THE

CYCLOPÆDIA

OF

ANATOMY AND PHYSIOLOGY.

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are, indeed, very unsafe, unless the number of facts observed is very great, and that is not the present condition of our knowledge of the copulative act. For that reason I have not dwelt upon this, *primâ facie* so obvious, line of argument.

Our knowledge of the function of the vesiculæ seminales is, therefore, nearly in the same condition as it was left by the great Hunter, whose concise paper on this subject is a master piece of reasoning and scientific acumen. I have been able to add to this, besides confirmation, little more than some few observations tending to render it more probable that the secretion of the vesiculæ is used in copulation. I have, further, ventured on an hypothesis which, I suppose, has suggested itself to many before, and with which I am by no means satisfied. So great, however, are the difficulties surrounding the subject, that in this unsatisfactory state—the positive function still hypothetical—I am compelled reluctantly to leave it.

(*S. R. Pittard.*)

VISION.—(Fr. *vision*, from Latin *visio*, from *video*, *visus*, sight.)—The faculty of seeing is one of the chief means by which living creatures are brought into relation with the world around, and is the especial means by which they are enabled to appreciate the wonderful phenomena which flow directly and indirectly from the creation of light. When in obedience to the Divine command, "There was LIGHT," there were organs created for its perception; and it is interesting to observe that the restoration of this gift of perception, when lost, was among the most frequent, and certainly not the least striking of the manifestations of miraculous power displayed by the Saviour of mankind. The vastness of the field over which the faculty of vision gives us command, the precision and permanence of this class of our perceptions, the variety and accuracy of the information it conveys, and the delight it affords, lead us irresistibly to regard it as the most perfect of our senses. In the investigation of this subject a train of minute adaptation and wonderful contrivance is disclosed to us, in which are combined the extremes of grandeur and of delicacy. There is no department of science that possesses a more absorbing interest than the laws of optics when applied to the eye, and certainly none which points with a steadier hand to the wisdom of an omnipotent Creator.

Very curious and unexpected information respecting the early condition of the surface of this planet and the ancient atmosphere has been afforded by an investigation into the structure of the organs of vision with which the earliest marine animals were supplied. In the eloquent language of Dr. Buckland, "with respect to the waters wherein the Trilobites maintained their existence throughout the entire period of the transition formation, we conclude that there could not have been that imaginary turbid and chaotic fluid, from the precipitate of which some geologists have supposed the materials of the surface of the earth to be derived: because the structure of the eyes of these animals is such, that any kind of fluid in which they could have been submerged at the bottom must have been pure and transparent enough to allow the passage of light to organs of vision, the nature of which is so fully disclosed by the state of perfection in which they are preserved. With regard to the atmosphere also, we may infer that had it differed materially from its actual condition, it might have so affected the rays of light, that a corresponding difference from the eyes of existing Crustaceans would have been found in the organs on which the impressions of such were then received. Regarding light itself, also, we learn, from the resemblance of these most ancient organizations to existing eyes, that the mutual relations of light to the eye and of the eye to light, were the same at the time when Crustaceans endowed with the faculty of vision were first placed at the bottom of primæval seas as at the present moment."

Light.—To the opinions of the ancients on the subject of light but little allusion need be made, as they were but crude and vague conjectures. One, for instance, supposed that the eyes emitted emanations of some sort by which objects were, as it were, felt. Others imagined that visible objects were constantly throwing out from them spectral resemblances of themselves, which, when received by the eye, produced an impression of those objects; but in these fanciful notions there is little satisfaction, and we proceed at once to the hypothesis of our illustrious countryman, Sir Isaac Newton. According to his theory, light was an imponderable substance, whose inconceivably minute particles produced the sensation of light by their action on the eye: moving with immense velocity, they were nevertheless acted on by attractive and repulsive forces residing in all material bodies, and by these forces were liable either to be turned aside from their natural straight course, reflected by the repulsive force, or penetrating between the particles of bodies, to take a direction on quitting them finally determined by the position of the surface at which they emerged. About the same time, however, a very different hypothesis was advanced by Huyghens, to the effect that all space is filled with an extremely elastic and rare ether, and that light is the result of the undulatory movements communicated to this ether by self-luminous bodies, which movements being transmitted to the optic nerve, give rise to the sensation of light. The beautiful experiments of Dr. Thomas Young strongly confirmed the truth of this theory, which is based upon the supposition that light acts by vibrations upon the retina, in the same manner as the undulations of the air striking upon the tympanum excite the sensation of sound.

The *velocity* of the luminous undulations deduced by Römer from the eclipses of the satellites of Jupiter, is proved to be about 192,500 miles in a second: in other words,

place easily, hence achromatopsy results from a certain state of torpor and indolence of the retina and motor muscles of the eye!

Professor Wartmann, the most recent authority upon this subject, stated in his first Memoir that achromatopsy (or Daltonism) has its origin in a defect of the sensorium. In his second Memoir he enters at length into a somewhat different explanation of the phenomena. "I admit (says he) with Harvey, Young, Jüngken, Müller, and others that its seat is in the retina, and I think that it is produced by an abnormal state of the nervous expansion, in such sort that it reacts equally under two or more differently coloured vibrations. If the vibration caused by a ray of red is identical with that engendered by a green ray, there will be confusion of these colours. This theory is independent of all systems destined to explain light. * * * The theory which explains Daltonism by an abnormal elasticity of the retina has the advantage of substituting a reasonable physical condition for a vague notion of the sensorium: besides, it is supported by facts, because the injuries which alter the ordinary constitution of the visual organ are capable of exciting, permanently or temporarily, a false perception of colours. Lastly it appears to be confirmed by the circumstance that with many Daltonians the eye sees less distinctly the red rays than those of which the refrangibility is greater."*

The actual seat of the phenomena of achromatopsy must, after all, remain matter of speculation, as it is one of those things incapable of demonstration. D'Alembert says: "It is very plain that the word colour does not designate any property of body, but merely a modification of our mind: that, for instance, whiteness and redness exist only in us, and by no means in the bodies to which we refer them by a habit in force from infancy." The knowledge that we possess of the existence of colours is derived from the evidence afforded by the thousands of persons endowed with the power of distinguishing them, and therefore we conclude that they do exist. But supposing we were all like Dalton and many others whose visual organs never appreciate red any more than the generality of eyes distinguish the calorific or actinic rays, we should then not be aware of the existence of the colour called red, which plays so conspicuous a part in the adornment of the universe; or if some few eyes gifted with superior powers discerned it, the majority would have to admit its existence on the evidence of others, not from knowledge derived from their own eyes.

As regards remedial measures, Wartmann and Seebeck recommend the employment of coloured glasses of a certain known tint; suppose this tint red, the impression of a green body and of a red body at first the same to the naked eye will be distinguished by the use of the transparent screen. Wartmann, however, admits that this method only remedies mistakes in the specific nature of colours, and not those which apply to the shades of one and the same tint. Jüngken and Chelius have recommended the use of coloured bands, bearing the name of their colour, and Szokalski has suggested that sensations of the various shades may be excited by fixing the eyes on different coloured patterns, and then on a black or white surface. But this proceeding is scarcely so likely to be productive of benefit as that recommended by Professor Wartmann.

Should the achromatopsy result from congestion, such means should be adopted as are best calculated to subdue it; as depletion, purgatives, and low diet. If it arises from menstrual suppression, it will be proper to prescribe emmenagogues, with mustard pediluvia, hip baths, and such other means as are likely to restore the catamenia. Should derangement of the hepatic system be the exciting cause, a dose of calomel, followed by a black draught, will often be sufficient to remove it; but it will be proper to follow such a prescription with alterative doses of mercurials and saline aperients, of which the Pullna and Marienbad waters are very serviceable: taraxacum with or without the nitro-muriatic acid may also be advisable.

Dyspepsia is too protean a disorder for us to attempt more than to suggest the propriety of carefully investigating the particulars of cases where the insensibility to colour can be traced to this cause, and of laying down such a plan of treatment, medical and general, as seems best adapted to the exigencies of each individual case.

Hyperchromatopsy (ὑπὲρ, beyond; χρῶμα, colour; ὄψις, vision).—Our knowledge of this condition of the vision which may be regarded as the opposite to achromatopsy, is at present very limited, and is chiefly derived from the publications of Dr. Sachs* and Dr Cornaz.† As we have never had an opportunity of investigating a case of the sort, we can only draw our information from these and some other sources.

Dr. Sachs is, we believe, an albino, and is in addition affected with hyperchromatopsy. The first account of this very singular anomaly of vision was published by him, and other instances have since been discovered. Professor Wartmann, of Geneva, in a communication with which he recently favoured us, thus writes:—"Quant à l'Hyperchromatopsie, c'est une affection qui n'est probablement pas extrêmement rare. Je connais deux personnes qui m'ont dit en être atteintes, et j'espère être un jour en état de publier quelques recherches sur ce sujet. Cet état n'est point nécessairement lié à l'albinisme."

* Deuxième Mémoire, p. 46. Dr. Wartmann enters at length into the discussion of this subject, but our space will not admit of our extracting his ingenious arguments.

* Historiæ Naturalis duorum Leucæthiopum Particulæ duæ. Erlangen, 1812.

† De l'Hyperchromatopsie, par le Dr. E. Cornaz. Bruxelles, 1851.

The characteristic of Hyperchromatopsy is that of attaching colours not merely to objects which, according to ordinary vision, possess them, but also to other objects which have no pretensions to them, and this to an extent scarcely credible.

It does not appear that the same colours always attach to the same objects with different individuals; on this point there is considerable diversity, but as the account published by Dr. Sachs of his own perceptions is the most minute which has appeared, we shall take it as the ground of the following description :—

The objects to which colours especially connect themselves in this condition of vision are, figures, dates, the days of the week, the letters of the alphabet, and musical notes. These colours are not all equally distinct: the clearest are yellow, different shades of pure white and blueish white; the less clear are orange, red, dull white, dark blue, brown and green. Black only attaches itself to one of the letters of the alphabet. This morbid sensibility to colours thus displays itself: — A and E are red, but the first has more of the vermillion tint, the second most of the rose. I is white, O orange, U black, and is the only example of black; UE or Ü is white, so is M and N. C is of a pale ash colour. D is yellow. F of a dull white. H a blueish ash colour. K approaches deep green. S is of deep blue, and W is brown.

Musical notes indicated by the names of the letters $\overset{\text{Do}}{\text{C}}\ \overset{\text{Re}}{\text{D}}\ \overset{\text{Mi}}{\text{E}}$ et cætera, present generally the same colours as these; however whilst in the alphabet, B and G appear almost colourless, the *Si* flat appears of an ash grey, and the *Sol* of an uncertain green.

Of figures, 0 is almost transparent, of a pale and uncertain yellow, 1 of an undecided white, 2 of an uncertain tint, 3 almost ash coloured, 4 minium red, 5 yellow, 6 indigo, 7 blueish white, 8 brown, 9 almost deep green. The numbers composed of several figures take the colours of the last forming them. 0 does not change the colours of the figures to which it is joined, but gives to them a certain appearance, whilst a figure often repeated in the same number causes the colour proper to it to increase in intensity. 10, 11, 100, 110 and 111 are white; the first of them resembles white glass, the second is milk-colour, the third semi-transparent white; the two last perfect white. 14, 24, 40, 44, 400 and 440 are red, but 15, 25, 50, 55, 500, 555 and 1000 are yellow; why the 1000 is yellow whilst 100 is white we do not understand, as the additional 0 does not account for it

Sunday, is to the eyes of this conscientious observer, white slightly tinged with yellow. *Monday*, another shade of white; the colour of *Tuesday* is obscure and undecided. *Wednesday* is yellow; *Thursday* is of a yellowish green, verging towards orange. *Friday* of a dull white, and *Saturday* is of a blueish ash colour.

It is stated that the abnormal sensations of colour are so intimately connected with these objects, that some can only be seen without them by a strong mental effort, and that in the case of others this does not suffice.

In the present state of our knowledge we are not in a position to offer any satisfactory explanation of this singular anomaly of vision. That its seat is not in the eye but in the sensorium is however most probable, and in this opinion Dr. Wartmann concurs. More extended opportunities for observations will doubtless throw additional light on what must be regarded as a very curious subject.

Anorthopia (ἀ, not; ὀρθός, straight; ὄψις, vision).— This is a condition of vision far from uncommon, and is characterised by the individuals subject to it being unable to discern when objects are not parallel one to the other, and is often accompanied by a want of ability to distinguish whether objects are symmetrical. Such persons are incapable of drawing objects correctly; a house will be sketched with its proportions wrong and leaning on one side, and a figure will be equally unnatural, yet the artist will be sublimely unconscious of any defects. They are unable to discern whether pictures are straight on the walls, or blinds drawn parallel with the window frame; Negroes are very subject to this peculiarity of vision. Nothing is more common than to see them, when marking out the ground-plan of a house, path, or boundary wall, draw the lines as awry as possible, and yet persist that they are quite straight, nor can they be convinced to the contrary. It has appeared to us that the persons in whom this condition of vision existed in a marked degree, were characterised by unsymmetrical heads and faces, but this may have been a coincidence merely.

In children who show evidences of anorthopia, pains should be taken to overcome it by practice and tuition. They should write upon ruled paper at first, and when subsequently writing on ordinary paper, should always be made to place it straight before them and to write across it by the hand moving on the wrist which should be a fixed point, and seldom moved. In drawing, the correctness of the lines should be ascertained by admeasurement; and the study of geometry, perspective, and all other branches requiring attention to symmetry are calculated to be of service.

Myopia (μύω, I shut; ὄψ, the eye), commonly called *near sight*, is an affection almost, if not entirely, confined to civilization.

Every eye, when in a state of repose, is adapted by its size, figure, and the refractive powers of its media, to the formation of a distinct image of an object presented before it, at one particular distance. This differs in different individuals; but from 12 to 20 inches may be regarded as the distance at which ordinary print is legible, the shortest distance at which it can be seen clearly and without exertion being from 6 to 8 inches. A person who brings small objects nearer to the eyes than 6 inches is considered myopic.

was presbyopic for horizontal lines and myopic for vertical. This he remedied by wearing spectacles the glasses of which were cylindric bi-convexes, with rectilinear, horizontal and similar axes. These glasses obviated the presbyopia relative to the horizontal lines, and they were combined with sphero-biconcave lenses to get rid of the myopia for vertical lines. Each of the glasses was made moveable for facility of cleaning.

The following means are recommended to ascertain if an eye has the defect now described. The person should attentively contemplate for some time and with attention a cross, three or four lines in size, made of fine wire and fixed in a frame. If affected, he will see the horizontal lines differ in thickness and blackness of tint from the vertical.

To determine the focal length which the lenses should have, a person whose sight is presbyopic in one direction should take bi-sphero-convex lenses which enable him to see distinctly at the ordinary distance the lines which otherwise appear indistinct: he can deduce the focal distance of the cylindrico-convex glasses. A person myopic in one direction should do the same with regard to bi-sphero-concave lenses. The convex glasses should be chosen of one or two numbers stronger.

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(The subject of Vision is more or less treated of in works on Optics and Natural Philosophy; papers on its physiology and pathology are very numerous, and are to be found in Philosophical Transactions and Journals, in the Annales d'Oculistique, &c.)

(*W. White Cooper.*)

VITAL STATISTICS.—

The duration of human life, with a consideration of the principal causes by which it may be lengthened or curtailed, is a subject which evidently belongs both to the domain of physiology and to that of statistics. It belongs to physiology, inasmuch as the duration of human life is the final effect of the operation of natural causes brought to bear on the healthy human frame; and it belongs to statistics, whether we use that term in the less exact sense of a branch of human knowledge largely indebted to the use of numbers, or in the more accurate sense of a department of science, having an important bearing on the interests of the public.*

In this place it is proposed to take only a limited view of the subject of Vital Statistics, and to examine the scientific methods which have been suggested and employed for determining the true duration of human life in communities and classes of men; in other

* For some remarks on the true meaning of the term "Statistics," see STATISTICS, MEDICAL, note, p. 803.