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OPHTHALMOLOGY IN BYZANTIUM  
(10<sup>th</sup>-15<sup>th</sup> CENTURIES)

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SUMMARY

*OPHTHALMOLOGY IN BYZANTIUM (10<sup>th</sup>-15<sup>th</sup> CENTURIES)*

*The study and analysis of the Byzantine texts after the 9<sup>th</sup> century, especially those of Theophanes and Ioannes Actuarius, reveals that the ophthalmology of this epoch follows in general lines the knowledge of the earlier ancient Greek and Byzantine physicians, adding, however, remarkable clarifications as to differential diagnosis and treatment. Nevertheless, there is some noteworthy information in the historical and hagiographical texts that indicate the high level of the practice of this specialty in Byzantine hospitals (xenones) in the middle and late periods.*

*Introduction*

It is not easy to judge the level of ophthalmology in Byzantium after the 9th century, which was marked by the book of Leo the Iatrosophist *Conspectus Medicinae*<sup>1</sup>, because, as in all other branches of medicine of this period, the wealth of historical sources present in numerous archives remain often unpublished and thus unknown to researchers. Hunger<sup>2</sup> maintains that it is only with difficulty that one can devote time to deal with the publication of any manuscript of this epoch, only to be finally disappointed on discovering that it was simply a copy of an earlier work or without any significance. Despite the opinion that medicine generally remained almost static in middle and late Byzantium<sup>3</sup>, there is nowadays a change of attitude about this, at least for what concerns some branches of it. For example, regarding

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the branch of surgery, the view that was expressed is that progress is maintained from the times of Hippocrates until the epoch of the great Byzantine physicians Oribasius, Aetius and especially Paul of Aegina<sup>4</sup>. We also possess evidence of significant progress even in the later Byzantine period. The well-known separation of Siamese twins (10th century)<sup>5</sup>, the lithotripsy in the bladder of the historian Theophanes (9th century)<sup>6</sup> the cauterisation in the urethra of the Emperor Isaac Comnenus I (1057-1059)<sup>7</sup>, all show the high level of surgery at that time. The same can perhaps be said, basing on certain evidence, of the branch of ophthalmology. The famous Xenon of Pantocrator, founded in the 12th century by the Emperor John Comnenus II, provided a special ophthalmological department<sup>8</sup>. This fact indicates the extensive spread of ophthalmological diseases on the one hand and, on the other, the great emphasis that was given to the diseases of the eyes and perhaps to ophthalmic operations, in regard to which evidence exists that they were carried out in the hospitals of Byzantium<sup>9</sup>. Moreover, the information that in the years of Manuel Comnenus I (1143-1180), when relations between Byzantium and the west had been strengthened, *an ophthalmologist from Salerno came to Constantinople for training and found whatever he required for his science provided by Theophilus who was the most educated, experienced and skillful physician in theory and surgery at the palace of the emperor*<sup>10</sup> constitutes strong evidence of the progress of ophthalmology in that period.

However, in the medical texts of the period from the 10th century until the fall of Constantinople (1453), we can perceive, from the ophthalmological perspective, considerable similarity regarding knowledge of previous epochs and especially to the works of the great physicians of Byzantium, Oribasius of Pergamum (4th century), Aetius of Amida, Alexander of Tralles (6th century) and Paul of Aegina (7th century). These followed Galen and other Greek authors from the Hellenistic period and their blind admiration of antiquity led them to consider the achievements of their predecessors to be dogmas<sup>11</sup>. This similarity, which the greatest historian of ophthalmology Julius Hirschberg calls *ophthalmological dogma*, has been ascribed by M. Wellmann to the copying by Byzantine physicians of the work of

Demosthenes of Massalia (1st century AD.), a disciple of Herophilus<sup>12</sup>. The Alexandrian school contributed greatly to the foundation of Byzantine ophthalmology as well, since all the great physicians of Byzantium studied in Alexandria. Thus, the ophthalmological knowledge of the works of the physicians of the Hellenistic period, and especially the systematic descriptions of surgical ophthalmology, remained valid for centuries - until the 18th century<sup>13</sup>; the key link in this chain of development remains the Byzantine and Arab physicians. In this period of about 2,000 years, we encounter, according to Hirschberg<sup>14</sup> *only few new discoveries and advances in ophthalmology, especially in surgical ophthalmology*. In the view of the same writer, however, the study and discussion of the original ancient Greek texts in the Renaissance helped in the development of a scientific terminology, that have allowed the retaining of many words for ophthalmic terms and concepts. Thus, Greek ophthalmology can be considered the basis of the modern science<sup>15</sup>.

The study and analysis of the medical texts of late Byzantium might be considered necessary for judging the level of ophthalmology of this epoch.

#### Material

The first significant medical author in the 10th century is Theophanes Chryssobalantes (incorrectly known as Nonnus in early bibliography)<sup>16</sup>, who compiled, in his book *Epitome*, an anthology of brief therapeutic instructions. This book was commissioned by the educated Emperor Constantine VII, the Porphyrogenitus, who led a campaign to promote scholarly works in his era. Theophanes dedicated his work to the emperor, writing *Theophanes Chryssobalantes to Constantine the Despot, the Porphyrogenitus King*<sup>17</sup>. Despite the work being considered a copy consisting mainly of abstracts of Oribasius<sup>18</sup>, recent researches have revealed influence of other works such as those of Paul of Aegina and several unidentified writers; nevertheless, no Islamic influence has been observed in this text<sup>19</sup>.

The ophthalmological section of *Epitome*, commences with chapter XLI, on the medications used to enhance the growth of the eyebrows<sup>20</sup>; for example, burnt date-stones with rose oil, and

is followed by ch. XLII, on medications to dye the brows black, e.g. the kernels of hazel - nuts roasted with talcum<sup>21</sup>. These two first chapters must have been influenced by Galen (*Galenī de compositione medicamentorum secundum locos Liber I*) or perhaps directly from the now-lost work of Criton (*On cosmetics*, in four books) or, finally, from the relative, also now-lost, text of Archigenes and the works of Dioscorides<sup>22</sup>. In the work of Criton we could read of, among other substances, laudenarn mixed with wine - used as a massage for the hair after bathing - and oil of myrtle, as substances promoting hairgrowth and protecting the hairs<sup>23</sup>. The same medicaments are included in Theophanes' work as dyes for the hair. A similar series of other substances such as cedar (resin of cedarwood) are used as dyes in Criton's work and as hair-enhancers in the book of Theophanes (also known from Dioscorides<sup>24</sup>).

The next chapter (XLIII)<sup>25</sup> is devoted to the treatment of the double line of the eyelids (*dystichiasis*), using already known medicaments with no mention of operation. Theophanes goes on to refer to an abundance of substances known from the works of earlier physicians and especially those of Galen, Oribasius and Paul, used for the following diseases: *chalazion*<sup>26</sup>, *taraxis*<sup>27</sup>, *ophthalmia*<sup>28</sup>, *phlegmone*<sup>29</sup>, *chemosis*<sup>30</sup>, *hyposphagma*<sup>31</sup>, *emphysema*<sup>32</sup>, *xerophthalmia*<sup>33</sup>, *sclerophthalmia*<sup>34</sup>, *ectropion* of the eyelids<sup>35</sup>, *aegilops*<sup>36</sup>, *anchilops*<sup>37</sup>, *milphosis* or *madarosis*<sup>38</sup>, *rhyas*<sup>39</sup>, ulcers of the cornea<sup>40</sup>, *trichiasis*<sup>41</sup>, *staphyloma*<sup>42</sup>, *amaurosis*<sup>43</sup>, *glaucosis*<sup>44</sup>, pain around the eyes (*periodynia*)<sup>45</sup>, sears of the cornea<sup>46</sup>, (the superficial, called *nepheia* [*nebulae*]). The deeper, called *leucomas*), *pterygium*<sup>47</sup>, *nyctalopia*<sup>48</sup>, carbuncle of the eyelids<sup>49</sup>, carcinoma of the cornea<sup>50</sup>: *amblyopia*<sup>51</sup>, *hypochyma*<sup>52</sup> and *hypopyon*<sup>53</sup>.

It is curious that from the whole *Epitome* of Theophanes, surgery is missing; he refers only to phlebotomy for certain diseases of the eye. Even for cataract, no mention is made of the operation of paracentesis, which is included in the works of Paul of Aegina and Leo the Iatrosophist in the previous centuries<sup>54</sup> and treatment is restricted to simply abundant administration of several collyria. This is due to the fact that surgical confrontation did not coincide with the aims of his manual. The author probably knew the operations, at least for *pterygium*, *trichi-*

*asis*, *ectropion*, cataract, *aegilops* and it is also known that the Byzantine physicians carried out therapeutic medicine alongside surgery. A complete separation between medicine and surgery as we find in the Arabian and European Middle Ages was at that time not the case in Byzantium<sup>55</sup>.

Ioannes Actuarius (14th cent.) in his chapter *On Diagnosis of Ophthalmia*<sup>56</sup> analyses with greater clarity than earlier physicians several ophthalmic diseases with his perceptive differential diagnostic skills. He classifies the inflammation of the eyes into firstly *taraxis*, which is due to blurring of the vision resulting from smoke, sorrow or rubbing and secondly ophthalmia, which is due to weakness of the eye, production of material or, finally, to epidemics. The latter remark is noteworthy since the author noted the epidemic nature of some conjunctivitis (a similar epidemic ophthalmia is described in the Life of St. Thecla)<sup>57</sup>. The inflammation (*phlegmone*) of the eye is attributed to trauma and bitter rheum. The symptomatology of *phlegmone* includes *dacryorrhoea*, thin at first, thick later and finally plentiful *lema*. Another type of inflammation, rheum, is classified into as many categories as the humours according to Hippocratic humoral pathology. Ioannes also distinguishes oedemas from emphysemas. The former, in his opinion, are traumatic in origin and aetiology and are located around the eyelids; the latter are due to thick *pneuma* (air) located in the eyelids themselves and originate from oedematous tumours. The Byzantine author attributes *ectropion* to hypersarcosis or scar of the eyelids which have not been treated satisfactorily so that the eyelids are pulled open and cannot easily close. The writer adds that in *anchilops*, the fistula can reach the bone. He includes the disease of *trachoma* (already known from earlier physicians such as Paul)<sup>58</sup> and considers it as a roughness of the internal surface of the eyelids which, when deteriorates, presents grooves and is called *sycosis* (*fig disease*)<sup>59</sup> but when it persists it is called *tylus* (that is, callos)<sup>60</sup>. Ioannes distinguishes *chalazion* from *chordeolum* which is not considered simply an accumulation of liquid but a longitudinal abscess of *tarsus palpebrarum*. He also includes *phthiriasis*, a disease already known to Paul<sup>61</sup>, but notes his own observations, writing that he himself saw living lice moving on eye-

lashes. Writing about *madarosis*, he states that the disease can spread in all over the head and body (he means baldness or alopecia). He completes the symptomatology of *ptilosis* that is the thickening of the eyelids, with redness which destroys the eyelashes (this is today's *blepharitis*). He clarifies the definitions of *rhyas* and *encanthis*, writing that the former is the *phthisis* or shrivelling of the bulb (atrophy) and the latter is the *hypersarcosis* of the interior *canthus*. He defines *proptosis* as a prolapse of the uvea of the bulb due to rupture or erosion of the cornea and, proportionately to its size, he classifies the disease into *myocephalon* (size of a fly's head), *staphyloma* (size of a grape), *melon* (apple size with prolapse between the lid margins) and finally *elos* (size even greater, causing blindness).

*Hypopyon* is defined as a concentration of pus behind the cornea which, when it resembles a finger - nail is called *onyx* (nail). He goes on to define *mydriasis* in which the pupil is wider than usual with reduction of vision of different degree and *phthisis*, with the meaning of today's *miosis*, in which the pupil is narrow and darker. Atrophy in his text, which in all these definitions follows Paul<sup>62</sup>, has the meaning of the smaller and lower bulb. Further, Ioannes defines *nyctalopia* in more detail, writing that the sufferers see the day, while when the sun sets they see less; at night they do not see at all. The Byzantine writer differentiates *glaucomis* from *hypochyma*, writing that the former is an incurable disease of the crystalloid (lens) and the latter is caused by the production of a liquid which solidifies between the cornea and crystalloid. *Amaurosis* is, according to the author, total blindness without there being any obvious cause. This opinion has been expressed by earlier writers<sup>63</sup>. However, it is worth noting the definition of *amblyopia*. The writer maintains that it is not due to a disease of the eye, its coats or liquids but to the optic *pneuma*, which becomes shorter or is not emitted at all, or due to obstruction of the nerves which transfer the light (optic nerves) or to an injury to the parts of brain responsible for vision. All these causes, the writer concludes, are responsible for preventing the flow of the *pneuma* and thus the eyes resemble lamps which are full of oil and perfect in their functioning but they cannot emit light (these views are based on the theory of the ancients

that vision resulted from the emission of rays from the eyes to the objects to be discerned<sup>64</sup>; Ioannes' remarks, however, about the lesions of the optic nerves and brain are very interesting).

Ioannes' views on *strabismus* are also noteworthy and interpret Paul's opinions<sup>65</sup>. *Strabismus* in the old is caused as a result of spasms and pulling of the muscles which move the eyes. In infants *strabismus* is caused as a result of looking sideways continually at a lighted lamp or other source of light so that then the eyes continually move towards that light and, as the muscles are soft, one muscle contracts and the other expands. However, he states that this does not occur in all infants but only in those which have a predisposition. He then adds congenital *strabismus*, maintaining that this anomaly can appear as a natural defect during the formation of the body organs. Thus, Ioannes recognises congenital *strabismus* as does Paul<sup>66</sup> and adds early and late - acquired types of the disease. He further describes the *exophthalmos* of today, calling it *ecpismus*, which he thought a common disease when the eyes come out from their usual position and remain protruding due to abundant and thick *rheum*.

The Byzantine writer also deals with refractive errors and maintains that myopia is a congenital disease (an opinion also of Paul, proved correct in the light of modern concept), thought incurable due to the weakness of the *pneuma* which cannot radiate far and for this reason the sufferers easily see close to but not at a distance<sup>67</sup>.

The philosopher Michael Psellus (11th century), who also studied and practiced medicine, in his work *Carmen de re medica*<sup>68</sup>, dedicates some verses to ophthalmology and gives a number of short definitions of some ophthalmic diseases. His definitions do not approach the quality of the differential diagnosis of Ioannes Actuarius and some of them appear also to be incorrect. Psellus identified *taraxis* with *ophthalmia* and thought *chemosis* to be a disease of the eyelids and *conjunctiva*. He calls deterioration of the *trachoma*, *typhlosis* (it is more likely due to the copying of the manuscript rather than the correct term *tylosis*, since *typhlosis* in Greek means *blinding*). Psellus identifies *leucoma* and considers *amaurosis* as a slight blurring and *amblyopia* as confusion of vision.

Symeon Seth (11th century)<sup>69</sup> recommends food such as fennel, bile of partridges for the treatment of *amblyopia* and onset of cataract. He also follows Aristotle, writing that colour-blindness whom he calls *sclerophthalmus* (*with hard eyes*) is present in certain persons who do not distinguish differences in colours<sup>70</sup>.

The famous physician and pharmacologist, Nicolas Myrepsus<sup>71</sup> (13th century) also prescribes collyria for *glaucomis* and carcinoma of the eyes, which he calls a *hopeless case*. Thus he uses collyria as palliative treatment while earlier physicians such as Paul<sup>72</sup> and Theophanes<sup>73</sup> for the same illness had administered collyria, probably with the aim of cleansing.

Nicephorus Vlemmydes (13th century), theologian and son of a physician, in his unpublished work *On medical instruction* deals with treatments of various ophthalmological diseases such as *leucomas*, *amblyopia*, lice and pain of the eyes. For *leucomas* he recommends grated bone of cuttle fish with honey in inunction (it is a drug known to ancient physicians used until recent times in empirical medicine)<sup>74</sup>. The whole work of Vlemmydes has no real scientific character but is simply empirical.

Melitiniotis (14th century) who introduced Persian *materia medica*, included in his work a drug useful for the onset of cataract which could have been given with clyster too<sup>75</sup>, a curious treatment for the disease because the usual confrontation was the instillation of several collyria as today<sup>76</sup>. The physician Andreiomenus (15th century) also prescribes collyria for blurring of vision<sup>77</sup> (cataract?).

### Conclusion

In conclusion, the study and analysis of certain important works of medical writers of Byzantium from the 10th century and on proves that ophthalmology in general lines followed the knowledge of earlier ancient Greek and Byzantine physicians. However, in this period, ending with the fall of Constantinople, medical writers and physicians achieved a more correct and clear differential diagnosis of ophthalmological diseases and the treatments applied were enriched mainly with their personal experience. Thus, the opinion of Hirschberg, who almost confines

the contribution of ancient ophthalmology to the fact that modern terminology has derived from Demosthenes, who based his knowledge on the earlier anatomical studies of the Hellenistic period, seems rather incomplete: it should not overlook the fact that the influence of physicians who followed Demosthenes, such as Galen, was also significant and that the additional knowledge of the Byzantine physicians must be recognised in the overall evolution of the specialty of ophthalmology.

Ophthalmological surgery, also, must have been improved in middle and late Byzantium despite the fact that incontrovertible evidence of this is lacking in the relevant medical texts. There are, however, some indications in hagiographical sources, such as hidden operations in congenital cataract in the *Life of St. Thecla* where reference is made to a cure of cataract of a child *pecked in the eye by a bird, exactly as physicians pricked the eye in this disease with an iron instrument*<sup>78</sup>, that is the *centiterion*<sup>79</sup>. Operations on cataract are mentioned in the *Miracles of St. Cosmas and Damien*<sup>80</sup> and in the book of Leo the Iatrosophist, although no description is given in the work of Actius who had written the most detailed and authentic chapter on ophthalmology during the Byzantine period<sup>81</sup>. There are also excellent descriptions in hagiographical texts of operations on eye injuries<sup>82</sup>, dacryocystitis and staphylomas<sup>83</sup>. The existence of a special ophthalmological department in the Xenon of the Pantocrator and the training of the ophthalmologist from Salerno in the hospitals of Constantinople, referred to above, also lead us to conclude that ophthalmology in Byzantium in this epoch was developed to a high degree. In general, it seems from non-medical literary sources that ophthalmology was more developed than medical sources so far published have indicated, a fact which provides the reasonable expectation that future publication of now unpublished medical material after the tenth century will reach the same conclusion.

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24. BERNARD I.O.S., ref. 20, pp. 186-189. KÜHN C.G., ref. 22, pp. 435-448.
25. BERNARD I.O.S., ref. 20, pp 190-193.
26. BERNARD I.O.S., ref. 20, pp. 192-193.
27. BERNARD I.O.S., ref. 20, pp. 194-197.
28. BERNARD I.O.S., ref. 20, pp. 194-197. Redness of the bulb with pain of the eyelids due to external factors or to no obvious causes.
29. BERNARD I.O.S., ref. 20, pp. 196-204.

30. BERNARD I.O.S., ref. 20, pp. 204-207. See also HIRSCHBERG J., ref 11, p. 321. The term is taken from Demosthenes according to Oribasius. The disease represents an inflammation with elevation of the bulba conjunctiva.
31. BERNARD I.O.S., ref. 20, pp. 206-209. Blood suffusion, due to traumatic nipture of the conjunctival veins. Galen also uses the term *haemalops*. Leo the term *haematis*. HIRSCHBERG I., ref. 11, p. 321.
32. BERNARD I.O.S. ref. 20, pp. 208-223. *Oedema* of the eyelids. The ancient Greeks understood from this term an acute inflammation with lid swelling while in modern times *emphysema* always means an accumulation of air (a meaning also acceptable to some ancient authors, such as Galen). KUHN C.G., ref. 22, X, p. 963; HIRSCHBERG J., ref. 11, p. 322.
33. BERNARD I.O.S., ref. 20, pp. 212-215. Itching without discharge – rheuma.
34. BERNARD I.O.S., ref. 20, pp. 212-215. Dryness with difficulty in eye mobility.
35. BERNARD I.O.S., ref. 20, pp. 214-215. The disease is due to materials which discharge or due to complication after surgery, e.g. removal of a tumour of the eyelid.
36. BERNARD I.O.S., ref. 20, pp. 216-219. Abscess between the internal canthus and nose, which breaks and fistules.
37. BERNARD I.O.S., ref. 20, pp. 216-219. The same type of abscess before perforation.
38. BERNARD I.O.S., ref. 20, pp. 218-221. Loss of lashes due to bitter humours.
39. BERNARD I.O.S., ref. 20, pp. 220-223. Paralysis of the internal canthus, resulting in continuous dacryorrhea.
40. BERNARD I.O.S., ref. 20, pp. 224-227. The ulcer is called pit (*bothrion*) if it is clear and hollow, excavation (*coeloma*) if it broader and more level. Is *argemon* if it is located on the limbus, burned ulcer (*epicauma*) if it is dirty and crusty so that when it is cleaned the liquids discharge (it means the rupture of the eye).
41. BERNARD I.O.S., ref. 20, pp. 225-227.
42. BERNARD I.O.S., ref. 20, pp. 225-229.
43. BERNARD I.O.S., ref. 20, pp. 228-229 and 254-257. Complete blindness. The term was dated back to Demosthenes, according to Aetius. HIRSCHBERG J., ref. II, p. 333.
44. BERNARD I.O.S., ref. 20, pp. 230-233. See also pp. 258-261.
45. BERNARD I.O.S., ref. 20, pp. 232-233.
46. BERNARD I.O.S., ref. 20, pp. 236-241.
47. BERNARD I.O.S., ref. 20, pp. 240-241. Excessive fleshiness of the conjunctiva.
48. BERNARD I.O.S., ref. 20, pp. 246-247. Night blindness according to Galen's definition. This disease is treated with male-goat liver; this is roasted and the liquid, *ichor*, which flows out is used for inunction of the eyes and the remaining liver may be eaten. This treatment is ancient, known from the papyrus of Ebers, the work of the Corpus Hippocraticum *On Vision*, Herophilus and other ancient physicians. HIRSCHBERG J., ref. 11, p. 332; MARKETOS S., LASCARATOS J., *The book About Vision of the Corpus Hippocraticum*. M.M.G. 1988;16:197-200.
49. BERNARD I.O.S., ref. 20, pp. 250-255. A painful ulcer with a black eschar.
50. BERNARD I.O.S., ref. 20, pp. 250-255. The disease is thought incurable, and presents severe pains. Hirschberg thinks of it as a progressive ulcer. HIRSCHBERG J., ref. 11, p. 329.
51. BERNARD I.O.S., ref. 20, pp. 254-257. Faint vision. The term is attributed to Galen, according to Aetius and Oribasius. HIRSCHBERG J., ref. 11, p. 333.
52. BERNARD I.O.S., ref. 20, pp. 258-261. An accumulation of a liquid between the iris and the crystalline lens; the writer repeats the earlier view of ancient Greeks as a

- dogma and is not influenced by the vagueness of his contemporary Arab physicians. HIRSCHBERG J., ref. 11, pp. 316-317.
53. BERNARD I. O. S., ref. 20, pp. 262-265. Theophanes gives a different from usual definition for *hypopyon*, that is a blackening of the low eye lid (usually *hypopyon* is defined as suppuration of the cornea. See HIRSCHBERG J., ref. 11, pp. 326-327).
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