

Research article - History of anatomy and embryology

## Giovanni Battista Della Porta's (1535?-1615) study on ocular anatomy

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### Abstract

Giovanni Battista Della Porta (1535?-1615) was a polymath who dealt with many scientific fields. Among his studies very important are those concerning optics and the physiology of vision. Due to his interest in optics it was inevitable to deal also with ocular anatomy. His anatomical description of the eye gives us a lot of information about the development of the knowledge concerning ocular anatomy of his time.

### Key words

Giovanni Battista Della Porta, ocular anatomy, Galen, Andreas Vesalius, Georg Bartisch, eye.

### Introduction

Giovanni Battista Della Porta (1535?-1615) known also as Giambattista della Porta (a portrait is available at the web address [https://en.wikipedia.org/wiki/Giambattista\\_della\\_Porta#/media/File:Giambattista\\_della\\_Porta.jpeg](https://en.wikipedia.org/wiki/Giambattista_della_Porta#/media/File:Giambattista_della_Porta.jpeg)) condenses in him the sense of *Humo Universalis*. He was a polymath, who dealt with many scientific fields and wrote a great number of works on many and different topics (Duchesne, 1801). He was born at Vico Equense and passed his life in Naples until his death. His first work was *Magiae Naturalis* (1558) in which various themes are discussed concerning mathematics, meteorology, natural philosophy, occult philosophy, astrology and alchemy (Della Porta, 1558). He published works on physiognomy, engineering, agriculture, phytology, hydraulics, cryptography and pharmacology (Muraro, 1978; Piccari, 2007). He was also a playwright (Clubb, 1965). He founded a scientific society called *Academia Secretorum Naturae*, whose members were known as *Otiosi* (Men of Leisure) (Bruno, 1989). Great success he had in the field of optics (Bevilacqua and Ianniello, 1982). He is the inventor of camera obscura (Zielinski, 2006) and it is believed that he first invented telescope but his death did not allow him to publish this study (Porta, 1962). Giovanni Battista Della Porta dealt also with ocular anatomy. His study has its special interest in the history of ocular anatomy.

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## Della Porta's ocular anatomy

Among the numerous treatises of Della Porta the one which concerns ophthalmology is his work, *De refractione optices* (1593). This work written in Latin consists of nine books and is devoted to the function of vision, optics and how human eye conceives the real world (Della Porta, 1593). The first book of this work deals with refraction in general, the second with the burning-glass, the third with the human eye, the fourth with vision, the fifth with perspective, the sixth with single and double vision, the seventh with the entoptic phenomena, the eighth with the passage of light through mirrors and the ninth with colors.

In the third book of this work we can find his anatomical description of the eye (Magnus, 1877). His descriptions consists of a three page text and an anatomical sketch (Fig. 1). He uses an outside inwards description analyzing the external ocular tunics passing to the inner anatomical elements of the eye. He cites the ancient Greek and the Arabic names of the parts of the eye, but it is obvious that he is mostly influenced by ancient Greek medicine, because he mentions only the Greek names in Greek.

He considers the eye as a sphere designing a profile incision of it. As the external tunic he recognizes *dura tunica* which can be identified as the sclera and in the top, as seen in the eye ball sketch, is transparent. From this transparent spot *dura tunica* is extended bilaterally, which according to him degenerates to the *dura mater*, forming in turn the ending of the optic nerve. Inside the sclera as a circle tunic is placed the *uvea*. The part of the *uvea* behind the transparent part of *dura tunica* is the pupil which has the function of a fenestra. Della Porta believes also that *uvea* degenerates to the *tenuis mater*. He will identify two other tunics innermost of *uvea*. That is *arana* (arachnoid) tunic which is a straight line running across slightly above the middle of the eye ball, but with a curvature in the medium because encloses the lens of the eye. According to him the two ends of *arana tunica* are the starting points of *retiformis* (retina) which has a semicircular shape that covers the inner rear portion of the eye ball. Apart from the ocular tunics Della Porta has the opinion that the eye consists also of three humors. The *crystallinus humor* which can be indentified as the crystal lens, is placed over the center of the eye ball towards the pupil but in a distance behind it. This humor occupies an oval shape place. *Humor acqueus* is the humor which fills the space formed by the *uvea*, while *humor vitreus* fills the other one formed by *arana tunica* and *retiformis*.

## Discussion

Della Porta's ocular anatomy derives from the anatomical descriptions of the eye presented by ancient Greek physicians and especially Galen (2<sup>nd</sup> century AD) (Hirschberg, 1899-1918), while great influence exercised on him the analogous anatomical studies by Andreas Vesalius (1514-1564) (Vesalius, 1543) and Georg Bartisch (1535-1606) (Bartisch, 1583). Ancient Greek medicine was the base of his knowledge in ocular anatomy due to the fact that the names and the places of the tunics and the humors follow the ancient Greek medical tradition as it was formed by Galen. The impression that eye is a prolongation of the brain, because *dura tunica* and *uvea*



**Figure 1** – Giovanni Battista Della Porta's anatomical sketch of the eye. From: Della Porta G.B. (1593) *Derefractio optice parte: libri novem*. Ex officina Horatii Salviani, apud Jo. Jacobum Carlinum, & Antonium Pacem, Neapoli. Page 68.

are considered as extensions of dura mater, tenuis mater and optic nerve, as it was conceived by Galen, shows his devotion to ancient Greek medical thought (Hirschberg, 1899-1918). The influence of Andreas Vesalius is detected in that there is not described a canal in the optic nerve as Vesalius had pointed. On the other hand Della Porta overcame Vesalius in the place of crystal lens, because Vesalius had placed them in the center of the eye ball, but Della Porta follows Georg Bartisch who placed it a little anterior. The way Della Porta sketched aranea tunica and retiformis resemble to the analogous designs by Bartish. The fact that Della Porta preferred and acceded to place crystal lens anterior as Bartish probably is an outcome of his studies in optics where he was successful, rather than an outcome of dissection experience. In the numerous sketches in order to explain the refraction and the perception of vision by the eye, a key role had the placement of crystal lens he chosen. The question if Della Porta had performed ocular dissection is difficult to be answered. Della Porta was a polymath and a scientist who experimented a lot, therefore it is probable that he had executed himself or watched one or more ocular dissection in human or animal eyes. But the facts that he was not a physician and his interest was focused only in one human organ, the eye, and also that his sketch lacks of great realism as instead we can see in the designs of Vesalius who tried to give a three-dimensional display

of the eye and in those of Bartish who tried to depict realistically several anatomical structures of the eye such as uvea, allow us to think that although ocular anatomy was important for his work in refraction, he choose to use the anatomical knowledge of the past and of his contemporaries adapting it to the needs derived from his studies on optics and on the physiology of vision.

## Conclusion

The interest in the anatomical study of the eye by Della Porta is that in his work is concentrated all the knowledge of the past combined with the discoveries of the time in ocular anatomy (Garin, 1986). The anatomical mistakes in the description of the eye demonstrate the difficulties faced by the scholars, which even the great anatomists of the time such as Vesalius could not overcome. It was necessary to pass a century and the publication of the anatomical studies of Johann Gottfried Zinn (1727–1759), in order to have an accurate anatomical description of the eye (Zinn, 1755). Nevertheless, Della Porta's anatomical study has its special place in the history of ocular anatomy, because is a great example of how the knowledge of the past was linked to that of the epoch of the scholar and how this has become a useful tool in the experimental investigation in the field of optics and refraction.

## Conflict of interest

All the authors declare that there is no conflict of interest.

## References

- Bartisch G. (1583) *Ophthalmodouleia. Das ist Augendienst. Newer und wolgegründeter Bericht von ursachen und erkenntnüs aller Gebrechen Schäden und Mängel der Augen und des Gesichtes wie man solchen anfänglich mit gebürlichen Mitteln begebenen vorkom.* Stöckel, Dreßden.
- Bevilacqua F, Ianniello M.G. (1982) *L'Ottica dalle Origini all'Inizio del '700.* Loescher, Torino.
- Bruno L. (1989) *Landmarks of Science: from the Collections of the Library of Congress.* Facts on File, New York.
- Clubb L.G. (1965) *Giambattista Della Porta, Dramatist.* Princeton University Press, Princeton.
- Duchesne H.G. (1801). *Notice Historique sur la Vie et les Ouvrages de J B Della Porta.* Chez Poignée, Paris.
- Garin E. (1986) Between 1500 and 1600: new sciences, new methods, new academies (Italian). *Nuncius Ann. Storia Sci.* 1 (1): 3-23.
- Hirschberg J. (1899-1918) *Geschichte der Augenheilkunde.* Band I. Engelmann, Leipzig.
- Magnus H. (1877) *Historische Tafeln zur Anatomie des Auges: ein Beitrag zur Geschichte der anatomischen Abbildungen des Auges.* Stiller'sche Hof- und Universitätsbuchhandlung, Rostock.

- Muraro L. (1978) Giambattista Della Porta Mago e Scienziato. Feltrinelli, Milan.
- Piccari P. (2007) Giovan Battista Della Porta. Il Filosofo, il Retore, lo Scienziato. Franco Angeli, Milan.
- Della Porta G.B. (1558) *Magiae Naturalis, sive de miraculis rerum naturalium libri III*. M. Cancer, Neapoli.
- Della Porta G.B. (1593) *De refractione optices parte: libri novem*. Ex officina Horatii Salviani, apud Jo. Jacobum Carlinum, & Antonium Pacem, Neapoli.
- Della Porta G.B. (1962) *De telescopio* [di] Giovan Battista Della Porta. L.S. Olschki, Firenze.
- Vesalius A. (1543) *Andreae Vesalii Bruxellensis De humani corporis fabrica libri septem*. Ex officina Ioannis Oporini, Basileæ.
- Zielinski S. (2006) *Deep Time of the Media. Toward an Archaeology of Hearing and Seeing by Technical Means*. MIT Press, Cambridge, MA.
- Zinn JG. (1755) *Descriptio anatomica oculi humani iconibus illustrata*. Viduam B. Abrami Vandenhoeck, Gottingae.