

THE ANCIENT ANATOMY (A short scheme)

The ancient conception of the anatomy of the eye was not based on detailed observation, but on speculation as to the nature of vision. The fluid in the eye was regarded as the principle of vision and a tube leading from the eye to the brain, allowing for the free movement of this visual substance, led Alcamaeon to postulate the *poros*. This postulated **hollow tube** is hardly the solid optic nerve of modern anatomy.

In Italy, city of Agrigentum on the south coast of modern Sicily, in the middle of fifth century, was one of the major centres of Greek medical science. Alcmeon (ca 450 b.C.) seems to be the first practitioner of anatomic dissection; his theories were on the senses and particularly on vision.

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PLATO:

"Vision sends its unedited message to the soul, but it is the mind that decides what we have seen !!"



Ebers' papyrus

The practice of medicine was fairly advanced in Ancient Egypt, with Egyptian physicians having a wide and excellent reputation.

This Egyptian papyrus from about 1552 B.C. is the oldest preserved medical document. It measures about 20.23 m in length and 30 cm. in height. More complete than the Edwin Smith papyrus, it is the most important medical papyrus yet recovered. It is written in hieratic script and contains the most complete record of Egyptian medicine known. The 110 pages scroll contains 700 magical formulas and folk remedies meant to cure afflictions ranging from crocodile bite to toenail pain and to rid the house of such pests as flies, rats, and scorpions.

The papyrus contains chapters on intestinal disease, **ophthalmology**, dermatology, gynaecology, obstetrics, pregnancy diagnosis, contraception, dentistry, and the surgical treatment of abscesses, tumours, fractures and burns.

It also includes a surprisingly accurate description of the circulatory system, noting the existence of blood vessels throughout the body and the hearts function as a centre of the blood supply. It also refers to birth control, diabetes mellitus, trachoma, hookworm and filariasis, as well as forms of arthritis.

Hunain ibn Is-hâq's, *Book of the Ten Treatises on the Eye*



L'occhio umano che ha la forma allungata della mandorla è bello a vedersi, quello rotondo invece appare deforme e brutto.
(Ibn al-Haitham, *Ottica*)

This picture, dating back to the X century, is absolutely the very first drawing of the human eye that we have.

It was in Arabian literature that figures illustrating the anatomy of the eye first made their appearance. Arabic manuscripts still exists in which reference is made in the text to figures, themselves missing, though space from them is provided. The earliest drawing as yet available appears in **Hunain ibn Is-hâq's, *Book of the Ten Treatises on the Eye***, recently discovered and edited by Meyerhof (frontispiece).

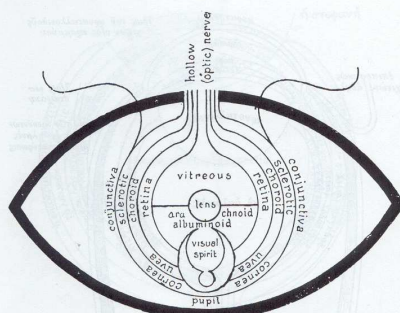
Through lack of illustrations it is difficult to get a clear conception of Greek and Roman knowledge of ocular anatomy, for the descriptions are frequently not only scant, but also confused through a multitude of names, which may or may not have had the same meaning

It is not only the first image depicting the human eye but also an extraordinary image due to the amount of information contained and to the philosophical implications. The only analysis of such picture would require a complete, dedicated lecture. **Hunain ibn Ishâq** paints a human eye. He is not looking at a man, dead or alive: Hunain is copying. He is copying another drawing, several centuries old. Perhaps the original picture was painted by a Greek author about one thousand and three hundreds years before. Other two hundreds years elapsed before that another unknown Arab had copied the painting. Such copy wanders in Asia Minor: libraries of physicians, of sultans, Koranic schools preserved for centuries. At last the picture reaches Egypt, Cairo, where **Max Meyerhof** finds it and publish it in 1911.

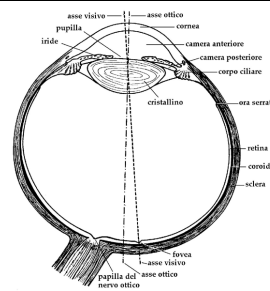
In 1942 Stephen Polyak prints it masterpiece on the vertebrate retina and publish again the Hunain's painting on the first page. (Polyak 1941, 1967).

It is the most ancient representation of the human eye preserved so far. It shows the layering of a sequence of cultures, one overlapping the other, and each one present with its heritage of graphics conventions, of images and myths. The eyelids open on a true medieval almond-shaped eye: the eye, sectioned along its optic axis, reveals its internal structure with its most precious and important part right in the centre: the lens!

Chapter 2

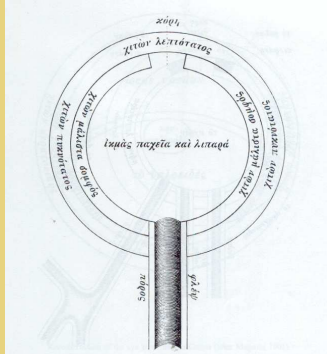


X secolo a.C.



2. Bulbo oculare destro in sezione orizzontale, con gli assi ottici.
Da G. Chiarugi, "Istituzioni di Anatomia dell'Uomo".
Vallardi Editore.

XX secolo



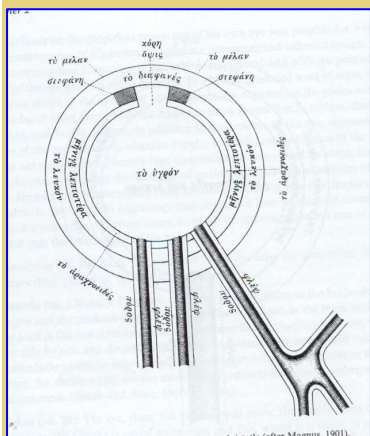
The structure of eye as conceived by Alcmeon (ca 450 b.C.)

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Alcmeon was important for the hegemony attributed to the brain.



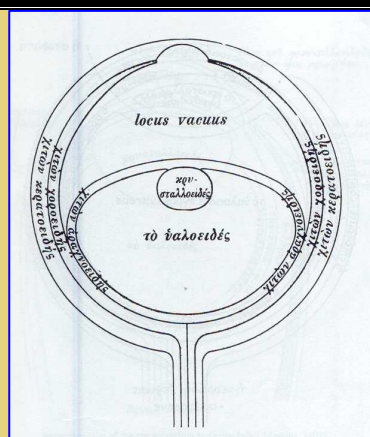
The structure of eye as conceived by Hippocrates & Aristotle (383—322 BC)

Aristotle had another view of the brain, which is not responsible for any of the sensations at all: "And of course the brain is not responsible for any of the sensations at all. The correct view is that the seat and source of sensations is the region of the heart". "The motions of pleasure and pain, and generally, all sensation plainly have their source in the heart". Aristoteles was well aware of the earlier claims for the dominance of the brain as opposed to heart, such as those of Alcmeon, Plato, Hippocrates, but repeatedly argues against this "fallacious" view. Aristotle attributes to the brain only a cooling function!

On the contrary, for the anatomy of the eye an advance of speculations can be found with **Aristotle, who obviously dissected an animal eye.**

Three layers instead of two are recognized, though knowledge of the retina hardly went beyond the recognition of its existence.

1. Knowledge of the structure of the cavity of the eye was vague.
2. There was no recognition of the anterior chamber;
3. it was held that the three layers of the eye are intimately opposed to each other.
4. The ocular fluid was considered as of uniform consistency, though some differentiation occurred on exposure to air; the lens, as far as it was clearly recognized, was thus regarded as a post-mortem manifestation.
5. The hollow tube of Alcamaeon became three in numbers, one of which entered the skull and joined with a corresponding structure from the other eye.
6. The recognition of the chiasma and of ocular vessels had therefore been achieved.

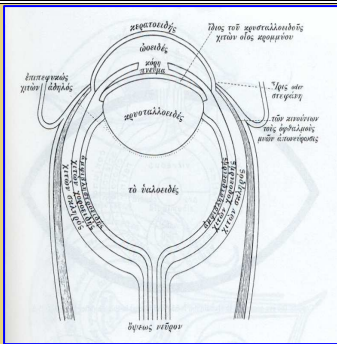


The eye as described by Celsus (150 a.C.)

As no manuscripts of this period have survived one has to rely on **Celsus** for information, and Celsus' account is by no means clear for the reason that he did not understand the subject.

1. There is a clear recognition of the existence of the lens, a drop-like body named *crystalloides*.
2. Whilst no anterior chamber is indicated -- the second layer is still contiguous with the first, except in the pupillary area, which is a mere perforation -- it is recognized that the retina does not come up to the cornea; it forms a smaller enclosing structure, and comes to surround the ocular fluid including the lens.
3. This arrangement leaves a large empty space -- *locus vacuus* -- between the two outer layers and the smaller retina.
4. As this locus vacuus is also spoken of as containing "humor", a near approach to the appreciation of the existence of the anterior chamber may have been made. What exactly Celsus knew of the optic nerve is not clear: he does not speak of any hollow canal, nor does he speak of a continuation of the retina into the nerve.
5. The optic nerve probably appeared to him as a continuation of the fused two outer layers of the eye.

Galen



**The eye as described by
Galen
(c. 129—199/200)**

If pre-Hippocratic anatomy was speculative, and Alexandrian anatomy truly descriptive, anatomy after Galen became a **historical exercise** on which commentators were busy for well over a thousand years.

1. A fairly clear recognition of the ciliary body seems to have been arrived at.
2. The corneo-scleral junction -- one name for which, incidentally, was *iris*, a designation that persisted until well into the 18th century -- was also the seat of fusion of the choroid and retina, where in addition a layer lining the anterior surface of the lens also terminated.
3. The posterior chamber was clearly recognized, as was also the fact that it contains the same fluid as the anterior chamber.

Just how much the description given by Galen is the result of his own observations or that of predecessors is not known. But Galen's account is of significance not only because it marked an advance, but even more because no advance was on it till after Vesalius, XVI Century.

The Stoic theory of the *pneuma* as an essential agent for vision provided for Galen a perfect means to interpret his detailed knowledge of the eye. Originating in the ventricles of the brain, it was in constant flow to the eyes via the optic nerves, which were hollow. There it filled the crystalline body which Galen regarded as the principal organ of sight. This was reinforced by Galen's knowledge of the effect of cataracts which were believed to occur between the crystalline body and the cornea, obstructing vision. As their removal restored sight, it was thought that they blocked the flow of the *pneuma* from the crystalline humour via the pupil to the surrounding air.

The greater curvature of the posterior surface of the lens was likewise recognized; the lens itself was held to fuse with the choroid by which it was kept in position.

It should be noted that whilst the recognition of the greater curvature of the cornea over the sclera was obviously the result of observation, the recognition of the existence of the posterior chamber was the result of speculation.

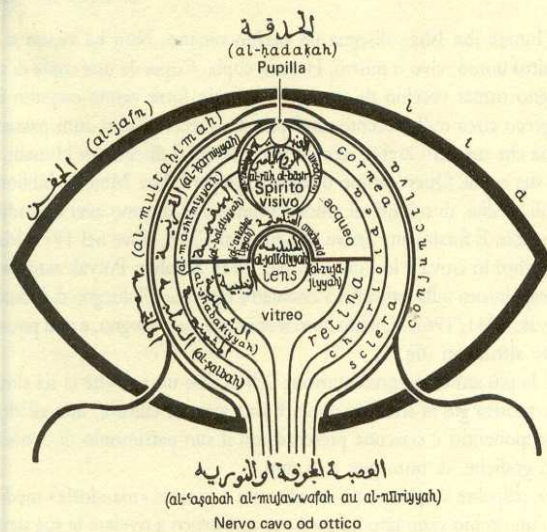


Figura 1

Soon behind the pupil we find an Islamic half-moon (that was not present in the original Greek painting). In the space embraced by the two horns of the half-moon the writing "Visual Spirit" occurs. A bit farther we meet the lens. **It is located exactly in the middle** of the eye (just like a Ptolemaic microcosm!). How is it possible?

Let us see how the eye has been described by Galen (150 AD), 8 centuries before.