

The ophthalmological examination as described by Constantine the African in the 11th century

by

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Abstract

Purpose: The publication of the compendium 'the Pantegni' by Constantine the African in the eleventh century was a pivotal moment in the history of medicine. As the first fully comprehensive medical text in Latin, it became a highly influential text that served European physicians for centuries. In this paper we study the chapter 'de oculis' (on the eyes) in book 1 of the oldest available copy, which is being kept in The Hague, the Netherlands.

Methods: We translated the text into English and commented on the content.

Results: Constantine appears to instruct the reader how to interpret the complexion of the eyes.

Conclusion: The ophthalmic examination and its interpretation as described by Constantine are outdated. Nonetheless, his writing marked the beginning of an era in European medicine and it is fascinating to be able to have a look at Constantine's contribution, almost a millennium later.

Islamic science blossomed around the year 1000 AD. At that time European medical science depended mostly on texts of the ancient era. In the middle of the 11th century a sudden change occurred with the arrival of Constantine the African in the abbey of Monte Cassino (Italy).

Constantine the African (also known as Constantinus Africanus) was born around 1020 AD and died about 1087 AD, but no evidence exists on these dates nor on the details of his life story, since the distinct biographies of Constantine that are known to us are remarkably different. Constantine might have spent the first part of his life in Ifriqiya (present day Tunisia) before coming to Salerno in Italy. He then noted that the Salerno physicians were not as experienced as the doctors in North Africa, for example in examining urine specimens. This was especially remarkable, since the medical school and the doctors of Salerno had a very high reputation; the Salerno Schola Medica Salernitana was even seen as the most important source of medical knowledge in Western Europe at that time. Constantine would have felt inspired to pass medical knowledge from the Arab caliphates to Italy with support of the local elite to which he was admitted. The story goes that he possibly even returned to Carthage in North Africa, where he practised medicine for three years and collected the available Arabic manuscripts on medicine. Returning to Salerno by boat he shipwrecked and some of these manuscripts would have got damaged in a storm. Arriving around 1065 AD in Salerno with what remained of the books, Constantine converted to Christianity and moved to the abbey of Monte Cassino. In the scriptorium of the monastery he was assisted by a dedicated team of scholars and clerks and translated many of the assembled Arab books and amalgamated the knowledge into various manuscripts. Among these is the parchment compendium Pantegni, which is discussed in this article. (For an excellent elu-

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cidation of Constantine's life history we refer to the introduction that Gaze wrote to the extensive study on Constantine's attribution to the Pantegni by Kwakkel and Newton).¹⁻³

Constantine based the Pantegni (meaning 'all professional expertise') predominantly on the Arab book *Kitāb al-malakī* (the title translates as 'Royal Book', but the manuscript was also known as 'the complete book of the medical art') by 'Ali ibn al-'Abbas al-Majusi (Persia, 10th century AD).¹ The quality of Constantine's Latin translations has been questioned, with many mistakes and seemingly misconceptions. Despite this the Pantegni is seen as the first medical textbook in Western Europe and remained influential for ages.^{1,2} The earliest available version is in the Dutch National Library in the Hague (Fig 1).^{4,5} This version of the Pantegni is composed of 10 books. Three parts focus on the eyes. In book 3 Constantine describes in chapter 13 the anatomy of the eyes as discussed by Russell who analysed the corresponding text in the *Kitāb al-malakī*.⁶ In book 9 chapter 13 he discusses the so called passions of the eyes. Book 1 deals with complexions and humours

of the body. At that time it was assumed that the bodily condition was a so called complexion, composed of different vital fluids: the humours. The different humours were characterised by different qualities: temperature (hot or cold) and humidity (moist or dry). In health the humours and their qualities were assumed to be in balance. Imbalance could cause propensity to illness or illness itself.⁷ In chapter 11 of book 1 Constantine instructs how to interpret the complexion or state of the eyes by ophthalmological examination. Below we study this chapter which, to the extent of our knowledge, has not been discussed in the medical literature before.

Materials and methods

We accessed the manuscript via the website of the Dutch National Library.⁵ We translated the text into English and subsequently distilled the content. In cases where legibility was impaired because of the handwriting, abbreviations or wormholes, we used as cross-reference one of the first printed editions of the Pantegni.⁸

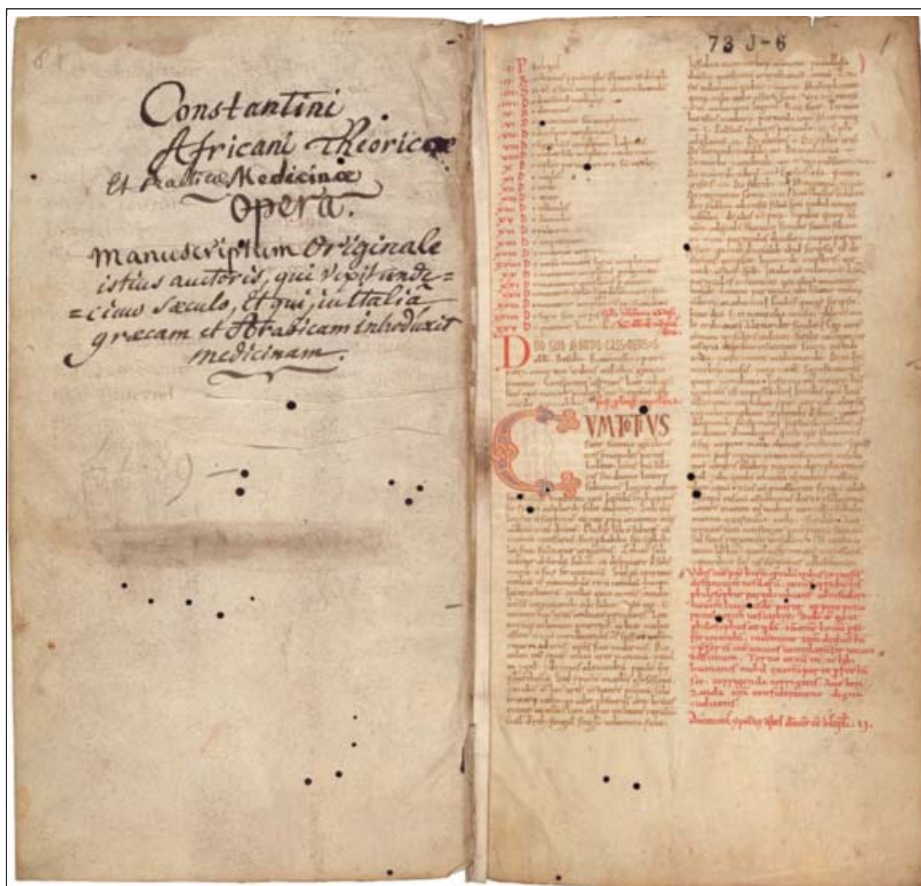
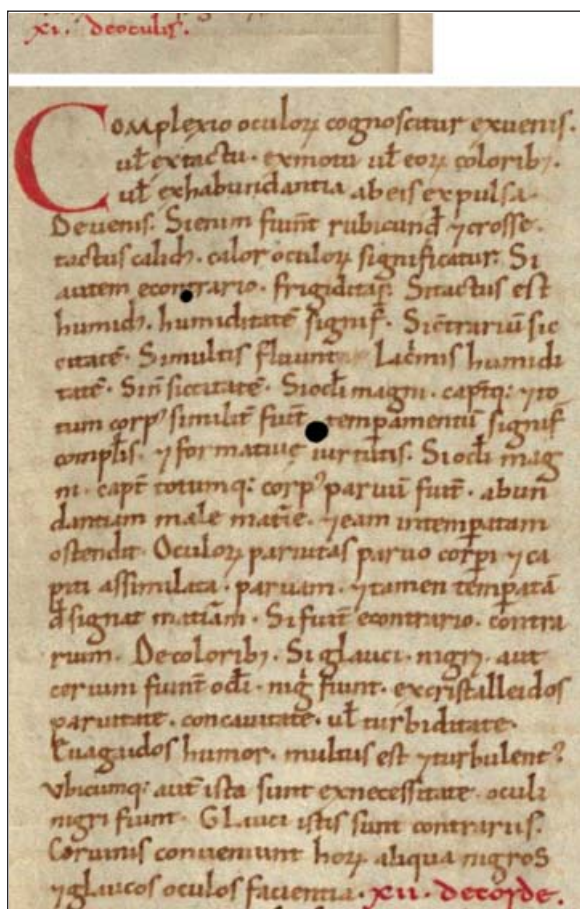


Fig 1. Digitalised scan of the title page of the medieval parchment manuscript Pantegni. It is written around 1080 AD under supervision of Constantine the African in the abbey of Monte Cassino, Italy. The manuscript is administered by the Dutch National Library and is online accessible via www.kb.nl/themas/middleleeuwen/liber-pantegni (accessed March 26/21)

Fig 2.

Digitalised scan of chapter 11 de oculis from book 1 of the medieval parchment manuscript Pantegni. It is written around 1080 AD under supervision of Constantine the African in the abbey of Monte Cassino, Italy. The manuscript is administered by the Dutch National Library and is online accessible via www.kb.nl/themas/middeleeuwen/liber-pantegni (accessed March 26, 2021).



Results

In figure 2 (right column) a scan is shown of the relevant chapter. We translated the text:

XI. de oculis.

Complexio oculorum cognoscitur ex venis, ut ex tactu, ex motu ut eorum coloribus, ut ex habundantia ab eis expulsa.

De venis. Si enim fuerint rubicund & grosse, tactus calidus, calor oculorum significatur. Si autem e contrario, frigiditas.

Si tactus est humidus, humiditatem significat. Si contrarium, siccitatem. Si multis fluunt lacrimis humiditatem. Sini siccitatem.

Si oculi magni, caputque & totum corpus similiter fuerit, temperamentum significat complexionis & formative virtutis.

Si oculi magni, caput totumque corpus parvum fuerit, abundantiam male materiae, & eam intemperatam ostendit. Oculorum parvitas parvo corpori & capiti assimilata, parvam & tamen temperatam designat materiam. Si fuerit e contrario, contrarium.

De coloribus. Si glauci, nigri, aut cervini fuerint oculi, nigri fiunt, ex cristalleidos parvitate, concavitate, ut turbiditate. Euagaidos humor, multus est & turbulentus. Ubi cumque autem ista sunt ex necessitate oculi nigri fiunt. Glauci istis sunt contrarii. Cervinis conveniunt horum aliqua nigros & glaucos oculos facientia.

Chapter 11. About the eyes

The complexion of the eyes is known by the blood vessels, as well as by palpation, as well as by the change of the colours and by the abundance which is expelled from them.

About the blood vessels: In case they become red and swollen, warmth of the eyes is assessed by a warm palpation. But in case of the opposite: coldness.

If the palpation is moist, it marks moistness; in case of the opposite: dryness. If they stream with many tears: moistness, if not: dryness.

In case of large eyes, and if the head and total body are in a similar state, then balance of complexion and formative force are present.

In case of large eyes, whereas the head and the total body are small, it signifies an excess of unfavourable nutrients and therefore an imbalance. Small size of the eyes, together with a small body and similar head, indicates few but balanced nutrients. The opposite arises in the opposite case.

About the colours. In case the eyes were glaukos, niger or cervinus, they become niger from a smallness, cavitation or turbidity of the kristalleidos. The humor euagaidos is plentiful and murky, everywhere this is, the eyes necessarily become niger. The glaukos coloured cases are the opposite. They come together in the cervinus colored cases if the eyes are somehow composed from both niger and glaukos.

Distillation

In this for the modern reader rather cryptic passage, Constantine appears to instruct how to interpret the complexion or state of the eyes:

- By the blood vessels, the palpation and the tear flow one can diagnose an imbalanced state of the eyes; whether they are hot, cold, moist or dry.

- From the size of the eyes in relation to the head and the rest of the body one can determine whether there is a balanced state of the eyes and also formative force, or rather whether disharmony exists because of excess of unfavourable nutrients.

- From the colour of the eyes the condition of the so-called *kristalleidos* and humor *euagaidos* can be deduced.

Discussion

Analysing historical texts is challenging and for adequate interpretation a thorough historical comprehension is required.^{9,10} In chapter 11 of book 1 of the *Pantegni*, it is also difficult to be sure what Constantine and his fellow translators exactly understood and meant. However, analysis of their sources and of later manuscripts that were based on the *Pantegni* can illustrate the state of knowledge in the scriptorium of the abbey of Monte Cassino at the time of writing.⁷

Nonetheless, the reader in the 21st century is left with several questions. What did Constantine have in mind when he wrote about the formative force (*virtus formativa*) which presumably arises within the body and is able to convert matter in anatomical structures? Apparently the answer to that question is beyond the scope of this study. But even the anatomical descriptions are difficult to interpret: what did Constantine understand by humor *euagaidos* and *kristalleidos*? Humor *euagaidos* describes a premature concept of the aqueous humour. The word *kristalleidos* is related to the Greek verb *κρυσταλλίζω* which translates as “transparent as crystal” and refers to a premature concept of the human lens.^{6,11} We know however that the authors of *Pantegni* and their predecessors only had a limited understanding of the anatomy of the eye.^{6,12} Writing about humor *euagaidos* and *kristalleidos*, they had not yet the knowledge of the ocular constellation with the aqueous humour, the lens and the vitreous body.

The colours are a further enigma. Constan-

tine names three colours; *glaukos*, *niger* and *cervinus*. It is very difficult to understand what was meant exactly with these words at that time: it has been shown that words for colours (especially ones with shorter wave lengths) gradually appear and evolve with the development of a language.^{13,14} Besides, analysis of the word *glaukos* as used by 120 different authors from Ancient Greece showed that the term covered a whole spectrum. Sixty-two percent used the expression to describe the colour of the eyes. These *glaukos* eyes were mostly healthy eyes, but 11% of the authors used the word *glaukos* to describe ocular pathologies of different origins.¹⁵

In conclusion, Constantine and his people stood right at the beginning of an era in medicine. He wrote the first Western European medical compendium, which has been a standard book for the following ages. The relevance of this work at that time cannot be overestimated. Nowadays the humoral theory may have been outdated and no added value exists for the ophthalmological examination as described by Constantine, nor for its interpretation. Nonetheless, it is fascinating to be able to have a look at his unique contribution, almost a millennium later. What is more, studying the origin of medical knowledge from the time of Constantine makes us realise how far we have come and that knowledge is an iterative process.

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