applied it to precious stones (such as the topaz) when we should say blue. The eyes of Athena are described by *glaucois*, not because they were blue, but because they were gleaming or fierce. With regard to purple, the Latin word *purpureus* meant various shades of red, and the corresponding word in Greece was probably first applied to the troubled sea and meant dark; it was only later that it was applied more definitely to colour.

The Greeks recognized three colours only in the human iris—first, *glaucois*, the lightest tint; second, *xaropos*, the intermediate shade, (but previously meaning bright-eyed and having no reference to colour); and third, *melas*, the darkest shade.

A very early reference to colour occurs with regard to Joseph's coat, which we are told was of many colours, but unfortunately they are not enumerated.

The rainbow, to which we have equally early reference, does not appear to have fascinated the ancients because it was polychromatic. In the Bible and in Homer it was considered to be merely a sign to man, and the word *iris* was used for any bright coloured circle surrounding another body. In this sense it was applied to the eye, which of course is usually monochromatic. It is a significant fact that form vision in the days when Pompeii was a living city was so advanced that the statuary of Phidias and Polycletois is of unsurpassable perfection; nevertheless the colour sense, after making allowance for the effects of time, is crude, and the tones are monotonous, red and yellow predominating. The mural paintings and frescoes at Pompeii are artistically inferior to the bronzes.

As time wore on presumably the function of the temporo-occipital lobe became more and more detailed, and in Saxon and early English days colour sense was well advanced; as we see in the illuminated missals of those times.

The Moors early developed a refinement of colour recognition, and there is no doubt that the Crusades stimulated the appreciation of tints and shades which prepared the way for the wave of Byzantine gorgeousness which swept over Southern Europe. When the Renaissance set in it is probable, judging from the works of da Vinci and Raphael, that colour perception was almost as matured as it is to-day, and that it was also a most important factor in the extraordinary development and progress of art, in all its branches, which distinguishes the sixteenth century.

The diagram shows the higher visual cortex on the lateral aspect of the right cerebral hemisphere. The upper part of the dotted area (A) is devoted to the recognition of words, letters, etc.; the middle (B) to persons and places; and the lowest (C), the temporo-occipital or fusiform lobe, to the recognition of colours. The posterior part is concerned with form vision (D) and ocular movements.

The isolated position of the fusiform lobe renders it probable that when a lesion is a primary one in that part of the occipital lobe, the earliest symptoms would be confined to loss of colour sense. On the other hand, a lesion spreading from other parts of the visual area would probably render the patient blind before a diagnosis of loss of colour recognition could be made.

A lesion confined to both fusiform lobes would probably not interfere materially with form vision, the centre for which is further back (D), except that the negation of colour would tend to blend all objects in one harmonious neutral tint. Such was the vision of our ancestors some few thousand years ago. In the present day, however, a congenital case of total colour-blindness is rare, and still fewer acquired cases have been published. A one-sided lesion in the colour centre is occasionally met with, and probably they are more common than is acknowledged. A patient

so affected, in walking along a country lane, would have a green hedge on one side and a grey one on the other.

It is well recognized that there are symptoms which point to intracranial pressure which precede papilloedema and amongst these are, I believe, changes in the recognition of colour. The importance of these pre-papilloedematous symptoms lies in the fact that the tendency of present-day surgery is in the direction of early decompression operations.*

Although acquired colour-blindness has not been investigated very extensively, the more general use of the lantern by physicians will, I believe, lead to an extended recognition of its prevalence in cases in which the temporo-occipital lobe is involved.

The investigation of a patient's capacity to discriminate between colours is no longer a matter of academic interest alone; it is no longer associated in practice only with the examination of railway men and sailors; but it is becoming an additional aid in the diagnosis of localization. The area of usefulness of colour tests has become increased, and it is worthy of the attention of the physician and of the surgeon. As the sense of touch is investigated for the recognition of heat and cold, and also for the presence or absence of stereognosis; as taste is examined with regard to sweets and bitters, for salts and acids; so too should vision be analysed, not only with regard to form and fields, but also as to the discrimination of colours.

A NOTE ON THE RELATION OF CORNEAL AND ABSOLUTE ASTIGMATISM.

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The object of this communication is to ascertain the relation of corneal astigmatism, as recorded by the astigmatometer, to absolute astigmatism, as worked out by retinoscopy, the retinoscopy being done either under atropine, or, in the case of older patients, under homatropine and cocaine. All the observations have been made by myself, the instrument used being Javal and Schiötz's astigmatometer (the same instrument being always used), and the retinoscopy having been worked out always with a plane mirror, the shadows being reversed in every case.

The 500 cases have not been selected in any way, but have been taken consecutively from my private journals; in this way the possibility of individual difference has been excluded. The corneal astigmatism and the absolute astigmatism were worked out quite independently of each other; in many cases the corneal astigmatism was observed one day and the absolute astigmatism worked out on the return of the patient a few days later, in this way excluding the possibility of any tendency one might naturally have to make one observation confirm the other. The cases have been limited to 500, a number sufficiently large, at any rate, to warrant some generalization from, and a convenient figure. The notes kept of the different cases were in the ordinary course of practice, without any intention of using them in this way.

These 500 cases give 1,000 eyes, and the observations have been made with the following results:

Out of the 1,000 eyes examined the absolute astigmatism and the corneal astigmatism are the same in 475 cases—that is, 47.5 per cent.; 230 were hypermetropic, 353 showed compound hypermetropic astigmatism, 89 were myopic, 190 showed compound myopic astigmatism, and 138 mixed astigmatism. The divisions into the different classes of hypermetropia, hypermetropic astigmatism, myopia, myopic astigmatism and mixed astigmatism, were made by the actual figures found by retinoscopy.

In each case the lens which first turned the shadows was the one noted, so that it might be said in every case there was an over-correction. In the ordinary course many of those eyes were practically emmetropic, or at least emmetropic in one meridian.

*Research is needed with regard to the quantitative estimation of colour perception. Cohn, as long ago as 1879, pointed out that a spot of red 1 mm. square could be seen at 14 metres, whereas a similar sized violet one could only be named at 2 metres. (BRITISH MEDICAL JOURNAL, 1892, ii, page 626.)

It is only fair to bear in mind that many cases were fitted with glasses without having recourse to retinoscopy, but in this note the results are built up from cases in which it was thought advisable to dilate the pupils.

THE ADMINISTRATION OF OXYGEN.

BY

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OXYGEN is usually given in a thin stream through a nozzle or small funnel held more or less near the mouth or nose of the patient. I have seen a nurse hold it 6 in. away. This method is more than inefficient; it is absurd. The oxygen diffuses into the atmosphere, and the patient inspires air enriched very slightly with oxygen. Analyses of the pulmonary alveolar air obtained from subjects to whom oxygen was administered in this way showed an increase of only 1 to 2 per cent. If a most wasteful current was used and the funnel held close to the mouth, the increase was at most 10 per cent. Patients who are ill and fretful, say with pneumonia, cannot bear a tight-fitting mask. Thus oxygen cannot be administered in the most economical way by means of an anæsthetic mask fitted with breathing bag and caustic soda to absorb the exhaled CO_2 . If such a method could be borne, a 20 ft. cylinder would give a supply for continuous breathing of oxygen, which would last all day, for a patient in bed uses only about 250 c.cm. per minute, and there are about 56 litres in the cylinder.

Ludicrously inefficient as the nozzle and funnel methods are, I have known of a practitioner going a step further in absurdity, in allowing the oxygen to escape in the patient's room! A man might as well hope to affect the composition of the sea by emptying his bladder into it.

It has been ascertained that in places situated at high altitudes, such as Mexico City, it gives the patient who has pneumonia much the better chance if he is rushed down to the plains. This shows the importance of the partial pressure of oxygen in maintaining the strength of the heart, etc., while the invading microbe is defeated by the rise in the immunizing powers of the blood. It therefore seems well worth while to try the effect of a still higher partial pressure of oxygen on patients situated at sea level.

It has been ascertained by Lorrain Smith, and by J. J. R. Macleod and myself that high pressures of oxygen produce inflammation of the lung. This is only brought out in mice by a very prolonged exposure (two or three days) to a partial pressure of 70 to 80 per cent. of an atmosphere—that is, four times as much oxygen as normal. The miners who practise wearing the Fleuss rescue apparatus for use in mines at the Howe Bridge and other rescue stations now set up in the colliery districts breathe 80 to 90 per cent. of oxygen for two hours or more, and never suffer in the least.

There is abundant evidence that the breathing of this partial pressure of oxygen has no ill effect. Börnstein has even breathed oxygen at two atmospheres pressure for half an hour without harm. Undue alarm as to the poisonous effect of oxygen has been felt by the medical profession. Oxygen does not influence the metabolism of the resting man at all. The common idea that the processes of combustion in the body are accelerated by breathing oxygen is erroneous. A man doing very

hard work is benefited by breathing oxygen because he does not then suffer from a shortage of oxygen, and so works more easily. Shortage of oxygen leads to the production of lactic acid, and this adding its effect to that of the carbonic acid in the blood increases the dyspnoea. The same must hold good with men ill of pneumonia. The problem is to contrive a mask which will allow a patient with pneumonia to receive an efficient supply of oxygen and yet will not render him uncomfortable or fretful. Messrs. Down have made for me a celluloid face-piece, to which a curtain of washable material is attached. The handle of the mask is also the inlet tube for the oxygen. The current of oxygen flows over the mouth and nose of the patient. The current is turned on until an agreeable cooling effect is obtained, and no sense of closeness is felt when the mask is applied to the operator's face. The operator, by applying the mask to his own face, will soon get to know the right degree of hissing noise in the tube. The patient inspires the atmosphere confined under the mask, and as a current is used sufficient to blow away the CO_2 , a very high percentage of oxygen is obtained in the alveolar air—for example, over 70 per cent.

Messrs. Down have also contrived for me a heating box which can be used with the mask for evaporating alcohol and adding vapour of alcohol to the oxygen. An incandescent electric lamp is placed at the bottom of the box; one of the lamps

in the ward or room can be inserted into the socket at the bottom of the box, and the wires from this attached by a plug to the socket from which the lamp was taken. A pot containing whisky or brandy, 2 parts, and water, 1 part, is placed in the box above the lamp. The current of oxygen is led through this box. There is no need to use a heating box or to wet the oxygen, unless alcohol or some other vapour is required to be given. Using the mask alone, I find patients like the cool stream to play upon their face. The

stream has to be made forcible enough to have a cooling effect, otherwise the patients push away the mask.

In the figure a water manometer is shown attached to the heating box. I devised this as an index for measuring the supply of oxygen, but experience has shown me that it is troublesome in use; the uninitiated cannot control the tap properly and blow out the water from the manometer. A gauge is not needed. It suffices to turn on the current until a distinct pleasant cooling effect is produced on the face, and learn to use the hissing noise of the current as an index. This method of giving oxygen is thoroughly efficient, and has produced most striking results in two cases of pneumonia on which I have tried it. The irregular pulse with its extra-systoles becomes regular, stronger, and less rapid, the ashen colour of the lips becomes red, and the patient recovers consciousness. In the case of an old retainer in my household dying of pneumonia, the administration of oxygen time after time restored her to consciousness. Aroused from that sleep which ends in death, she said, "Why, you have woken me up," and answered questions, only to relapse again soon after the oxygen was withdrawn. The return to consciousness makes the patient sensible of his illness, it improves his condition but he feels his distress, and therefore may ask for the oxygen to be discontinued.

In the struggle with the invading micro-organism oxygen helps to maintain the strength of the heart and so preserve the patient until the process of immunization is established and the disease arrested. To give oxygen most efficiently we require to place the patient altogether in a superoxygenated atmosphere, wherein he can live and be

Oxygen mask and heating box (Down Brothers). A, The mask, which can be used with or without the heating box. C, The cup in which alcohol and water are placed above the electric lamp. The ingoing current of oxygen blows over the cup. D, The manometer, the use of which I have discarded.