. A warm rich hue of the utmost intensity may be produced, which possesses considerable permanence, although not equal to that of uranium yellow.

275. *Zinc Brown.*

A yellow-brown, so yellow that it might fairly have been classed with the ochrous colours of that denomination, is made by combining zinc with another metal by the aid of heat. Experience tells us that it is, chemically, a thoroughly good and stable pigment. Safely to be used in admixture, it is a clear, bright colour, affording good greens by compounding with blue. Of no great power, and semi-opaque, this yellow-brown or brown-yellow is superior to some of the pigments at present used, but is probably too much like them in hue and other properties to be of [361] any special value.

Besides the preceding, there are those browns of a citrine or russet cast which are elsewhere described, such as raw umber, madder brown, &c. Moreover, there are numberless other varieties, obtainable from most of the metals, from many organic substances, and from a combination of the two. Of all colours, a 'new' brown is the most easily discovered: success may not be met with in seeking a yellow, red, or blue, or an orange, green, or purple; but it is strange if in the course of one's experiments a brown does not turn up. No difficulty, therefore, would have been found in greatly extending the present list; but it was felt that no advantage could have accrued by further multiplying the notices of a colour, with which we are already furnished so abundantly by nature and art, and which is capable of being produced in such profusion by admixture.

With the exception of ivory and bone browns, and perhaps Cassel and Cologne earths, all the browns commonly employed may be considered more or less durable.

CHAPTER XVIII. [362]

ON THE SEMI-NEUTRAL, MARRONE.

We have adopted the term MARRONE, or *maroon* as it is sometimes called, for our second and middle semi-neutral, as applicable to a class of impure colours composed of black and red, black and purple, or black and russet, or of black and any other denomination in which red predominates. It is a mean between the warm, broken, semi-neutral *browns*, and the cold, semi-neutral *grays*. Marrone is practically to shade, what red is to light; and its relations to other colours are those of red, &c., when we invert the scale from black to white. It is therefore a following, or shading, colour of red and its derivatives; and hence its accordances, contrasts, and expressions agree with those of red degraded; consequently red added to dark brown converts it into marrone if in sufficient quantity to prevail. In smaller proportions, red gives to lighter browns the names of bay, chestnut, sorrel, &c.

Owing to confused nomenclature, most of the colours and pigments of this class have been [363] assigned to other denominations—puce, murrey, morelle, chocolate, columbine, pavonazzo, &c., being variously ranked among reds, browns, and purples. This vagueness also accounts for pigments having been ranged under heads not suited to the names they bear, and explains why Brown Ochre has been classed among the yellows, Italian Pink among the same, Brown Pink among the citrines, &c.

As adapted to the walls of a picture gallery, marrone, more or less deep and inclined to crimson, is one of the best colours known. For the reason that each colour has its antagonist, and consequently may affect a picture well or ill, according to its tone or general hue, there can be no universally good colour for such a purpose. What suits one picture or style of painting may not suit another: with a blood-red sunset, for instance, or portrait with crimson drapery, marrone would be out of place. But as it is impossible to provide each picture with a separate background, all that can be done in large collections is to study the general effect, sacrificing the interests of the few to the good of the many. If cool-coloured landscapes predominate, with blue skies and green foliage, it will be found that the orange-yellow of the frames agreeably contrasts the former, and the crimson-marrone of walls as agreeably sets off the latter. If portraits and historic [364] paintings prevail, which are in general of a warm advancing nature, then a modest green may prove eligible. And if engravings form the staple, the grey hue of the print is best opposed by a bright fawn colour. Where several rooms are devoted to pictures, a suitable wall colour is most easily secured by classifying the paintings as far as possible according to their general hue, and placing them in different chambers: in each there will be a prevailing character in the colouring of its pictures, and each can be painted or papered accordingly. However, whether this plan is adopted or not—and it may be objected to as involving a certain monotony—care should be taken to have a wall colour of some sort or other, that is, to let it be seen. Pictures crammed together kill each other: without a pin's point between them, a speck of wall space visible, much of the illusion is destroyed. "It is only," says Chevreul, "the intelligent connoisseur and amateur who, on seeing a picture exhibited in a gallery, experience all the effect which the artist has wished to produce; because they alone know the best point of view, and because, while their attention is fixed on the work they are observing, they alone end by no longer seeing the surrounding pictures, or even the frame of that one they contemplate." Amid a moving crowd of people, inseparable from nearly all public exhibitions, it becomes difficult for the visitor, intelligent or [365] otherwise, thus to concentrate his attention on one work. As far, therefore, as space will allow, paintings should be kept separate: larger rooms, or fewer pictures, are what is wanted.[B]

From this digression, pardonable, let us hope, because in the interests of art, we will pass on to a consideration of marrone pigments.

276. BROWN MADDER

is an exceedingly rich marrone or russet-marrone brown, bearing the same relation to the colour marrone that raw umber bears to the colour citrine. One of the most valuable products of the madder root, it has supplied a great desideratum, and in water especially is indispensable, both as a local and auxiliary colour. Of intense depth and transparency, if made with skill, it affords the richest description of shadows, either alone or compounded with blue, and the most delicate pale tints. Being quite permanent, a good drier, and working most kindly, it is a pigment which cannot be too strongly recommended to the landscape painter's notice. Containing a large proportion of red, it is eligible, with yellow or blue, for mixed orange or mixed purple of a subdued tone. It may be used to lower red curtains or draperies, and for the darkest touches in [366] flesh. Mixed with cobalt, it forms a fine shadow colour for distant objects; and with indigo or Prussian blue and black, is serviceable for the shades of those nearer the foreground. It is similarly useful when mixed with black, and will be found advantageous in rusty iron, as anchors, chains, &c. For the deepest and richest parts of foregrounds it may be employed alone, as also for deep dark cracks and fissures, or strong markings in other near objects, as boats and figures. With French blue, or cobalt and white, a set of beautiful warm or cold grays may be obtained, in proportion as the brown or blue predominates. Compounded with blues and bright yellows such as aureolin, it gives fine autumnal russet greens. A good purple for soft aerial clouds is furnished by cobalt and brown madder, or for stormy clouds by the brown, Prussian blue, and black: an equally good slate colour is obtained from cobalt, sepia, and the brown. For glazing over foliage and herbage, a mixture of the madder with aureolin or gamboge is adapted; and for brooks and running streams compounds of this brown with raw Sienna, cobalt and raw Sienna, Vandyke brown, and French blue, will each be found useful. Black sails are well represented by burnt Sienna, French blue, and brown madder; and red sails by light red or burnt Sienna with the brown.

277. MIXED MARRONE. [367]

Marrone is a retiring colour easily compounded in all its hues and shades by the mixture variously of red, and black or brown; or of any other warm colours in which red and black predominate. A reference to the permanent brown, black, and red or reddish pigments will show to what extent the colour marrone may safely be produced by admixture. In compounding marrone, the brown or black may be itself compounded, before the addition of the red, reddish-purple, or russet, requisite for its conversion.

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278. *Chica Marrone.*

Chica, the red colouring principle alluded to in the ninth chapter, is extracted from the *Bignonia chica*, by boiling its leaves in water, decanting the decoction, and allowing it to cool, when a red matter falls down, which is formed into cakes and dried. Insoluble in cold water, it dissolves in alcohol and alkalies; is precipitated from alkaline solutions by acids without alteration; and is bleached by chlorine. Another variety of the same substance, obtained from Para in Brazil, and known as crajuru, carajuru, or caracuru, behaves in a similar manner. This is said to be superior to the former sort.

A chica pigment, brought from South America, and examined by the author, was of a soft [368] powdery texture, and rich marrone colour. Somewhat resembling Rubens' madder in hue, it was equal in body and transparency to the carmine of cochineal, though by no means approaching it in beauty, or even in durability. Simply exposed to the light of a window, without sun, the colour was soon changed and destroyed. Conclusive evidence as this is that the sample submitted to Mr. Field was worthless, it remains to be seen whether all the colours to be derived from chica, by different modes and from different kinds, are equally valueless as pigments.

279. *Chocolate Lead,*

or Marrone Red, is a pigment prepared by calcining oxide of lead with about a third of copper oxide, and reducing the compound to a uniform tint by levigation. It is of a chocolate hue, strong opaque body, and dries freely. Like all lead and copper colours, it is blackened by impure air.

280. *Cobalt Marrone.*

There is obtainable from cobalt a very rich marrone brown, which, like many other colours, is more beautiful while moist than when dried. Permanent, if carefully made and most thoroughly [369] washed, it is an expensive compound, and must rank among those colours which are interesting in the laboratory but superfluous in the studio.

281. *Madder Marrone,*

or Marrone Lake, was a preparation of madder, of great depth, transparency, and stability. Working well in water, glazing and drying in oil, and in every respect a good pigment, it was one of those colours which gradually—and often, as in this case, unfortunately—become obsolete, on account of their hues being easily given by admixture of other pigments. There was likewise a deeper kind, called Purple Black. A good madder marrone may be produced by adding to brown madder either rose madder, madder carmine, or Rubens' madder, with a slight portion of black or blue if required.

282. *Mars Marrone.*

Under the heading of a New Marrone Pigment there appeared some months back in a chemical journal the following:—"The blood-red compound obtained by adding a soluble sulphocyanide to a salt of iron in solution can be made (apparently at least) to combine with resin thus: To a concentrated solution of sesquichloride of iron and sulphocyanide of potassium in ether, an etherial solution of common resin is added, and the whole well shaken together. There [370] is then mixed with it a sufficiency of water to cause a precipitate, when it will be found, after the mixture has stood a few hours, that the whole or nearly the whole of the red-coloured iron compound has united with the precipitated resin, forming the marrone-coloured pigment in question. When this coloured substance is finely powdered and mixed with water, the liquid is not the least coloured; whence it is inferred that the red iron compound has chemically united itself with the resin."

The foregoing account is rather to be regarded as of scientific interest than of practical utility. The blood-red solution of sulphocyanide of iron is in itself not stable: when the red solution of this salt is so exposed to the sun, that the rays pass through the glass jar containing it, it is rendered colourless, but the colour is retained or restored when the rays pass directly from the air into the fluid; so that when a properly diluted solution is placed in a cylindrical glass vessel in direct sunshine, it loses colour in the morning till about eleven in the forenoon, when the rays beginning to fall upon the surface exposed to the air, gradually restore the colour, which attains its maximum about two o'clock. Moreover, the solution is immediately decolourised by sulphuretted hydrogen and other deoxidizing agents, as well as by alkalies and many acids. It is scarcely probable that the union of the red colouring matter with the resin would suffice to [371] secure it from change; and there is little doubt that the new marrone pigment would be a chameleon colour.

Failures in the process of burning carmines, and preparing the purple of gold, frequently afford good marrones. Compounds more or less of that hue are likewise furnished by copper, mercury, &c. Some ochres incline to marrone when calcined: indeed we have remarked in many instances that the action of fire anticipates the effects of long continued time; and that several of the primary and secondary colours may, by different degrees of burning, be converted into their analogous secondary, tertiary, or semi-neutral colours.

The one marrone or brown-marrone pigment at present employed, brown madder, is permanent.

FOOTNOTES:

[B] This was written previous to the opening of the new rooms of the Royal Academy at Burlington House. In these, among other improvements, the subject of wall space has been considered.

CHAPTER XIX. [372]

ON THE SEMI-NEUTRAL, GRAY.

Of the tribe of semi-neutral colours, GRAY is third and last, being nearest in relation to black. In its common acceptation, and that in which we here use it, gray, as was observed in the third chapter, denotes a class of cool cinereous colours faint of hue; whence we have blue grays, olive grays, green grays, purple grays, and grays of all hues, in which blue predominates; but no yellow or red grays, the prevalence of such hues carrying the compounds into the classes of brown and marrone, of which gray is the natural opposite. In this sense the *semi-neutral* Gray is distinguished from the *neutral* Grey, which springs in an infinite series from the mixture of the neutral black and white. Between gray and grey, however, there is no intermediate, since where colour ends in the one, neutrality commences in the other, and vice versâ. Hence the natural [373] alliance of the semi-neutral gray—definable as a cool coloured grey—with black or shade; an alliance which is strengthened by the latent predominance of blue in the synthesis of black, so that in the tints resulting from the mixture of black and white, so much of that hue is developed as to give apparent colour to the tints. This explains why the tints of black and dark pigments are colder than their originals, so much so as in some instances to answer the purposes of positive colours. It accounts in some measure for the natural blueness of the sky, yet not wholly, for this is in part dependent, by contrast, upon the warm colour of sunshine to which it is opposed; for, if by any accident the light of nature should be rendered red, the colour of the sky would not appear purple, in consequence, but green. Again, if the sun shone green, the sky would not be green, but red inclined to purple; and so would it be with all colours, not according to the laws of composition, but of contrast; since, if it were otherwise, the golden rays of the sun would render a blue sky green.

The grays are the natural cold correlatives, or contrasts, of the warm semi-neutral browns, as well as degradations of blue and its allies. Hence blue added to brown throws it into or toward the class of grays, and hence grays are equally abundant in nature and necessary in art: in both they comprehend a widely diffused and beautiful play of retiring colours in skies, distances, [374] carnations, and the shadowings and reflections of pure light, &c. Gray is, indeed, the colour of space, and has therefore the property of diffusing breadth in a picture, while it furnishes at the same time good connecting tints, or media, for harmonizing the general colouring. Consequently the grays are among the most essential hues of the art, though they must not be suffered to predominate where the subject or sentiment does not require it, lest they cast over the painting that gloom or leaden dulness reprobated by Sir Joshua Reynolds; yet in solemn works they are wonderfully effective, and proper ruling colours. Nature supplies these hues from the sky abundantly and effectively throughout landscape, and Rubens has employed them as generally to correct and give value to his colouring, with fine natural perception in this branch of his art: witness his works in the National Gallery, and in that of the Luxembourg.

According to the foregoing relations, grays favour the effects and force of warm colours, which in their turn also give value to grays. It is hence that the tender gray distances of a landscape are assisted, enlivened, and kept in place by warm and forcible colouring in the foreground, gradually connected through intermediate objects and middle distances by demi-tints declining into gray; a union which secures full value to the colours and objects, and by [375] reconciling opposites gives repose to the eye. As a general rule, it may be inferred that half of a picture should be of a neutral hue, to ensure the harmony of the colouring; or at least that a balance of colour and neutrality is quite as essential to the best effect of a painting as a like balance of light and shade.

283. MINERAL GRAY,

or Mineral Gr*e*y, as it is often improperly spelt, is obtainable from the lapis lazuli, after the blue and ash have been worked out. So derived, it is a refuse article, worthless if the stone has been skilfully exhausted of its ultramarine. As this is now generally the case, the best mineral gray is no longer a waste product, but a lower species of ash, a pale whitish blue with a grey cast. Possessing the permanence of ultramarine, it may be regarded in colour as a very weak variety of that blue, diluted with a large quantity of white slightly tinged by black. A pigment peculiar to oil painting, it is admirably adapted to that gray semi-neutrality, the prevalence of which in nature has been just remarked. For misty mornings, cloudy skies, and the like, this gray will be found useful. [376]

284. MIXED GRAY

is formed by compounding black and blue, black and purple, black and olive, &c.; and is likewise produced by adding blue in excess to madder brown, sepia, &c., transparent mixtures which are much employed. It should be borne in mind that the semi-neutrals, like the secondaries and tertiaries, may be so compounded as to be permanent, semi-stable, or fugitive. The due remembrance of this cannot be too strongly insisted upon, seeing that in every picture the browns and grays are of frequent occurrence. These it is that lend such charm to the whole, flowing, as it were, like a quiet under-current of colour beneath the troubled surface of more decided hues. In the work of every true artist—between whom and the mere painter there is as much difference as between the poet and the poetaster—there is sentiment as well as colour, whether the subject be an exciting battle-scene or a bit of still life. This sentiment, as strongly felt as the colour is clearly seen, is imparted in no small degree by the skilful use of semi-neutrality, the compounding of which, as time goes on, will therefore affect a picture for good or for evil.

Subjoined is an analysis of the three semi-neutrals, which serves partly to show in what great variety they may be obtained by admixture.

[377]

Brown	=	Black	+	Yellow	
"	=	"	+	Orange	} + Red, Purple, &c.
"	=	"	+	Citrine	
"	=	2 Yellow	+	Red	+ Blue
"	=	2 Orange	+	Green	+ Purple
"	=	2 Citrine	+	Russett	+ Olive
Marrone	=	Black	+	Red	
"	=	"	+	Purple-red	
"	=	"	+	Russet	
"	=	2 Red			
"	=	2 Purple-red	}	+ Dark Brown or Black	
"	=	2 Russet			
Gray	=	Black	+	Blue	
"	=	"	+	Purple-blue	} + 2 White
"	=	"	+	Olive	
"	=	2 Blue			
"	=	2 Purple-blue	}	+ Light Brown, or Black + 2 White	
"	=	2 Olive			

In the last division, the White has been added to remind the reader that grays are coloured greys, not coloured blacks; and are therefore faint of hue. This paleness, however, need not necessarily be produced by admixture with white: it can be gained by means of thin washes. As a pigment, gray may be to all appearance black in bulk.

285. NEUTRAL TINT,

or, more correctly, *Semi*-Neutral Tint, is a compound shadow colour of a cool character. It is permanent, except that on exposure the gray is apt to become grey, a change which may be prevented by a slight addition of ultramarine ash. So protected, it becomes serviceable in landscape for the extreme distance, which, it may be laid down as a general principle, should be [378] painted rather cold than otherwise. Blue being the principal compound of atmosphere, it is of the utmost importance to obtain this in the first instance, particularly as, from its being only of a blue tint, not blue colour, it is so immediately altered and acted upon by subsequent washes; whereas, the blue tone once lost, it will be found very difficult to be recovered. Wherever a picture is wanting in air effect, the cause will, upon examination, be seen to rest entirely upon the absence of pure grays, bordering upon a bluish tone, not tending, be it observed, to brown or purple. A bluish gray, then, of rather a cold tone, such as the neutral tint, is recommended as the prevailing hue with which to begin the extreme distances; and, as a rule, it is better to pass with this over as much of the landscape as possible, and thus lay the foundation for a general atmosphere.

286. PAYNE'S GRAY

resembles the preceding in being a compound colour and liable to assume a grey cast by time, but differs from it in having more lilac in its hue, and being therefore of a warmer tone. Giving by itself a clear violet shadow, it may be rendered more neutral by a small portion of burnt Sienna, an admixture which, whether the gray or Sienna predominates, affords useful tints. Compounded with light red or Vandyke brown, the gray is good for shipping and sails, or the stems and [379] branches of trees; while with gamboge or aureolin it is suited to glossy leaves in high light, also to very cold tones in foregrounds, herbage, &c. Yellow ochre, light red, and Payne's gray form a mixture for banks and roads; the ochre, gray, and sepia, a most beautiful tint for stones; and brown madder and the gray, a fine shade for the black head and feet of cattle. Alone, the gray is serviceable for slate; and compounded with light red, for bricks or tiles in shadow.

287. ULTRAMARINE ASH

is obtained from the stone after the richer and more intense blue has been extracted. Although not equal in beauty, and inferior in strength of colour to ultramarine, it is a valuable bye-product varying in shade from light to dark, and in hue from pale azure to cold blue. With a grey cast, it affords delicate and extremely tender tints, not so positive as ultramarine, but which, as water-colours, wash much better. It furnishes grays softer, purer, and more suited to the pearly tints of flesh, skies, distances, foliage, shadows of drapery, &c. than those composed of other blues, with white and black, which the old masters were wont to employ. Ultramarine, however, produces the same effects when broken with black and white, and is thus sometimes carried throughout the colouring of a picture. The ash, compounded with lamp black, gives a soft cold gray for dark louring clouds, or for twilight away from the sun's influence. Alone it is adapted to very remote hills or mountains, and with orient yellow or aureolin to distant foliage. [380]

The native phosphate of iron, which has been already described in the tenth chapter under its name of Blue Ochre, might have been classed among the grays, being similar in colour to the deeper hues of ultramarine ashes. Powdered slate, slate clays, and several native earths, likewise rank with grays; but some of the earths we have tried are not durable, being apt to become brown by the oxidation of the iron they contain. It may be proper here to mention those other pigments, known as tints, which, being the result of the experience of accredited masters in their peculiar modes of practice, serve to facilitate the progress of their amateur pupils, while they are more or less eligible for artists. Such are *Harding's* and *Macpherson's Tints*, composed of pigments which associate cordially, and sold ready prepared in cakes and boxes for miniature and water painting.

Of the four grays in use—mineral gray, ultramarine ash, neutral tint, and Payne's gray—the two first are quite unchangeable, and the others sufficiently stable to be classed as permanent.

CHAPTER XX. [381]

ON THE NEUTRAL, GREY.

Grey is the second and intermediate of the neutral colours, standing between *white* and *black*. True or normal grey is only obtainable by admixture of pure white with pure black, various proportions of which afford numerous tones of pure grey. In practice it may likewise be produced by a thin wash of black over white. The neutral gr*e*y differs from the semi-neutral gr*a*y in not being coloured by any primary, secondary, tertiary, or semi-neutral; hence any blue, purple, olive, or gray added to it, at once destroys the neutrality of grey, and converts it into gray. Thus easily defiled and changed in class, grey is rather a theoretical than a practical colour. To our knowledge, there has never been a true grey pigment, that is, one composed exclusively of pure white and pure black; the gr*a*ys known to the palette as Mineral Grey and Payne's Grey having been incorrectly named. Practically, the nearest approach to a normal grey is furnished by Black [382] Lead, which forms grey tints of greater permanence and purity than the blacks in general use, and is now employed for this purpose with approved satisfaction by experienced artists.

Being compounded of white and black, grey partakes in some measure of the qualities of both those colours—for colours, as a matter of convenience, they must be called; although white is often spoken of as no colour, and black as the complete extinction of all colour. With white predominant, grey is used, pure or coloured, for the general lights of a picture; just as, with black predominant, grey is employed, pure or coloured, for the shades. It helps to subdue the absolute white, and to make the absolute black conspicuous. Black and white are in some respects complementary to each other, and when in contact, appear to differ more from each other than when viewed separately: both show with best effect when harmonised by a medium of grey, normal or otherwise. The primary colours, also, gain in brilliancy and purity by the proximity of grey. With dark colours, such as blue and violet, and deep tones in general, grey forms assortments of analogous harmonies; while with the luminous colours, such as red, orange, yellow, and the light tints of green, it forms harmonies of contrast. Although grey never produces a bad effect in its assortments with two luminous colours, in most cases the association is dull and inferior to black and white. The only instance in which grey associates with two such colours [383] more happily than white is that with red and orange. Grey is inferior to both white and black with red and green, red and yellow, orange and yellow, orange and green, yellow and green; and is not so good as white with yellow and blue. In association with sombre colours, such as blue and violet, and with broken tones of luminous colours, grey gives rise to harmonies of analogy which have not the vigour of those with white; but if the colours do not combine well together, it has the advantage of separating them from each other. Associated with two colours, one sombre, the other luminous, grey will perhaps be better than white, if white produces too strong a contrast of tone: on the other hand, grey will be preferable to black, if that has the inconvenience of increasing too much the proportion of sombre colours. Grey associates more happily than black with orange and violet, green and blue, or green and violet.

288. MIXED GREY.

When a ray of solar light (a sunbeam) is passed through a prism of flint glass, and the image or 'prismatic spectrum' received upon a screen of white paper, it is found to consist of numerous rays of different colours, which are conveniently divided into six groups—red, orange, yellow, [384] green, blue, violet. Optically, the union of red, yellow, and blue, in proper proportions, constitutes white light; whether the rays of the three separate colours are mixed, or of one with the other two in combination: the same result ensues when red is mixed with green as if it were mixed with blue and yellow, because green is composed of blue and yellow. Consequently, any primary mixed with a secondary composed of the other two primaries, forms the complement of rays necessary to constitute or make up white light, and vice versâ.

There is, however, a very great difference between the results arising from the mixture of the pure coloured rays of the spectrum, and those from material colours or pigments. When, by means of a convex lens, we reunite the coloured rays of the spectrum white light is reproduced; but when we mix coloured materials, blues, yellows, and reds, the compound is never white, but grey or black; even if these coloured pigments are taken in the exact proportions in which their colours exist in the spectrum. Ultramarine, our purest blue, reflects red rays as well as blue rays; aureolin, our purest yellow, reflects blue as well as yellow rays; and carmine reflects yellow as well as red rays. Now whenever the third primary colour is present in any mixture of coloured materials, it tends to form grey, by mixing with a sufficient quantity of the other coloured rays to [385] neutralize it, and the presence of this grey breaks or tarnishes the pure colour. Hence it is that to obtain a pure green, a blue should be taken tinged with yellow rather than with red, and a yellow tinged with blue: if there were chosen either a blue or a yellow tinged with red, this latter colour would go to form some grey in the compound, which would tarnish the green. In like manner, to produce pure orange, neither the red nor the yellow must contain blue; and similarly with pure purple, neither the blue nor red should contain yellow.

As regards pigments, then, a proper mixture of yellow, red, and blue; or of yellow and purple, red and green, or blue and orange; or of orange, green, and purple, affords black if sufficiently intense, and grey if sufficiently diluted. The black may be rendered grey by spreading a thin wash over a white ground, or by the direct addition of white. It must be remembered, however, that suitable proportions of the component colours are essential. When all three of the primaries, for example, are mixed together, colour is neutralised according as they are compounded of equal strength and in right quantities: if proper proportions are observed, pure black or normal grey results; but if not, there will be produced a coloured black or a coloured grey, an excess of one or two of the primaries giving rise to brown, marrone, or gray. [386]

A reference to the lists of permanent primary and secondary pigments will show to what extent durable greys can be compounded. As these pigments differ so widely in hue and other properties, no fixed rules can be given for their admixture: to ensure neutrality, practice and a correct eye are indispensable. Without perfect neutrality, difficult to attain and rarely to be met with, grey ceases to exist. In pure white, pure grey, and pure black, colour is, so to speak, conspicuous by its absence.

CHAPTER XXI. [387]

ON THE NEUTRAL, BLACK.

Black is the last and lowest in the series or scale of colours descending—the opposite extreme from white—the maximum of colour. To be perfect, it must be neutral with respect to colours individually, and absolutely transparent, or destitute of reflective power as regards light; its use in painting being to represent shade or depths, of which black is the element in a picture and in colours, as white is of light.

As there is no perfectly pure and transparent black pigment, black deteriorates all colours in deepening them, as it does warm colours by partially neutralizing them, but it combines less injuriously with cold colours. Though black is the antagonist of white, yet added to it in minute portion, it in general renders white more neutral, solid, and local, with less of the character of light. Impure black is brown, but black in its purity is a cold colour, and communicates a coolness to all light colours; thus it *blues* white, *greens* yellow, *purples* red, and *cools* blue. Hence the [388] artist errs with ill effect who regards black as of nearest affinity to hot and brown colours, and will do well to keep in mind—"The glow of sunshine and the *cool* of shade."

It is a fault of even some of our best colourists, as evinced by their pictures, to be too fond of black upon their palettes, and thence to infuse it needlessly into their tints and colours. With such it is a taste acquired from the study of old pictures; but in nature hardly any object above ground is black, or in daylight is rendered neutral thereby. Black, therefore, should be reserved for a local colour, or employed only in the under-painting properly called grounding and dead colouring. As a local colour, black has the effect of connecting or amassing surrounding objects, and is the most retiring of all colours, a property which it communicates to other colours in mixture. It heightens the effect of warm as well as light colours, by a double contrast when opposed to them, and in like manner subdues that of cold and deep colours. In mixture or glazing, however, these effects are reversed, by reason of the predominance of cold colour in the constitution of black. Having, therefore, the double office of colour and of shade, black is perhaps the most important of all colours to the artist, both as to its use and avoidance.

It may be laid down as a rule that the black must be conspicuous. However small a point of [389]
black may be, it ought to catch the eye, otherwise the work is too heavy in the shadow. All the ordinary shadows should be of some *colour*—never black, nor approaching black, they should be evidently and always of a luminous nature, and the black should look strange among them; never occurring except in a black object, or in small points indicative of intense shade in the very centre of masses of shadow. Shadows of absolutely negative grey, however, may be beautifully used with white, or with gold; but still though the black thus, in subdued strength, becomes spacious, it should always be conspicuous: the spectator should notice this grey neutrality with some wonder, and enjoy, all the more intensely on account of it, the gold colour and the white which it relieves. Of all the great colourists, Velasquez is the greatest master of the black chords: his black is more precious than other people's crimson. Yet it is not simply black and white that must be made valuable, rare worth must be given to each colour employed; but the white and black ought to separate themselves quaintly from the rest, while the other colours should be continually passing one into the other, being all plainly companions in the same gay world; while the white, black, and neutral grey should stand monkishly aloof in the midst of them. Crimson [390]
may be melted into purple, purple into blue, and blue into green, but none of them must be melted into black.

All colours are comprehended in the synthesis of black, consequently the whole sedative power of colour is comprised in black. It is the same in the synthesis of white; and, with like relative consequence, white includes all the stimulating powers of colour in painting. It follows that a little white or black is equivalent to much colour, and hence their use as colours requires judgment and caution. By due attention to the synthesis of black, it may be rendered a harmonizing medium to all colours, to all which it lends brilliancy by its sedative effect on the eye, and its powers of contrast: nevertheless, we repeat, it must be introduced with caution when *hue* is of greater importance than shade. Even when employed as a shadow, without much judgment in its use, black is apt to appear as local colour rather than as privation of light; and black pigments obtained by charring have a tendency to rise and predominate over other hues, subduing the more delicate tints by their chemical bleaching power upon other colours, and their own disposition to turn brown or dusky. For these reasons deep and transparent colours, which have darkness in their constitution, are better adapted as a rule for producing the true natural and permanent effects of shade. Many pictures of the early masters, and especially of the Roman [391]
and Florentine schools, evince the truth of our remarks; and it is to be feared the high reputation of these works has betrayed their admirers into this defective employment of black.

Black substances reflect a small quantity of white light, which receives the complementary of the colour contiguous to the black. By 'complementary' is meant that colour which is required with another colour to form white light; thus, green is the complementary of red, blue of orange, and yellow of violet, or vice versâ; because green and red, blue and orange, and yellow and violet, each make up the full complement of rays necessary to form white light. Briefly digressing, we give the following mode of observing complementary colours:—Place a sheet of white paper on a table opposite to one of two windows admitting diffused daylight[C] into a room; take a piece of coloured glass and so place it that the coloured light transmitted through it falls over the surface of the paper; then put an opaque object on the paper close to the coloured glass. The shadow of this object will not appear black or of the colour of the glass, as might be supposed, but of its complementary colour; thus if the glass is red, the colour of the shadow will be green, [392]
although the whole of the paper surrounding it appears red. Similarly, if the glass is blue, the shadow will appear orange; if it is green, the shadow will appear red; and so with other colours. It is absolutely essential, however, to the success of this experiment, that the paper be also illuminated with the white light admitted from the other window.

It has been said that black substances reflect a small quantity of white light, which receives the complementary of the colour contiguous to the black. If this colour is deep, it gives rise to a luminous complementary, such as orange, or yellow, and enfeebles the black; while the other complementaries, such as violet or green, strengthen and purify it. In colours associated with black, if green is juxtaposed therewith, its complementary red, added to the black, makes it seem rusty. Those colours which best associate with black are orange, yellow, blue, and violet. It would be well to remember that black, being always deeper than the juxtaposed colour, entails contrast of tone, and tends to lower the tone of that colour.

Most of the black pigments in use are obtained by charring, and owe their colour to the carbon they contain. As the objects of vegetal and animal nature may be blackened through every degree of impurity by the action of fire, black substances more or less fitted for pigments abound. [393]
The following are the chief native and artificial black pigments, or colours available as such:—

289. BLACK LEAD,

Plumbago, or *Graphite*, contains in spite of its name no lead, being simply a species of carbon or charcoal. In most specimens iron is present, varying in quantity from a mere trace up to five per cent, together with silica and alumina. Sometimes manganese and titanic acid are likewise found. It is curious that carbon should occur in two distinct and very dissimilar forms—as diamond, and as graphite; one, white, hard, and transparent; the other, black, soft, and opaque: the artist, therefore, who uses a pigment of plumbago, paints with nothing more or less than a black diamond. The best graphite, the finest and most valuable for pencils, is yielded by the mine of Borrowdale, at the west end of Derwent Lake, in Cumberland, where it was first wrought during the reign of Elizabeth. A kind of irregular vein traverses the ancient slate-beds of that district, furnishing the carbon of an iron-grey colour, metallic lustre, and soft and greasy to the touch. Universally employed in the form of crayons, &c. in sketching, designing, and drawing, until of late years it was not acknowledged as a pigment: yet its powers in this respect claim a place for it. As a water-colour, levigated in gum in the usual manner, it may be effectively used with [394] rapidity and freedom in the shading and finishing of pencil drawings, or as a substitute therein for Indian ink. Even in oil it may be employed occasionally, as it possesses remarkably the property of covering, forms very pure grey, dries quickly, injures no colour chemically, and endures for ever. These qualities render it the most eligible black for adding to white in minute quantity to preserve the neutrality of its tint.

Although plumbago has usurped the name of Black Lead, there is another substance more properly entitled to this appellation, and which may be used in the same way, and with like effects as a pigment. This substance is the sulphide of lead, found native in the beautiful lead ore, or Galena, of Derbyshire. An artificial sulphide can be prepared by dry and wet processes, which is subject to gradual oxidation on exposure to the air, and consequent conversion into grey or white. Neither variety can be compared to graphite for permanence, although the native is preferable to the artificial.

Plumbago, or the so-called Black Lead, is often adulterated to an enormous extent with lamp black.

290. BLUE BLACK,

Charcoal, *Liege*, or *Vine Black*, is a well-burnt and levigated charcoal prepared from vine twigs, [395] of weaker body than ivory or lamp black, and consequently better suited to the grays and general mixed tints of landscape painting, in which it is not so likely to look black and sooty as the others may do. Of a cool neutral tint, it has, in common with all carbonaceous blacks, a preserving influence on white when duly mixed therewith; which it owes, chemically, to the bleaching power of carbon, and, chromatically, to the neutralizing and contrasting power of black with white. Compounded slightly with blue black, and washed over with zinc white, white lead may be exposed to any ordinary impure atmosphere with comparative impunity. It would be well for art if carbon had a like power upon the colour of oils, but of this it is deficient; and although chlorine destroys their colour temporarily, they re-acquire it at no very distant period.

Alone, blue black is useful as a cool shade for white draperies; and compounded with cobalt, affords a good gray for louring clouds.

291. BRITISH INK

is a compound black, preferred by some artists to Indian ink, on account of its not being liable to wash streaky, as the latter does: at the same time it is not so perfectly fixed on the paper as Indian ink.

292. INDIAN INK,

sometimes called *China* or *Chinese Ink*, is chiefly brought from China in oblong cakes, of a musky [396] scent, ready prepared for painting in water. Varying considerably in body and colour, the best has a shining black fracture, is finely compact, and homogeneous when rubbed with water, in which, when largely diluted, it yields no precipitate. Without the least appearance of particles, its dry surface is covered with a pellicle of a metallic appearance. When dry on the paper, it resists the action of water, yet it will give way at once to that action, when it has been used and dried on marble or ivory, a fact which proves that the alummed paper forms a strong combination with the ink; possibly a compound of the latter on an aluminous base, might even be employed in oil. Different accounts are given of the mode of making this ink, the principal substance or colouring matter of which is a smoke black, having all the properties of our lamp black; the variety of its hues and texture seeming wholly to depend on the degree of burning and levigating it receives. From certain Chinese documents, we learn that the ink of Nan-king is the most esteemed; and

among the many sorts imported into this country, we find those of the best quality are prepared with lamp black of the oil of Sesame; with which are combined camphor, and the juice of a plant named **Houng hoa** to give it brightness of tone. According to an analysis by M. Proust, the better kinds contain about two per cent. of camphor. By some, the pigment known as Sepia has been [397]
supposed to enter into their composition.

Liquid Indian Ink is a solution for architects, surveyors, &c.

293. IVORY BLACK

is ivory charred to blackness by strong heat in closed vessels. Differing chiefly through want of care or skill in preparing, when well made it is the richest and most transparent of all the blacks, a fine neutral colour perfectly durable and eligible both in water and oil. When insufficiently burnt, however, it is brown, and dries badly; or if too much burnt, it becomes cineritious, opaque, and faint in hue. With a slight tendency to brown in its pale washes, this full, silky black is serviceable where the sooty density of lamp black would be out of place. It is occasionally adulterated with bone black, a cheaper and inferior product.

Being nothing more nor less than animal charcoal, ivory or bone black had best not be compounded with organic pigments, in water at least. It is well known that this charcoal possesses the singular property of completely absorbing the colour of almost any vegetal or animal solution, and of rendering quite limpid and colourless the water charged with it. If a solution of indigo in concentrated sulphuric acid be diluted with water, and animal charcoal [398]
added in sufficient quantity, the solution will soon be deprived of colour. The more perfect the ivory or bone black, the more powerful is its action likely to be: either over or under calcined, animal charcoal is less energetic; in the former case, because it is less porous; in the latter, because the animal matter, not being wholly consumed, makes a kind of varnish in the charcoal which interferes with its acting. To a greater or less extent, gums, oils, and varnishes serve similarly as preventives, thereby decreasing the danger of employing these blacks in admixture; but, in the compounding of colours, nothing is gained by needless risk. To mix with organic pigments, therefore, blue or lamp blacks should be substituted for those of ivory or bone; that is, vegetal charcoal should be used instead of animal. It is a question whether even with inorganic pigments the adoption of the former in admixture would not be advisable. It was once the general opinion that the action of animal charcoal was limited to bodies of organic origin, but it has since been found that inorganic matters are likewise influenced. "Through its agency," says Graham, "even the iodine is separated from iodide of potassium;" whence probably pigments containing iodine would suffer by contact. The investigation of Weppen appears to prove that the action of the charcoal extends to all metallic salts; with the following, no doubt remains of this being so, to [399]
wit:—the sulphates of copper, zinc, chromium, and protoxide of iron; the nitrates of lead, nickel, silver, cobalt, suboxide and oxide of mercury; the protochlorides of tin and mercury; the acetates of lead and sesquioxide of iron; and the tartrate of antimony. Whether animal charcoal exercises any deleterious influence on pigments consisting of these metals, and, if so, how far and under what circumstances, can only be answered when our knowledge of the properties of pigments is greater than it now is. At present, perhaps, it is safer to choose vegetal charcoal for mixed tints, inasmuch as, although it shares the property of bleaching in a certain degree, it does not possess the same energy.

294. LAMP BLACK,

or *Lamblack*, is a smoke black, being the soot procured by the burning of resins or resinous woods. It is a pure vegetal charcoal of fine texture, not quite so intense nor so transparent as the black made from ivory, but less brown in its pale tones. It has a very strong body that covers readily every underlay of colour, works well, but dries badly in oil. On emergency, it may be prepared extemporaneously for water-painting by holding a plate over the flame of a lamp or candle, and adding gum to the colour: the nearer the plate is held to the wick of the lamp, the [400]
more abundant and warm will be the hue of the black obtained; at a greater distance it will be more effectually charred, and blacker.

Mixed with French blue or cobalt, lamp black gives good cloudy grays, which are useful for the shadows of heavy storm clouds. With French blue and this black alone various beautiful stormy skies may be represented; the contrast of the blue causing the black to assume, if desired, a warm tone in shadows. For like purposes, the black with ultramarine ash affords a very soft hue, and with light red and cobalt in different proportions yields silvery tones most serviceable. To the dark marking of murky and dirty clouds, a compound of lamp black and light red is particularly suited; while a mixture of the black with cobalt and purple madder is adapted for slate-coloured sunset and sunrise clouds. French blue softened with a little lamp black is fitted for mountains or hills, very remote; and the same blue and black with rose madder meet their tints if nearer. In seas the black is useful with raw Sienna and other colours; while, whether in storm or calm, vessels and boats may be painted with tints of lamp black, madder brown, and burnt Sienna, varying in degrees of strength according to the distances. Lamp black alone, or with French blue, cobalt and purple madder, emerald green, or rose madder, is good for rocks;

and for dark foreground objects when mixed with madder lake and burnt Sienna. With aureolin [401] the black furnishes a sober olive for foliage, and with rose madder a fine colour for the stems and branches of trees. Compounded with light red, it is suited to the first general tones of the ground for banks and roads; and with yellow ochre or madder red, to parts of buildings and cattle. A very eminent miniature painter recommends for hair tints, lamp black, Indian red, and burnt Sienna. Being a dense solid colour, this black must be used sparingly to avoid heaviness.

Hitherto confined to painting and engraving, lamp black has lately refuted the assertion that there is nothing new under the sun by making its appearance in photography. By a method which combines the fidelity of that art with the permanence of prints, there is produced a species of photographic engraving, so to speak, having lamp black or carbon for its colouring matter. Indeed, in this 'Autotype' process, as it is called, any other durable pigment or pigments may be used, and a photographic picture thus obtained. In copying the works of artists, especially, the mode promises to be of value, inasmuch as by its agency the same pigments may be made the colouring matter of the reproduction as are employed in the original. If this be in sepia or bistre, the copy can be autotyped in those colours; or if a red chalk drawing be required to be multiplied, the proofs may be in red chalk, the copy when produced to the same scale being [402] scarcely distinguishable from the original. In like manner, any single colour of the artist's palette is applicable without restriction or limitation, so that not only are every line and touch rendered absolutely, but the very pigment used in the original is found in the copy. Moreover, as the pigments are quite unchanged by the action of the other agents employed, the resulting colour of the print is determined once for all, just as the artist mixes those pigments on his palette for his picture. As extending the use of lamp black and permanent pigments in general, this brief digression on Autotypography may be pardoned in a treatise on colours.

295. MIXED BLACK.

Black is to be considered as a synthesis of the three primary colours, the three secondaries, or the three tertiaries, or of all these together; and, consequently, also of the three semi-neutrals, and may thus be composed of due proportions of either tribe or triad. All antagonistic colours, or contrasts, likewise afford the neutral black by composition; but in all the modes of producing black by compounding colours, blue is to be regarded as its archeus or predominating colour, and yellow as subordinate to red, in the proportions, when their hues are true, of eight blue, five red, [403] and three yellow. It is owing to this predominance of blue in the constitution of black, that it contributes by mixture to the pureness of hue in white colours, which usually incline to warmth, and that it produces the cool effect of blueness in glazing and tints, or however otherwise diluted or dilated. It accords with the principle here inculcated that in glass-founding the oxide of manganese, which gives the *red* hue, and that of cobalt, which furnishes the *blue*, are added to brown or *yellow* frit, to obtain a velvety black glass. Similarly the dyer proceeds to dye black upon a deep blue basis of indigo, with the ruddy colour of madder and the yellow of quercitron, &c.

Some of the best blacks and neutrals of the painter are those formed with colours of sufficient power and transparency upon the palette. Prussian blue and burnt lake afford a powerful though not very durable black; and compound blacks in which transparent pigments are employed will generally go deeper and harmonize better with other colours than any original black pigment alone. Hence lakes and deep blues, added to the common blacks, greatly increase their clearness and intensity: in mixture and glazing of the fine blacks of some old pictures, ultramarine has evidently been used. In this view, black altogether compounded of blue with red and yellow, each deep and transparent, and duly subordinated according to its powers, will give [404] the most powerful and transparent blacks; although, like most other blacks, they dry badly in oil. Of course, as with all compound colours, it depends entirely on the pigments employed whether these mixed blacks are permanent or not: a compound black can very well pass through the stages of black to grey, gray, or dirty white, if each link in the chain of combination be not as strong as its fellows.

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296. *Black Chalk*

is an indurated clay, of the texture of white chalk, and chiefly used for cutting into crayons. Fine specimens have been found near Bantry in Ireland, and in Wales, but the Italian has the most reputation. Crayons for sketching and drawing are also artificially prepared, which are deeper in colour and free from grit. Wood charcoal is likewise cut into crayons, that of soft woods, such as lime, poplar, &c., being best adapted for the purpose.

297. *Black Ochre,*

Earth Black, or Prussian Black, is a native earth, combined with iron and alluvial clay. It is found in most countries, and should be washed and exposed to the atmosphere before being employed. [405] Sea-coal, and other black mineral substances, have been and may be used as substitutes for the more perfect blacks, when the latter are not procurable, which now seldom or never happens.

298. *Bone Black,*

obtained by charring, is similar to that of ivory, except that it is a little warmer in tone, having a reddish or orange tinge, and is a worse drier in oil. Like ivory black, it is very transparent. Immense quantities of bone black are consumed with sulphuric acid in the manufacture of shoe blacking.

299. *Coffee Black,*

though little known and not on sale, has been strongly recommended by Bouvier as one of the best blacks that can be used. Soft without being greasy, light, almost impalpable, even before being ground, it gives tints of a very bluish gray when mixed with white, a quality precious for making the blues of the sketch, and dull greens. It is said to dry better than blue or vine black, and to combine admirably with other colours. De Montabert prefers calling it Coffee Brown, giving it as an exemplification of a bluish-brown, but probably this brown hue is owing to want of skill in its manufacture. We have not had personal experience of the colour, but there is no [406] theoretical reason why a carbonaceous black should not be produced from coffee. The mode of proceeding is to calcine the berry in a covered vessel, and well wash the resulting charcoal with boiling water by decantation. In order to prevent the powder, which is of great lightness, from floating, it is made into paste with a few drops of alcohol before adding the water.

300. *Frankfort Black*

is said to be made of the lees of wine from which the tartar has been washed, by burning, in the manner of ivory black; although the inferior sort is merely the levigated charcoal of woods, of which the hardest, such as box and ebony, yield the best. Fine Frankfort black, though almost confined to copper-plate printing, is one of the best black pigments extant, being of a neutral colour, next in intensity to lamp black, and more powerful than that of ivory. Strong light has the effect of deepening its colour. It is probable that this was the black used by some of the Flemish painters, and that the pureness of the greys formed therewith is due to the property of charred substances of preventing discolourment.

301. *Manganese Black,*

the common black oxide of that metal, is the best of all blacks for drying in oil without addition. It [407] is also a colour of vast body and tingeing power. As a siccative, it might be advantageously employed with ivory black.

302. *Mineral Black*

is a native impure carbon of soft texture, found in Devonshire. Blacker than plumbago, and free from its metallic lustre, it is of a neutral colour, greyer and more opaque than ivory black, and forms pure neutral tints. Being perfectly durable, and drying well in oil, it is of value in dead colouring on account of its solid body, as a preparation for black and deep colours before glazing. It would likewise be the most permanent and best possible black for frescoes.

303. *Paper Black,*

a pigment unknown to the modern palette, like most of our numbered italicised colours, is of the nature of blue or vine black. Very soft and of a fine bluish-gray, it is fitted for flesh, or for mixing with whites or yellows in landscapes.

304. *Peach Black,*

or Almond Black, made by burning the stones of fruits, the shell of the cocoa-nut, &c., is a violet-black, once much used by Parisian artists. Bouvier believes it to be a good black, but at the same time sensibly asks, of what use is it to have a black of this cast, which can always be given by [408] lake, without diminishing but rather increasing the intensity of the black it may be mixed with.

305. *Prussian Black.*

The same Prussian blue which gives a brown when burnt in the open air, yields a black when calcined in a close crucible. Very intense, very soft and velvety, and very agreeable to work, this bluish-black dries much more promptly than most other blacks, and scarcely requires grinding. On account of its extreme division, however, it would probably be found more energetic as a decolourising agent in admixture with organic pigments than most carbonaceous blacks.

Another Prussian black, containing copper, and made by a wet process, is obtained when a dilute solution of cupric sulphate and ferrous sulphate, in proper proportions, is mixed with a quantity of ferrocyanide of potassium not in excess. A very bulky deep black precipitate is formed, which is difficult to wash, and is deep black when dry. It is insoluble in water, and appears to be a compound analogous to Prussian blue. As a pigment, this black is inferior to the preceding.

306. *Purple Black*

is, or rather was, a preparation of madder, of a deep purple hue approaching black. Powerful and [409] very transparent, it glazed and dried well in oil, and was a durable and eligible pigment. Its tints with white lead were of a purple cast.

307. *Spanish Black,*

or Cork Black, is a soft black, obtained by charring cork, and differs not essentially from Frankfort black, except in being of a lighter and softer texture. "Some of my friends," says Bouvier, "call it *Beggars' Ultramarine*, because it produces, by combinations, tints almost as fine as ultramarine." A blue but not a velvet black, where intensity is required some other is to be preferred. For mixtures, however, it is stated to be admirable, and especially for linen, skies, distances, and the various broken tints of carnations, &c.

Besides those blacks which have been mentioned, there are others furnished by several of the metals and by many organic substances employed as dyes; but as the blacks in common use are all permanent, and have been found sufficient for every purpose, it is scarce needful to swell the list. Nor is it more needful, the Editor considers, to swell the book; lest his aim be defeated of reflecting in a *moderate*-sized mirror the palette as it is and might be at the present day. Arrived at age, as it were, in its twenty-first chapter, this treatise may fitly conclude with Black, the last [410] of the series of colours. Let us hope the maxim of Sir Joshua Reynolds, that success in some degree was never denied to earnest work may apply here.

Still, by way of finale, we would offer a few remarks. In no branch of the science, perhaps, is it more hazardous to commit oneself to a positive dictum than in the chemistry of colours, so liable are theory and practice to clash, and so often does the experience of one person or one time differ from that of another. He who has turned his attention to pigments, finds nearly every assertion must be qualified, for to nearly every rule there is some exception, and learns that theory alone may mislead. For example, a colour known to be fugacious may last, in certain cases, a surprisingly long time; while, on the contrary, a pigment permanent when used alone, may be rendered fugitive by improper compounding. Again, what holds good of a colour produced by one process, or employed in one vehicle or by one artist, may not be true of the same colour made by a different mode, or used in another vehicle or by another artist. It is because, then, colours are of every degree of durability, from the perfectly stable to the utterly fugitive, and because each one is liable to influence by every condition of time, place, and circumstance, that the chemist's theory is opposed as often to the painter's practice as the [411] experience of artists themselves varies. This may explain the charges of inconsistency and contradiction which have been brought against writers on pigments, faults that lie rather with the nature of the subject than with the authors.

Even at the risk of being tiresome, we have throughout insisted on the choice of permanent pigments, not simply for use alone but for mixed tints. To quote Cennini, "I give you this advice, that you endeavour always to use ... good colours.... And if you say that a poor person cannot afford the expense, I answer, that if you work well (and give sufficient time to your works), and paint with good colours, you will acquire so much fame that from a poor person you will become a rich one; and your name will stand so high for using good colours, that if some masters receive

a ducat for painting one figure, you will certainly be offered two, and your wishes will be fulfilled, according to the old proverb, 'good work, good pay.'" Of a truth, if man cannot dip his brush in the rainbow and paint with the aerial colours of the skies, he can at least select the best pigments that earth and the sea afford him; preferring, where he cannot get brilliancy and permanence combined, sobriety and permanence to brilliancy and fugacity. It must be the wish of every real artist to leave behind him a lasting record of his skill, a permanent panorama of those hues of [412]
nature which in life he loved so well. To effect this, genius alone is powerless: there must be first a proper choice of materials, and next a proper use of them. The painter's pigments are the bricks wherewith the mortar of his mind must be mixed, either to erect an edifice that shall endure for ages, or one which will quickly topple over like a house of cards. Now in nothing more than in painting is prevention better than cure—indeed cure may be said to be here out of the question: for good or for evil a picture once painted is painted for ever. Without a strong constitution there is no hope for it; no chemistry can strengthen the sickly frame, restore the faded colour, stop the ravages of consumption: Science stands helpless before dying Art.

And yet, she sighs to think, it might have been otherwise. If durable pigments had been employed, if her counsel had been sought, this need not have been. In the history of modern art the use and abuse of colours would furnish a sad chapter, telling of gross ignorance, and a grosser indifference. Happily there is promise of a healthier state of things. When this comes, Art will be less shy to consult her sister: in the interests of both there should be closer union. Without waiting till the picture is finished—for then it will be too late—let her, if in doubt, frankly display the contents of her palette and ask advice. Now, not knowing what pigments are chosen or how they are used, never standing by and watching the progress of the work, how can Science lend [413]
her aid? She would willingly, for she herself needs help: at present her knowledge is limited, not so much of the chemistry of colours as of the properties of pigments. She seeks to mix her pound of theory with an ounce of practice, and craves a warmer welcome to the studio. For any approximation to the truth to be arrived at, facts must be noted with the conditions under which they occur, not by one sister alone nor by the other alone, but by both. In future, Art and Science should go hand in hand, mutually dependent on each other, mutually trustful of each other, working with and for each other, earnestly and patiently.

FOOTNOTES:

[C] Light is either direct or diffused—direct, when the sun's rays fall upon any object; diffused, when ordinary daylight illumines objects with white light, causing them to appear of their peculiar colours.

ADDENDUM. [414]

With the present rapid progress of applied chemistry, an addendum in a work of this kind is quite excusable. Even while the book is being printed some fact may be announced which the author or editor would wish to insert. In our case this has happened. Very recently there has been introduced in France as a pigment

308. TUNGSTEN WHITE,

or *Tungstate of Baryta*. "At the request of a landscape painter," says M. Sacc in a letter to M. Dumas, "I was induced to examine in succession all our insoluble white compounds, with regard to their adaptability to painting purposes. Tungstate of baryta answers perfectly, covers as well as white lead, and is as unalterable as zinc white. It has been employed by this artist for three months, and was found equally successful in oil or water colours, chromolithography, and even in making white impressions on a black ground. This harmless substitute for the injurious white lead is prepared on a large scale in Paris by M. E. Rousseau." We have not met with a sample of [415]
that gentleman's manufacture, but judging from our own specimens, made both by wet and dry processes, and carefully tried in water and oil, it would seem that a perfect white pigment has yet to be discovered. With us, at least, tungstate of baryta is far from having the body of white lead, and indeed is inferior in opacity to good zinc white. Unaffected by foul air, the tungstate appears to possess the common fault of all whites when compared with white lead—want of body, moreover it is a bad dryer. However, M. Rousseau's preparation may not be open to these objections, and we therefore reserve our final opinion of tungsten white. It is intended to publish from time to time a fresh edition of Field's Chromatography, and we hope in the next issue to give a more detailed and favourable account of the new pigment.

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ERRATA

Page	16	*for*	inharmonious *read* harmonious
"	35	*for*	There prevails *read* There prevail
"	48	*for*	as whiteness, or light do, *read* as whiteness or light does
"	166	*for*	purple of cassius *read* purple of Cassius
"	182	*for*	which manufactures *read* which

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"	258	*for*	*Laque Minéral read Laque Minérale*
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THE END.

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Transcriber's Notes

Greek characters may not be visible in all browser on all computers. The errata above and the following have been corrected in the text:

Page	vi	Semi-neutral changed to Semi-Neutral
"	10	life less changed to lifeless
"	17	sun-rise changed to sunrise
"	20	in the the changed to in the
"	22	perpective changed to perspective
"	29	marone changed to marrone
"	69	di-carbonate changed to dicarbonate
"	73	hydrogren changed to hydrogen
"	77	imimical changed to inimical
"	81	feuillemorte changed to feuillemort
"	91	Item numbering has been left consistent with the omission of item no. 23
"	129	extemes changed to extremes
"	169	muroxide changed to murexide
"	188	dullness changed to dulness
"	192	gaslight changed to gas-light
"	200	durablity changed to durability
"	206 and 293	developement changed to development
"	212	decolorized changed to decolourised
"	235	indentical changed to identical
"	241	re-acting changed to reacting
"	250	Exibition changed to Exhibition
"	273	childrens' changed to children's
"	336	toneing changed to toning
"	352	fine tooth-comb changed to fine-tooth comb
"	408	analagous changed to analogous
"	414	announceed changed to announced
"	421	abies changed to Abies

Inconsistencies in the use of analyse/analyze, harmonise/harmonize and neutralise/neutralize have been retained as in the original text, as have the use of aërial and aerial.

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