A

PROBATIONARY ESSAY

ON THE

ANATOMY AND PHYSIOLOGY

OF

THE EYE.

SUBMITTED, BY THE

AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO

THE EXAMINATION

OF THE

Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE FOR ADMISSION INTO THEIR BODY.

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE ADMISSION OF ORDINARY FELLOWS,

BY

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TO THE

REVEREND GEORGE HOME,

THIS ESSAY

IS DEDICATED

AS A MARK OF

AFFECTION AND ESTEEM.

ON THE

ANATOMY AND PHYSIOLOGY

OF

THE EYE

The Eye receives the impressions of light, and is the organ of vision. It is of a globular form, surrounded with muscles, placed in a cavity called the Orbit, covered externally by the eyelids, and attached internally to the Optic Nerve. The anterior part is composed of a segment of a smaller sphere than the posterior.

The apparatus of vision may be divided into parts proper to the Eye and its appendages.

The Appendages of the Eye

Are the Eye-brows, Eyelids, Caruncula lacrymalis, Lacrymal Gland, Ducts, and Conjunctiva.

The parts proper to the Eye.

Are the Sclerotic, Choroid, Retina, Iris, Cornea, the three Humours (with their Capsules,)—namely, the Aqueous, Crystalline, and Vitreous—and the Optic Nerve.

Appendages to the Eye.

The Eyelids consist of Skin, Sebacæous Follicules, Tarsal Cartilages, Eyelashes, Muscles, Vessels, Nerves, and Conjunctiva or Mucous Membrane.

The Eyelids are two in number, a superior and inferior, or greater and lesser. They fit closely to the eye, and when shut cover entirely its anterior surface. The superior is the more moveable, and descends over more than one half of the eye. The margins of the eyelids are strong, firmand resisting, fringed and with hairs, which are covered with an unctuous matter from the sebacæous glands at their roots. The hairs of the upper eyelid are longer than those of the under, and are turned upwards; the hair of the lower are turned downwards. The tarsal cartilages are two white bodies which form the margins of the eyelids, are attached to the orbicularis muscle, and are of a semilunar form. The cartilage of the superior palpebra or eyelid is stronger and broader than that of the inferior. The use of these cartilages is to keep the eyelids extended, and of a proper shape, and to protect the eye from external injury. In some animals they are awanting.

The cellular membrane of the eyelids is extremely fine and delicate, containing no fat. The palpebræ are lined internally by a mucous membrane, which is a reflection of the skin going to form the conjunctiva.

The uses of the eyelids are, to protect the eye from a too great application of the external air, to moderate the effect of light, to diffuse the tears equally over the conjunctiva, to preserve the eye from the entrance of extraneous bodies and from external injury, and to cover the eye during sleep.

The Conjunctiva is that part of the outer skin reflected, which, after lining the eyelids, passes on to the eyeball. It is a mucous and secreting membrane. Its use is to keep the eye in its proper situation, to prevent extraneous bodies from passing to the back of the eye, and to secrete a fluid which, mixing with the tears, lubricates and facilitates the motions of, the eyeball. The Conjunctiva is supposed by most Anatomists to cover the anterior surface of the cornea lucida.

The Caruncula Lacrymalis is a small red body situated at the inner angle of the eye. It is a conglomerate gland, and secretes a mucous fluid similar to that secreted by the glands of the eyelids. It consists of seven or eight follicules, each opening separately. Two or three hairs generally grow from it.

On the margin of each eyelid, at the inner angle, we observe a small opening called punctum lacrymale, through which the tears pass into the lacrymal sac. These puncta are always open, and have their mouths turned towards the eyeball. The ducts which lead from these puncta are very narrow, and admit with difficulty a hog's bristle; they are about four lines in length, and are situated between the orbicularis palpebrarum and the conjunctiva. They open, sometimes separately, sometimes together, into the lacrymal sac. These ducts are supposed to have a contractile power, which is sufficiently probable.

The Lacrymal Gland is situated in a small fossa in the upper and outer part of the orbit. The gland is small, of a yellowish colour, and composed of numerous lobules, connected together by cellular membrane. It is supplied with arteries and nerves by the ophthalmic artery and nerve. Its function is to secrete the tears, which are excreted by six or seven ducts, which do not communicate with each other. They run for some way between the lobules, and then pierce the conjunctiva near the tarsal cartilage, and outer angle of the eye. The tears are diffused over the eye by the motions of the palpebræ and eyeball.

The Lacrymal Sac is somewhat of an oval form, situated in a groove formed by the os unguis and superior maxillary bone. It is composed of a thick mucous membrane, derived from the schneiderian membrane of the nose, and is extremely vascular. From this sac the nasal duct arises, and runs obliquely backward and downward, in a bony canal formed by the os unguis and superior maxillary bone, and terminates in a round opening at the lower and back part of the inferior spongy bone. This duct conveys the tears from the lacrymal sac to the nose. It is supplied with nerves from the nasal branch of the fifth pair.

The following is the manner by which the tears are conducted to the inner canthus. During the time we are awake, the eyelids have a constant motion, which diffuses equally over the eyeball the lacrymal fluid. This fluid is prevented from running over the margins of the eyelids by these being a little raised at their external edge, and is conducted by the moist eye towards the punctum lacrymale. Another cause seems to assist the passage of the tears to the inner canthus; namely, that in shutting the eyelids the palpebræ join first at the external canthus, and last at the internal, which has the effect of forcing the tears towards the puncta.

During sleep, when the eyeball and eyelids are at rest, there is no friction or irritation applied to the gland; its secretion is therefore much lessened in quantity, as is the case with the salivary, and other conglomerate glands; the quantity of their secretions being always in proportion to the stimulus applied. At this time the lacrymal fluid is merely sufficient to lubricate the eye, and is diffused over it and carried to the internal canthus;—1st, by a slight motion of the palpebræ, which we observe to take place from time to time during sleep;—and, 2dly, by the small canal which is formed by the eyelids touching at the external edge of their margins only, and by their closing but imperfectly. Some part of the lacrymal fluid, it is probable, is absorbed by the tunica conjunctiva. The doctrine of Majendie is, that the tears, following the course which is easiest for them, descend by that part of the eye, where the conjunctiva passes from the eyelids to the ball, by their own gravity. This might serve as an explanation, if our posture during sleep was erect: but, as our position when asleep is generally on the one or other side, it would suit one eye only, and the tears of the other following the principle of gravitation would of course run towards the external canthus. The manner by which the tears are taken into the puncta is supposed to be by capillary attraction.

The Parts proper to the Eye.

The Sclerotic Coat is of a fibrous texture, strong, and elastic; it covers the whole eye, except the cornea lucida, is endowed with very little sensibility, and has few arteries. These are branches of the ciliary. This coat gives shape and consistency to the eye, protects its more tender and useful parts, and serves for insertion to the muscles which move the eyeball. It is joined to the conjunctiva by a thin layer of cellular membrane.

The Choroid Coat lies immediately beneath the sclerotic, is attached to it by cellular membrane, and at the fore part by the ciliary ligament. It is much thinner than the sclerotic, and of a brownish colour. It is a vascular and nervous membrane, consisting of two layers, is internally villous, and is largely supplied with blood vessels. Its brown colour is owing to its being impregnated with a black substance, which is not changed in colour by heat or chemical tests. Its nerves (the ciliary) are flat, and may be seen passing along its surface. They are accompanied by the ciliary arteries and vorticose veins.

The Ciliary Ligament consists of dense cellular membrane, is of a greyish colour, and attaches the Iris and Choroid coat to the sclerotic. Soemering says, that it is composed chiefly of nerves and blood-vessels.

The Ciliary Processes are doublings of the Choroid coat. Their extremities float loosely in the aqueous humour behind the Iris. Their structure and uses are unknown. Some authors suppose them muscular, others glandular or vascular.

The Optic Nerves, the medium of communication between the eye and brain, are generally described as arising from the thalami nervorum opticorum: but, according to Winslow, Santorini, Gall, and other anatomists, from the nates and testes. They are large, and of a whiter colour than the other nerves, and are covered by the Dura Mater and Pia Mater. They consist (like other nerves) of small fibres running parallel to each other. These fibres are chiefly evident in that part of the nerve which is situated between the sella turcica and eye. The Optic nerves approach each other at the sella turcica, and appear to intermingle the one with the other. But Anatomy has not yet enabled us to determine whether they merely touch or whether they are intimately mixed. Some authors suppose that the fibres cross each other, and that the nerve, issuing from the brain on the right side, crosses over to the left eye, and vice versa. Pathology does not settle the question; for when the right eye is diseased, the optic nerve of the right side is sometimes found diseased in all its length, and in other cases the anterior part only of the right side and posterior of the left. These nerves enter the eyeball nearer the nose than the axis of the orbit, and are somewhat contracted at their entrance. They then expand into a nervous membrane called Retina.

The Retina is a thin nervous membrane nearly transparent, of a slight milky colour, thickest at its origin from the nerve, and situated between the choroid, and hyaloide, or membrane of the vitreous humour. It has a yellow spot about two lines from the nerve towards the external angle. This membrane runs forward as far as the capsule of the crystalline humour, and is supplied with blood-vessels by the Arteria Centralis Retinæ.

The Iris, which is seen behind the cornea, is of different colours in different individuals, corresponding in general with the colour of the hair. It floats loosely in the aqueous humour, dividing it into an anterior and posterior chamber. It has an aperture in the centre called the pupil, and dilates and contracts according to circumstances. It is a muscular membrane richly supplied with blood-vessels and nerves (branches of the ciliary;) its nerves are large and numerous in proportion to the size of the organ. Its posterior surface is covered with a black pigment. Mr. Edwards says, that the Iris consists of four layers, two derived from the choroid, a third from the membrane of the aqueous humour, and the fourth peculiar to itself.

The Cornea, which forms the convex transparent part of the eyeball, is a section of a smaller sphere than the rest of the eye. It consists of many thin laminæ or plates joined together by cellular membrane, is convex without, and concave within, resembling in shape a watch-glass. It is not exactly circular, and when in a healthy state does not admit the red particles of the blood.

The Aqueous Humour, which fills the space between the capsule of the lens and the cornea lucida, consists of the following ingredients, and, according to Berzelius, in the following proportions, viz:—Water 98. 10, a little albumen, muriates, and lactates 1. 15, Soda with a matter soluble in water only, 0. 75. This humour is frequently turbid in the fœtus, but very pellucid in the adult.

The Lens, or Crystalline Humour, placed immediately behind the pupil, is in the form of a double convex lens; the posterior surface being the segment of a smaller sphere than the anterior. It consists of concentric layers joined together by cellular membrane, but easily separated by boiling. It increases in density towards the centre. This increase has considerable influence on its refracting power. This humour was formerly thought to consist chiefly of albumen; but, according to Berzelius, it is composed almost entirely of water, and of an animal matter, which has very great analogy in its chemical properties with the colouring part of the blood. In the fœtus the lens is generally of a red colour, in the adult transparent, and in old age commonly of a topaz colour. The lens is contained in a pellucid and elastic capsule, to which it slightly adheres. The capsule is thicker before than behind, and is supposed to contain a little water.

The Vitreous Humour is very much of the consistence of the white of an egg, is enveloped in a thin capsule named Tunica Hyaloidea. Small divisions of this membrane run through the humour, dividing it into small cells, which communicate with one another; 100 parts of this humour consists, according to Berzelius, of water, 98.40, albumen 0.16, muriates and lactates 1.42, soda and an animal matter soluble only in water, 0.2.

The Tunica Hyaloidea is composed of two layers, joined together at the bottom of the eye, but separating as they approach the lens. The outer layer adhering to the retina, is inserted into the capsule of the lens, at about one twentieth of an inch from the edge, on its anterior surface; whilst the interior layer, keeping close to the vitreous humour, is attached to the posterior surface of the capsule at about one tenth of an inch from the former layer, leaving a small vacant space surrounding the capsule of the lens; called (after its discoverer) the canal of Petit.

Uses of the Cornea and Aqueous Humour.

As the surface of the CORNEA is highly polished, it reflects part of the light which falls upon it, and thus assists in forming the brilliancy of the eye. The cornea is also of much use in refracting the rays of light.

The uses of the aqueous humour are to keep the cornea distended, and to refract the rays of light. As the rays enter this medium, they of course approach more to the perpendicular, the aqueous humor being a denser medium than the air. Those rays only, which pass through the pupil, assist in vision; those which fall on the Iris being reflected through the cornea.

Uses of the Lens or Crystalline Humour.

This humour has great refracting powers; part of the rays of light, however, are reflected from it, and repass through the pupil to add to the brilliancy of the eye, and part are absorbed by the black pigment which coats the posterior surface of the Iris. The loss of the lens does not destroy vision; its useful powers being in part supplied by the use of convex glasses.

The aberration of rays which takes place in a double convex glass lens (to which this humour has been compared) is obviated in the crystalline, by its being denser towards the centre than near its surface, so that the light which passes near its edge, is less refracted than that which passes near the centre. The aberration of rays is also prevented by the smallness of the pupil, which excludes the more oblique rays; no rays passing through it which have a greater angle of incidence than 28°.

USES OF THE VITREOUS HUMOUR—The Vitreous humour has less refracting power than the Crystalline. The rays therefore diverge on entering it. From its size, it allows of the greater expansion of the optic nerve upon its surface.

MOTIONS OF THE IRIS.—The mechanism by which the Iris is moved, has been the subject of much discussion. Dr. Monro, in his "Treatise on the brain, eye, &c." says, that "it is certainly muscular, that on the inner and an-"terior part of the Iris, and on the whole of its posterior "part, the fibres are disposed like radii. If they are "muscular, they are well situated for dilating the pupil. "These fibres are seen as well as a concentric set round "the pupil, by washing off the black pigment. The "concentric set of fibres are placed immediately round "the pupil, and are equally well seen on its fore and "back part. They occupy about a fifth of the breadth of "the Iris; the rest of its breadth being filled up by the "radiated fibres, blood vessels, &c." But many Anatomists of the present day think that the Iris is not muscular, but that its different movements are caused by the nervous and vascular fibres of which it is composed.

The Iris is not at all affected by light applied to itself. Fontana found that he could direct a quantity of light on the Iris of a cat, without causing any perceptible movement. But when the light was directed upon the retina, instantaneous contraction of the Iris was produced. It is found by experiment, that Galvanism produces a contraction of the Iris, which is adduced as a proof of its muscularity. But as the retina is at the same time subjected to the galvanic influence, the contraction of the Iris may arise from the effect of the Galvanism upon the retina. Some authors affirm that the Iris changes its dimensions according to the distances of objects: but this is by no means certain. In man the motions of the Iris are involuntary, and depend on the effect produced by light on the retina. But in some animals, as the parrot, owl and some other birds of night, its motions are voluntary.

The Iris may be cut without giving pain, but vomiting and other unpleasant symptoms occasionally succeed.

Uses of the Choroid.—The chief use of the choroid is to asbsorb, by means of its black pigment, the rays of light, as soon as they have traversed the retina, and to prevent the glare that would otherwise occur from the reflection of light within the eye. The choroid is darker in the negro, where it is more essential, because of the greater power of the sun in tropical climates, and its greater reflection from surrounding objects. The reason why Albinos see better in the evening than at mid-day is evident.

It has been supposed by Mariote and some other anatomists, that the choroid alone receives the images of objects; but this opinion seems to be devoid of proof.

The chief objections to it are, that the choroid is composed almost entirely of cellular membrane and vessels, and that the Pigmentum Nigrum is impenetable to light.

Celiary Processes.—Their uses are unknown, but they are supposed by different Anatomists to secrete the aqueous humour, to secrete the pigmentum nigrum, and to regulate the position of the crystalline.

Of the Retina and Optic Nerve.

The Retina receives the impressions of light, and on it are depicted the images of external objects. But how these images are conveyed to the mind is entirely unknown.

If we continue for any length of time to look steadily at one point, the corresponding point of the retina becomes insensible. For instance, if we regard a white spot on a black ground for some time, and suddenly remove the eye to a white ground, we percive a black spot corresponding in size to the white one. This arises from a spot of the retina becoming insensible from fatigue.

Although a large body be depicted on the retina, we have the power of regarding one part of it more attentively than another, or of making one part appear more distinct than the rest. For example, in reading, the whole page is depicted on the retina, but we confine our attention to a particular letter or word; which letter or word appears more distinct than when we regard the whole page equally. This is in part effected by making the rays from that part of the object which we wish to examine attentively, fall on the central part of the retina, which is more highly endowed with sensibility than the rest.

It is generally supposed, that the part of the retina, where the optic nerve enters, is insensible. Mariote says, that a circle having the diamater of one ninth of its distance from the eye is not seen: and by calculation this is found to correspond with the diamater of the optic nerve. The same is also mentioned by Monro. This, however, is denied by some physiologists, and among others, by Professor Majendie.

It will appear from the principles of optics, that the luminous cones from the lower parts of objects will appear uppermost, those from the upper parts, undermost, on the retina. And in the same manner the rays from the right side of objects will be depicted on the left, and vice versa.

Different means have been employed to prove this fact. Artificial eyes of glass were for a long time used: at present, the eye of an ox, or other large animal is made use of; which, (the posterior part of the sclerotic and choroid, being removed,) is placed in a hole made in the shutter of a dark room. By these means we may distinctly observe the images of external objects depicted in a reversed position on the retina.

Majendie uses the eyes of hares, pigeons, or other animals in which the sclerotic and choroid are nearly transparent. He strips them of the surrounding fat and muscle only; and uses them in the same manner as the eyes of the ox are used. This way of performing the experiment was known to Haller.

By discharging a small quantity of the aqueous humour, the image depicted on the retina loses its distinctness, which proves that the humours are in such relative proportions as to render vision distinct. The size of the image depicted on the retina bears a certain proportion to the distance of the object viewed.

By couching, or extracting the lens, the image formed becomes at least four times its previous size, is very indistinct, and the light which produces the image very feeble; by placing a double convex glass before the eye, after the lens is depressed, it will be found that the size of the image will be diminished and rendered more distinct.

By removing the cornea and lens (leaving the capsule and vitreous humour only) no image is formed on the retina. The greater part of these experiments agree with the theories of vision of the present day. There is one, however, which does not; namely, the equal distinctness of the image, depicted on the retina, of an object viewed at different distances. According to the present theories, the eye ought to be accommodated, either by the action of its muscles, by the contraction of the crystalline, or by the contraction of the ciliary processes, to the distance of the object.

On the Action of the two Eyes.

A very natural question occurs—how happens it that an object appears single when seen with both eyes? It has been affirmed that we use only one eye at a time, and thus receive but one impression. But this is refuted by the fact that we see more of a globe with two eyes than with one*. Thus a person looking at the globe C, with the eye A only, would have all the part a a concealed from

* See fig. 2.

his view and looking with B only, B b would be concealed. But when looking with both eyes, the space a B alone would be concealed. Upon this principle Leonardo da Vinci long ago asserted that it was impossible for any painting to imitate the relievo of objects, unless it were regarded with one eye only, and at a distance: for the colours must necessarily hide all the back ground, which true relievo would in part discover when viewed with both eyes.

But the fact is, that we do see objects double; as a proof of this, if we look at an object interposed between the eye and a wall, with the right eye only, we will find it to correspond with a certain part of the wall; if we then regard the same object with the left eye we will find it to correspond with a second point of the wall; and if we look at it with both eyes at the same time we will find it to correspond with a point between the two former. So that we find that an image of an object is formed in each of our eyes, and we see the object double; that is to say, one to the right and one to the left of its real position,—We judge it single and in its real position, because this error of vision is rectified by the sense of touch, and by two corresponding points of the retinæ being affected at the same time. When images of an object fall on corresponding points of both retinæ, we judge it to be single from habit and experience alone. For when the position of one eye is changed, by disease or blows on the head, we again see objects double, and are reduced in this respect to the state of infants. These facts are well illustrated by a case related by Cheselden, of a gentleman who from a blow on the head had one eye distorted; every object appeared to him double; but by degrees the more familiar objects came to appear single, and in time all objects did so, although the eye remained in its distorted position. A case similar to this is related by Dr Smith.

Objects seen by both eyes appear brighter than when seen by one only. Dr Jurine mentions the following experiment. He laid a sheet of white paper directly before him on a table, and applying the side of a book close to his right temple, so that the book was advanced considerably more forward than his face, he held it in such a manner as to hide that half of the paper which lay at his right hand from his right eye, while the left side of the paper was seen by both eyes without any impediment; then looking at the paper with both eyes, it appeared to be divided from top to bottom by a dark line and the part that was seen by one eye only was manifestly darker than the part seen by both.

It was owing to an observation of a similar nature, by Dr Smith, that the binocular telescope was invented, namely, that objects that are pretty remote when viewed by both eyes appear stronger and brighter than when viewed by one only. On closing one eye the pupil of the other dilates. In some cases we use one eye only, in preference to both; as in shooting, &c.

Distance of Objects.

Berkeley observed, that distance is a line directed endwise to the eye, and its impression is the same, whatever the length of the line may be. The distance of objects is known by the sense of touch and of vision united. That distances are not known, from an original property of the Eye, is well illustrated by Cheselden's boy. He thought, on his first getting his sight, that all objects touched his eye; he could not conceive the house larger than the room:" thus proving that the minima visibilia are in all cases the same in number. Distances are known,

1. By varying the convexity of the cornea.

2. By the sensation of the motion necessary to direct both eyes to the same object.

3. The visible magnitude of known objects suggest to us their distance. But this is not the case with unknown objects, as the Stars. Nor do objects seen through powerful microscopes appear nearer.

4. The faintness of colours transmitted through the atmosphere gives us an idea of distance, remote objects being more indistinct than near.

5. Intervening objects, whose distances are already known, suggest to us the idea of the distance of those more remote. But we are still liable to mistakes, for a distant plane appears to us to rise at an angle of 4°. We judge much more correctly of distance when objects are on the same level with us. Thus the distance of the upper part of a house appears to us less than that of the under which is seen by intervening objects. The distance joined to the visible magnitude is the rule by which we judge of the real size of bodies.

Faintness of colour seems to give us an idea of magnitude, by previously suggesting that of great distance. Thus a gentleman on a journey being attacked with incipient amaurosis, the stones, as he turned blinder, appeared to him to increase in size; which could depend on the faintness of colour only.

Adaptation of the Eye to different distances.

Rays from different distances cannot be made to converge on a, of the retina, without a change of form of the eye, or a difference of its refractive power. Hence, when we look at a near object, distant ones appear dim and confused, and when we look at a distant object, near ones appear so. But we have the power of accommodating the Eye to different distances. De la Hire contradicts this statement, but without reason. Indeed, Dr Porterfield has proved by experiment that the eye has such power. Looking through two holes in a card, at an object moderately distant, he saw it distinct and single; when he turned his eye to a nearer object, the former appeared double; when on the contrary he viewed a more distant object the middle one was again seen double; and on shutting the left hole the right image was intercepted. The annexed plan will shew this in a clearer manner (see figure 1st) Thus in looking at O through the card N, it is seen single, on looking at L, then O, was seen double at C and D, and the image D entered by the hole b, when the eye was directed to M, then O was seen double in A and B, and the image B entered by the hole a, proving that it was short of the range of distinct vision. This experiment clearly proves the power possessed by the eye of accommodating itself to different distances.

The means of thus adjusting the eye were supposed to arise from changes of its refractive power depending on some change of the lens. But persons, who have had the lens extracted, have the power of adjusting the eye to different distances. Home and Ramsden found that the cornea is protruded in viewing near objects. This, it is probable arises from the pressure produced by the recti muscles. Dr Hossack found that by pressing the eye, by means of a speculum, he could read a book at two inches distance from the eye, though when the pressure was removed the letters could not be seen. Mr. Ramsden thought that the protrusion he observed might arise from the whole eye being pushed forward instead of the cornea, alone. Dr Rutherford suggested that the image of the object reflected from the eye should be received on a speculum, and Mr Ramsden found that a change did take place in the size of the object reflected from the cornea according to its being directed to near or to distant objects. He found that the elongation of the optic axis has also some effect in viewing near objects. (See Philos. Trans. 1794,—95—96.)

On Vision in Infants, &c.

The eyes are among the parts first formed in the fœtus. In the embryo they have the appearance of two black points. In a fœtus of seven months they have the power of modifying light, so as to form an image on the retina. Before this period it would have been impossible; because the pupil is closed by the pupillary membrane; which membrane, according to Mr. Edwards, is a prolongation of the capsule of the aqueous humour and the external layer of the choroid. According to the same author there is no water in the anterior chamber before the pupillary membrane is absorbed, the humour being contained in the posterior chamber alone. In some fœtuses there are no appearances remaining of this membrane at the fifth or sixth month. Before birth the eyelids are closed, and as it were, glued together.

The eye then at birth is perfectly formed to act on light, and images are formed on the retina. During the first month of infancy, however, it does not appear, that the eyes are sensible to light. They move slowly and unsteadily; and it is not till the seventh week that we discover that they are affected by light, and even then a very bright light only makes impressions. Towards the eighth week, infants appear pleased with bright colours, and begin to distinguish large objects, But they have no idea of their distances or dimensions; and as their first want is food, they carry every thing to their mouth, of whatever size the object may be. Their sight is very imperfect at first; but it is gradually improved by experience, and the organ of sight undergoes, as it were, a regular education.

In a short space of time the organ of vision becomes as perfect as it is capable of being, and it is not till the decline of life that any sensible alteration takes place.

Three causes seem to impair sight in old age,

1. The humours of the eye decrease, by which means its refractive powers are lessened,

2. The crystalline begins to lose its transparency, and

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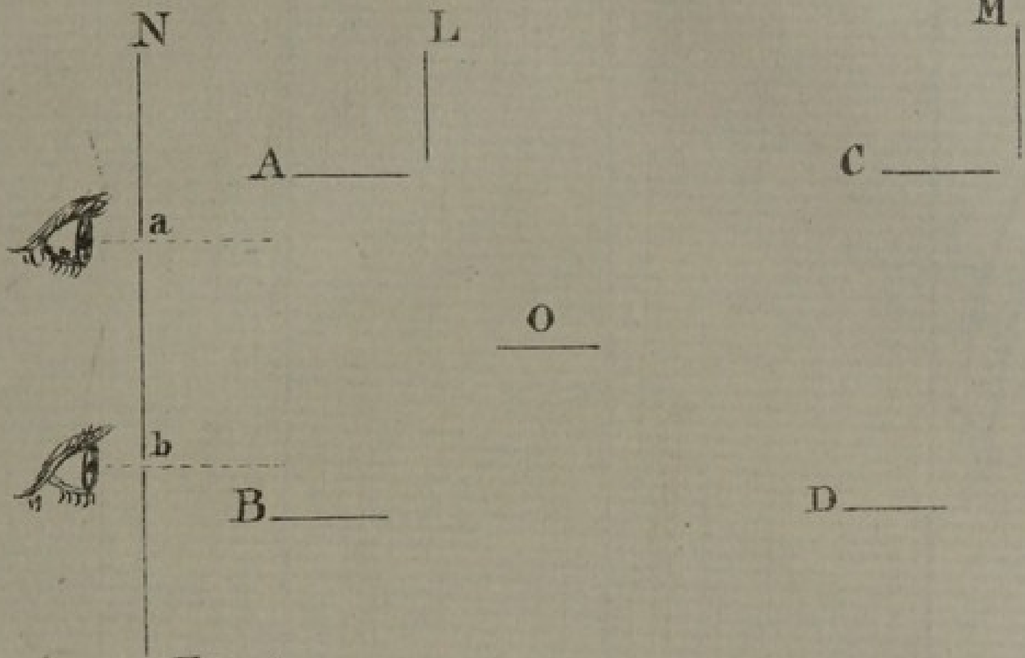

Fig. 1

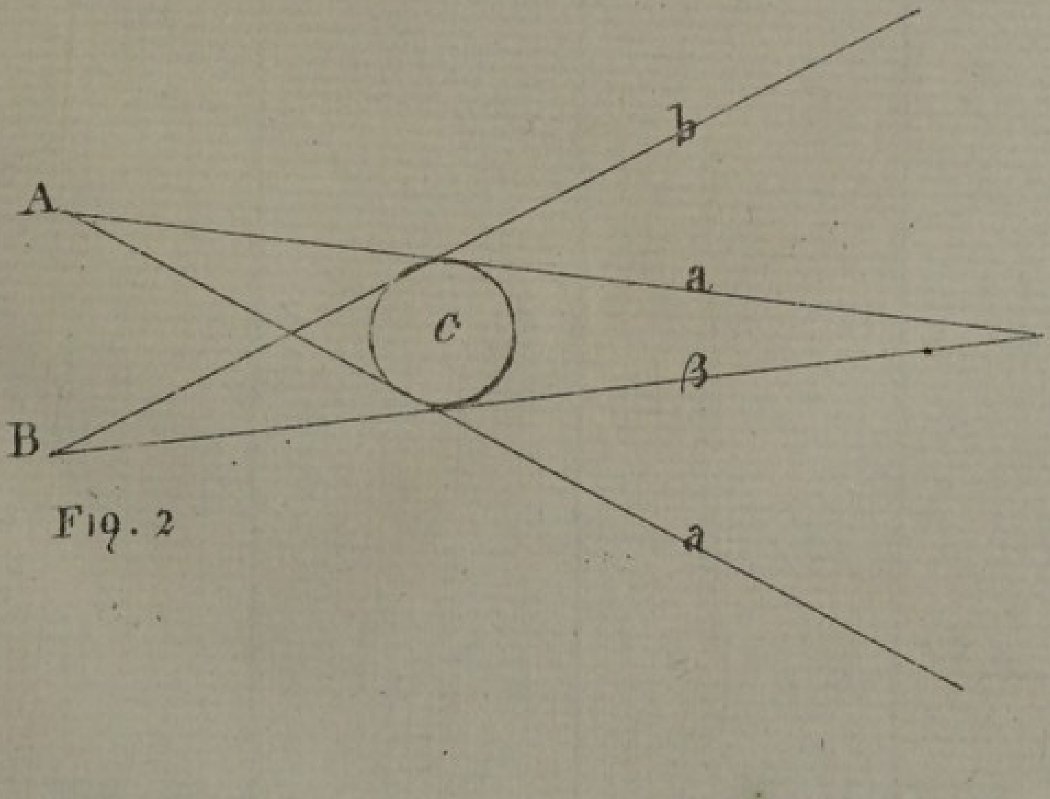

Fig. 2