their morphological position at the oral end of the body; and, with only one or two exceptions, there is but a single pair of eyes. In Patella, the row of eyes last seen in Solen has become a simple sphere of pigmented cells; and in Haliotis we have also an open sphere, but, instead of the refractive cuticula in front of each cell, there is one combined mass forming a lens, which is purely a secretion, not cellular as in vertebrates. Fissurella goes practically as far as any gastropod, having a closed eye containing a lens, and a transparent epidermal covering acting as a cornea. Both Fissurella and Haliotis have a distinct nerve specialized for sight, which connects the eye with the superior cephalic ganglion.

In an early stage of the vertebrate embryo, the anterior medullary groove divides into three segments, — the fore, mid, and hind brain. The fore-brain sends outwards and laterally a swelling, which increases in size, and passes on to the epidermis; and here an invagination takes place to meet this outward brain-growth. This invagination finally closes, and soon becomes cut off, forming a hollow vesicle, the cavity of which is finally obliterated, and, becoming transparent, forms the lens of the adult eye. In the mean time the growth from the brain has arched over and above this vesicle; and then, folding over laterally, it encloses the lens (fig. 3), which fills up the anterior opening of the cavity of this 'secondary optic vesicle.' After the closure is completed by the union of *a* and *b*, there is a double-walled vesicle, the interior wall giving rise to the many layered retina, while the external wall forms the pigment layer of the choroidea.

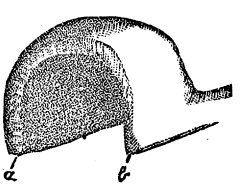

FIG. 3. — Diagram to illustrate the method by which the secondary optic vesicle encloses the lens which should fill up the open end. Eye of vertebrate.

The evolution of this eye seems simple; for, as soon as it became of importance to its possessor, a corresponding stimulation took place in the brain, where sight is without doubt seated. An increase of development began all along the tract, from the lens to the brain; and, as this increased, that part of the brain nearest the eye enlarged, and proceeded by steps outward in a manner similar to the process now taking place in the development of the eyes of Vertebrata. We then have a stage in which a part of the brain closes over the superior part of the eye, being separated by a layer of fibres which is the much shortened and flattened primitive optic nerve. The pedicle connecting this advanced part of the brain, which may be looked upon as a ganglion, will now be called the 'secondary optic nerve,' — the optic nerve of the eyes of the adult Vertebrata. Dr. Sharp thus holds, 1°, that the lens of the vertebrate eye is homologous with a primitive invaginated eye, such as we find to-day in the gasteropods; 2°, that the layer of optic fibres of the retina is homologous with the primitive optic nerve.

In vertebrates as well as invertebrates we frequently find blind animals, the near relatives of which have well-developed organs of sight. In these cases the accessory organs are first to disappear, the lens first; and in the lowest forms of degeneration, Branchiostoma notably, nothing remains but a slight deposit of pigment on the anterior end of the neural canal. This deposit in Branchiostoma, and a similar deposit in some larval Ascidia, have led Lankester to regard the primitive type of Vertebrata as a transparent animal with eyes sessile in the brain; but Dr. Sharp's investigations have led him to the opinion that forms so degenerate as these should not be taken as a standard on which to base our conclusions in regard to the origin of the vertebrates.

CIVILIZATION AND EYESIGHT.

THE discussion following Lord Rayleigh's article upon 'Civilization and eyesight' (*Nature*, No. 798, p. 340) has resulted in a clear exposition of this interesting subject. Rayleigh is of the opinion that the supposed superiority of the savage eye is merely a question of attention, and practice in the interpretation of minute indications; and that it is comparable with the acuteness of the blind in drawing conclusions from slender acoustical premises. It is doubtful whether the blind can hear sounds wholly inaudible to others; and, likewise, it seems impossible for the savage eye, with practically the same aperture as the civilized eye, to resolve objects, beyond a certain point, calculable by the laws of optics from the wave-length of light.

J. Rand Capron (*Nature*, No. 799, p. 359) suggests that, in considering the question of aperture, the fact that this, though probably following a general rule applicable alike to savages and civilized beings, varies in individual cases, should be taken into account. He mentions an assistant who had a singularly 'sharp' eye, and could pick out with ease companions to double stars, small satellites, etc., which others saw with difficulty. The pupils of his eyes were always larger than those of most other persons; and he had the peculiar power of being able to read fine print with ease when the gas was turned half on, and it was his habitual custom to read in this way. He suggests that there must be something more than a mere 'question of attention and interpretation of minute details,' when a savage can resolve two distant dots into distinctly appreciable personages, as regards sex and garments.

R. Brudenell Carter urges (*Nature*, No. 800, p. 386) that there is no necessity for a larger aperture to explain acuteness of vision. The savage might have greater sensitiveness to variations of light, greater sensitiveness to color, and acuteness of vision over a larger retinal area. All these advantages might be conferred by better formation or higher development of the retina; and such higher development might at once be promoted by exercise, and handed down by descent. He believes that the conditions of town-life are unfavorable to the evolution, and favorable to the degradation, of the eye; and, further, that a mod-

erate amount of attention might greatly modify these conditions, and might do for the eyes what is done by athletic games and exercises for the muscles.

A still different explanation of the phenomenon is given by G. B. Buckton (*Nature*, No. 801, p. 407). The same amount of light entering the eyes of different individuals produces widely different effects, according to health or age. A student becoming accustomed to see objects from a short distance, will permanently accommodate himself to a short focus, and hence become short-sighted. Such modifications can be conceived of as being hereditary, and long-sight might be brought about in a race by the opposite use of the eye.

Apropos to this discussion, it may be well to notice briefly a discussion upon near-sightedness, which was started by Lord Rayleigh's article. The investigation of the question of the increasing prevalence of short-sight, which has recently been carried on in Germany, has led to legislative restrictions in the schools. The numerous statistics from the German schools have shown that the proportion of short-sighted boys continually increases from form to form; and from this fact it has been argued that the continued use of the eyes for the perception of near objects, is the essential, if not the only, factor in the production of short-sight. This view is again supported by the statistics, which allot the largest proportion of short-sighted individuals to those branches of industry, or those pursuits, which constantly call for near vision. In this connection, Mr. George A. Berry (*Nature*, No. 800, p. 387) suggests that two points have been forgotten in arriving at such a conclusion. In the first place, there is an undoubted tendency to grow short-sighted with age alone, up to the period of cessation of growth. This has been shown to be due to the elongation of the antero-posterior axis of the eye, and is no more a disease than is the attainment of more than an average height by certain individuals. It is merely a type; and, as such, is governed by the laws of heredity. A small proportion of cases are, however, due to disease; and these are as frequent among the illiterate as the educated, and are not hereditary. In many cases, people drift into literary and similar pursuits because they are near-sighted, and not well adapted for other occupations. Further, as a man's circle of acquaintance is, for the most part, amongst individuals having similar interests in life, intermarriage in myoptic families must frequently occur, and would tend to perpetuate, and perhaps increase, the defect. In savages, on the other hand, where the great principle of survival of the fittest is not frustrated to the same extent as among civilized races, every thing would be against the perpetuation of a myoptic type.

CHEYNE'S OBSERVATIONS ON THE CHOLERA MICROBE.

IN connection with the work of Van Ermengem upon the cholera bacillus (*Science*, No. 133), that of Cheyne, recently published (*British med. journ.*, April 25–May 23, 1885), deserves attention. This gives the results of his investigations at Paris during the epidemic of cholera, and afterwards at his own laboratory. In eight cases investigated, he found the curved bacilli in larger or smaller numbers: in a ninth case, supposed to be cholera, but turning out not to be, no curved bacilli were found. He failed to demonstrate these bacilli in the walls of the intestines in almost all cases; and, when he succeeded in finding them at all, they were very indistinct. He very justly observes, however, that Koch may succeed in such a demonstration where others fail; for Koch's technique is unquestionably superior to that of any other worker in this field.

Having sent his slides and cultures to Koch, and having the latter's assurance that they were pure, and made up of the curved bacillus of Asiatic cholera, Cheyne made various experiments with them in culture-media of different kinds and at different temperatures, the results of all of which were in conformity with what was already known. In particular, he found no difficulty in repeating Koch's observation, that drying rapidly destroys the vitality of these organisms: 'in three hours they are completely dead.'

His conclusions are, that the comma bacillus was present, and generally in large numbers, in all the cases of cholera which were examined; and that he has never met with the cholera bacillus except in cholera, and that the other curved bacilli described (Finkler and Prior's, Lewis's, and Dencke's or Flügge's), differ from it in important particulars.

Inoculation experiments were performed on seventeen guinea-pigs, with successful results in only two. Two other animals died, but were not examined, because destroyed. (We would suggest greater care of his inoculated animals, for these misfortunes seem to be but a repetition of those that happened in this observer's work on tuberculosis; see *Practitioner*, April, 1883.)

The last part of Mr. Cheyne's article is devoted to an able refutation of Klein's arguments against the specific nature of the comma bacillus. He shows the hasty work of this observer, which has led him to conclusions so entirely at variance with those of Koch and his supporters. He (Cheyne) thus summarizes his opinion of the work of the English cholera commission: "The two errors which, in my opinion, lie at the root of the work of the English cholera commission are, first, that, acting on the idea that Koch diagnosed the cholera bacilli by the microscope alone, they proceeded to investigate the matter by microscopic examination; and, secondly, that, seeing the stress which Dr. Koch laid on the cultivation appearances, they concluded that he meant to say that the organism was pathogenic, because it grows in a particular manner: and, therefore, they naturally proceeded to inquire whether the appearance of the cultivations, as compared with cultivations of other bacteria, could warrant this conclusion; and, of course, they found that it could not."