Ophthalmologists of the Medieval Islamic World
by

M. Zafer Wafai, MD, FACS, FICS, FRCOphth
Preface

The main purpose of this monograph is to review some of the contributions made by ophthalmologists from Muslim civilisation between the 9th century CE (early 3rd century AH) and the late 14th century CE (middle 7th century AH). The work is based upon my personal effort to collect microfilms and photocopies of Arabic manuscripts from public libraries in Syria, Egypt, Turkey, Tunisia, Saudi Arabia, Morocco, Rome, Paris, London, and El Escorial in Spain. The late Professor M. Rawwas Qal‘aji and I had the opportunity to edit most of these manuscripts and publish them through different organisations.

Part one highlights the most important contributions known prior to visiting specific parts of each book. Chronologically, it deals with books which specialise in ophthalmology and are written by ophthalmologists. Part two also appears in chronological order and discusses chapters concerning ophthalmology in Arabic textbooks on general medicine. This part is terminated by a note on the medical code of ethics amongst those ophthalmologists.

“The Arabs held high the torch of medical science in all parts of the Islamic world, from the river Oxus to the Guadalquivir. They added a new knowledge at a time when in the European countries a nearly complete darkness had settled. I would like to mention here only that the European ophthalmologists of the middle-ages had no other teachers than the Arabians.”

Julius Hirschberg

LIST OF CONTENTS

Preface

Introduction

Part I:

   “Treatise About the Ophthalmic Nerve” رسالة في عصب العين

   Daghal Al-‘Ayn دعلم العين
   “Knowing the Oculist Profession: Questions and Answers” معرفة مهنة الكحاليين

J. D. Wayenborgh Verlag, Germany, 1985. Translated by: Professor Frederick C. Blodi, MD, Professor of Ophthalmology, University of Iowa.
3. Ḥunayn Ibn Ishāq Al-‘Ābādī (D 255 AH/878 CE).
   “Ten Treatises on the Eye”
   العشر مقالات في العين

4. Thābit Ibn Qurrah Al-Ḥarrānī (D 288 AH/900 CE).
   “Vision and Perception”
   البصرة البصرة

   “The End and Sufficient Construction of the Eyes, Their Shape, Treatment and Remedies”
   النهاية والكفاية في تركيب العينين و خلقهما و علاجهما و أدوينهما

   “Treatise About the Nature of Ophthalmia, Its Classification, Causes and Treatments”
   رسالة في ماهية الرمد و أنواعه و أسابيعه و علاجه

7. Aʿyān Ibn Aʾyān (D 373 AH/995 CE).
   “A Book About Eye Diseases and Their Management”
   كتاب في أمراض العيون و مداونتها

8. ʿAlī Ibn ʿĪsā of Baghdadī (D 400 AH/1010 CE).
   “Memorandum Book for Ophthalmologists”
   تذكرة الكحالين

9. 'Ammār Ibn 'Alī Al-Mawṣīlī (D400AH/1010CE).
   “Selected Eye Diseases”
   المنتخب في علم العين

10. Ahmad Ibn ʿAbdul-Ḥarīm Al-Mandawayh Al-ʿAsfahānī (D 410 AH/1019 CE).
    “Treatise About the Construction of Eye Coats”
    رسالة في تركيب طبقات العين
    “Treatise about the Treatment of Mydriasis”
    رسالة في علاج انتشار العين

11. 'Alī Ibn Ibrāhīm Ibn Bakhtyashuʿ Al-Kafārṭābā (D 460 AH/1063 CE).
    “A Book About the Anatomy of the Eye, Its Shape and Treatment of Its Diseases”
    كتاب في تشرح العين و أشكالها و مداوتها أعلاها

    “A Book About Eye Diseases and Its Treatment”
    كتاب في أمراض العين و مداونتها

    “Comments About the Eye”
    تعاليق في العين

    “A Book About Careful Examination of Eye Diseases”
    تقيق النظر في علاج حاسة البصر
15. Zarrin-Dast (D 480 AH/1087 CE).
   “The Light of the Eyes”
   نور العين

   “A Book About the Experienced in the Eye”
   كتاب المجريات في العين

17. Mohammad Ibn Qassūm Ibn Aslām Al-Ghāfiqī (D 595 AH/1197 CE).
   “The Guide in Ophthalmology”
   المرشد في الكحل

18. 'Abdullah Ibn Qāsim Al-Harīrī Al-Iṣḥābī Al-Baghdādī (D 646 AH/1248 CE).
   “The End of Thoughts and the Pleasure of Vision”
   نهاية الأفكار و نزهة الأقصار

   “The Final Thought About the Treatment of Eye Diseases”
   نتيجة الفكر في علاج أمراض البصر

   “The Sufficient in Ophthalmology”
   الكافي في الكحل

   “The Well Versed in Tried Ophthalmology”
   المهندس في الكحل المجرب

22. Ṣalāḥ Al-Dīn Al-Kāḥfāl Al-Hammāwī (D 696 AH/1296 CE).
   “The Light of the Eyes and the Compilation of the Arts”
   نور العين و جامع الفنون

   “Uncovering the Unknown in Eye Conditions”
   كشف الربن في أحوال العين

24. Ṣadāqaḥ Ibn Ibrāhīm Al-Masrī Al-Ḥanāfī Al-Shathilī (D 751 AH/1350 CE).
   “The Ophthalmic Support for Diseases of the Visual Organ”
   العمدة الكحلية في الأمراض البصرية

25. 'Alā’ Al-Dīn Al-Kahhāl Al-Safādī (D 786 AH/1384 CE).
   “The Book of Rules in Ophthalmology”
   كتاب القانون في أمراض العين

Part Two

1. 'Alī Ibn Sahl Raban Al-Ṭabarī (D 247 AH/861 CE).
   “The Paradise of Wisdom”
   فردوس الحكمة

   Continens (Al-Hawī Fī Āl-’Tib)
   الحاوي في الطب
Medical code of ethics amongst ophthalmologists

Introduction

Ever since the first human settlement in communities around major rivers such as the Nile, Euphrates, and Tigris, two sciences proved important: the first being morality, ethics and spirituality, the second is the health and wellbeing of the settled communities. It is clear that the first is responsible for the organisation of relations and communities, adopted rules and regulations, in order to solve any disputes that may arise. As for the second science concerning health, it was viewed as vital for keeping individuals strong and fit enough, both physically and mentally, to survive in the wilderness and maintain the existence of the human race.

It is believed that the first recognised physician in the history of medicine was Asclepius I, who lived around 5500 BCE in ancient Greece. ² Succeeding Asclepius, Pharaoh Amun from Ancient Egypt was considered a God by the Egyptians due to his ability to treat a multitude of diseases and cure patients.³ Famous ancient healers, or physicians, that followed Asclepius and Pharaoh Amun include Horus, Menes, Hermiones, Bermanedes, Plato, Asclepius II, Hippocrates, Galen, and to mention a few.⁴

² Samarrai, vol.1, 72.
³ Samarrai, vol.1, 33.
⁴ Samarrai, vol1, 75,76.
The works of Hippocrates and Galen were translated into Arabic during Muslim Civilisation. During the early days of Islam, traditional healers practiced primitive medicine and surgery based upon knowledge inherited from their ancestors or through personal experience. With this knowledge they were able to cure some endemic diseases and treat wounded soldiers in the battlefield. The Umayyad Dynasty followed with a few shy attempts to translate scientific books—mainly chemistry—but these translations were not extensive enough to make any tangible impact on the practice of medicine.

Serious translations began at the “House of Wisdom” or Bayt al-Hikmah in Baghdad, where master physicians and translators were employed. Among the 47 mentioned in literature were Georgis Ibn Jibrīl Ibn Bakhtyashu’, the famous Hunayn Ibn Ishāq Al-‘Abdī, his son Ishāq Ibn Hunayn, and his nephew Ḥuibaish Al-A‘sam. After a wealth of translated works and knowledge was accumulated a new era began around 400 AH (1010 CE). Numerous scholars excelled in fields such as geography, astronomy, medicine, mathematics, among other major accomplishments in literature and history as a result.

Amalgamating knowledge from the books translated from Greek, Persian, Indian, and Syriac allowed for the compilation of several major medical encyclopaedias. The Latin translation of those books remained the main, and perhaps the only, source of teaching material in European Universities till the late part of the 15th or 16th centuries. Among famous translators from Arabic into Latin were Demetrius Damianos and Constantini Africani. They translated medical encyclopaedias such as “The Royal Book” by 'Alī Ibn 'Abbās Al-Ahwāzī (d. 994 CE), “The Canon of Medicine” or Al-Qānūn Fi Al-Ṭib’ by Ibn Sīnā, and the “Comprehensive book on medicine” or Al-Hawī by Al-Raźī.

While Demetrius and Constantini Africani claimed the knowledge in their respective works, Galeni Liber de Oculis translatus a Demetrio and Liber de Oculis Constantini Africani, to be their own, J. Hirschberg identified Hunayn Ibn Ishāq as the original author. Demetrius and Constantini Africani merely translated Hunayn Ibn Ishāq’s “Book of the Ten Treatises on the Eye”.

Gerard of Cremona (1147-1187 CE) spent a few years of his life in Toledo studying Arabic, and upon instructions from Emperor Friedrich II, he translated into Latin several major Arabic books, such as Al-Ḥawī by Al-Rażī, Al-Qānūn by Ibn Sīnā, and Al-Tṣārif by Abu Al-Qāsim Al-Zahrāwī. While Demetrius and Constantini Africani claimed the knowledge in their respective works, Galeni Liber de Oculis translatus a Demetrio and Liber de Oculis Constantini Africani, to be their own, J. Hirschberg identified Hunayn Ibn Ishāq as the original author. Demetrius and Constantini Africani merely translated Hunayn Ibn Ishāq’s “Book of the Ten Treatises on the Eye”.

Four centuries later, in 1547, Andreas Alpago\textsuperscript{7} travelled to Cyprus, Syria, and Egypt to learn Arabic. He became a great admirer of Ibn Sinā. His improved translation of \textit{Al-Qānūn} served as a primary reference to medical students and practitioners until the late 18\textsuperscript{th} century.

Much of the Greek works were translated into Arabic initially by Nestorian Christians. These translators were financially compensated by the Caliphs for leaving Jundishapur (Gondēshāpūr, Persian city founded around 500 CE) in the southern part of Persia (Iran). Their translations included books written by philosophers, mathematicians, astronomers, and very prominent physicians, such as Hippocrates and Galen.\textsuperscript{8} Without these translations, these ancient works would have been lost forever. Hirschberg comments, “The antique Greek, Hellenistic world are for us the cores of all science, but the Arabian civilisation was its conduit.”\textsuperscript{9}

**PART I**

This part highlights the most important contributions known prior to visiting specifics of each book. It appears in chronological order and deals with books which specialise in ophthalmology and are written by ophthalmologists.

\textbf{1/1: Jibrāīl Ibn Bakhtyashu' Ibn Georgis (D 214 AH/828 CE)}

جلấnيل بن بختيشوع بن جيورجيس

 رسالة في عصب العين

“Treatise about the Optic Nerve”

Ibn Georgis wrote one book titled “Treatise about the Optic Nerve”. Unfortunately, there are no known manuscripts of this book currently in existence. However, Al-Samarrai mentioned one manuscript found in a private collection of Al-Jarrāh in Aleppo, Syria. It was listed in Paul Sbat 1/8 #12. Unfortunately, lack of information available regarding Al-Sammarai’s manuscript prevented verification of Ibn Georgis’s manuscript.\textsuperscript{10}

\textbf{1/2: Yūḥanna Ibn Māsawayh (190-242 AH/815-865 CE)}

يوحنا بن ماسوئه

Yūḥanna Ibn Māsawayh (known to Latin translators as \textit{Mesue Senior} or \textit{Janus Demascenus}) was an enlightened Christian from Jundishapur. He served as director in a Baghdadi hospital -

\textsuperscript{7} Hirschberg, 23.
\textsuperscript{8} Ibid, 26
\textsuperscript{9} Ibid, 40.
the only known hospital of its time. For half a century, he was the personal physician and eye
doctor (Kaḥṭal) of a few Caliphs including: Al-Maʿmūn, Al-Mutasim, Al-Wāṭiq, and Al-Mutawakkil.

He wrote two books on ophthalmology: 11

1. *Daghal Al-ʿAyn* (“The Alteration of the Eye”)
2. “Knowing the Ophthalmology Profession: Questions and Answers”

Max Meyerhof mentioned in the introduction of his book, “Ten Treatises on the Eye”, that
two copies of each book exist in Cairo (Taymour) and in Leningrad, yet the numbers of the
said manuscripts have not been stated. 12

1/3: Ḥunayn Ibn Ishāq Al-ʿAbādī (194-264 AH/817-887 CE)

Ḥunayn Ibn Ishāq Al-ʿAbādī was born in Al-Hira, (الحيرة), North-eastern Syria. He studied
medicine in Jundishapur under the famous teacher Yūḥanna Ibn Māsawayh. He then travelled
around to master the Greek language and to Basra, Iraq to improve his Arabic. He displayed
strong command of Syriac (his first language), Persian, Greek, and Arabic. Medieval Latin
translators refer to him as Juhannitus.

Ḥunayn was one of the senior scholars at the House of Wisdom in Baghdad. He worked as
Chief Translator of the Greek, Syriac and Persian books in medicine, botany, mathematics, and
astrology. After he passed away, he left the legacy of Hunayn’s School of Translation. This was
inherited by his son Ishāq Ibn Ḥunayn and nephew Hubaysh Al-Aʿsam حبيش الأسم.

In addition to his skills in translation, Ḥunayn was a prominent physician and ophthalmologist.
Uṣaybiʿā 13 mentioned the following of his books:

1. “Ten Treatises on the Eye”
2. “The Book about the Eye in Question and Answer Format”
3. “Treaties about the Construction of the Eye”

---

Press, 1928), X.
4. “Treaties about How to Choose Eye Medication”
5. “Treaties about the Surgical Treatment of Eye Diseases”
6. “Summary of Galen’s Book on Eye Diseases”

“Ten Treatises on the Eye” was translated three times throughout history - twice into Latin and once into English.

Some Latin translators claimed to be the authors of Hunayn’s work:

1. *Galini liber de oculis translatus Demetrios*
2. *Liber de oculis: Constantini Africani*

J. Hirschberg ¹⁴ discovered that neither Demetrios nor Constantini Africani were the original authors, but were in fact translators of Hunayn’s “Ten Treatises on the Eye”. The translation into English was the work of Max Meyerhof. It was published in Cairo, in 1928 to commemorate the 100th anniversary of the establishment of King Fu’ād University, Cairo. ¹⁴

The book gained its fame owing to the highly meticulous and precise manner in which it was written that resembles the writing of modern textbooks. Moreover, it contained the very first drawing of the eye illustrating the optic nerve and six muscles to which he added the retractor bulbi muscles, these are only found in certain classes of mammals. He also explained and simplified the mechanism of vision as written by Galen, شرح آلية البصر على مذهب جالينوس, which stated that light reflects from objects to meet the luminous rays of vision. The emanation of the luminous spirit streams from the brain through the optic nerve, the lens, and the pupil. The intermediary of the two rays is dependent on clear air, if the air is clear, so too will the vision. Aristotle and Galen developed this theory of vision, which Hunayn adopted. However, Hunayn vehemently rejected two other theories about vision. The first he rejected was that developed by Embledocles, أبومونتيس, claiming that an image-ray leaves the object and meets the eye, a theory Ibn Al-Haytham supported and proved at a later date. The second was that of Epicurus, أيبوروس stating that the visual rays leave the eye, stretch themselves out to the objects, and feel them.

Hunayn’s book was of such importance that most, if not all, Arabian, Persian and Turkish authors followed Hunayn’s method of writing textbooks. Meyerhof noted its significance and concluded in his introduction to the English translation of “Ten Treatises on the Eye” that it was: “the oldest known book written in a scientific and academic way” and that “it is the first book to contain the first known drawings of the eye and its components, and it is much better than the drawings of the European books written much later.” ¹⁵

1/4: Thābit Ibn Qurrah Al-Ḥarrānī (211-288 AH/823-900 CE)

"Vision and Perception"

Thābit Ibn Qurrah Al-Ḥarrānī was born and raised in Harran, Mesopotamia in the year 221 AH, 823 CE. He moved to Baghdad during the reign of Caliph Al-Mu'tadid and enjoyed a very high rank in the Caliph’s court. It is in this court where he learnt and mastered several ancient languages such as Aramaic, Greek, and Syriac in addition to Arabic. Thābit Ibn Qurrah was a philosopher, mathematician, astrologist, and physician. He translated many books dealing with philosophy and excelled in this field. He was a distinguished

---

mathematician and a master of astrology. He wrote a book titled “Solar and Lunar Eclipses”, but died before finishing it. In the field of medicine, he was competent enough to become the personal physician of Caliph Al-Mu'taḍid. As an ophthalmologist, he wrote a book entitled “Vision and Perception”. Although it is a small book compared to the books he wrote later, it was quoted by most of the ophthalmologists who followed him. These included Khalīfah, who referenced “Vision and Perception” in his book Al-Kāfī (Sufficient Knowledge in Ophthalmology). Al-Ｒāzī also referred to it in his Al-Hāwī fi Al-Ｔīb (Continens). The only known manuscript of “Vision and Perception” is in Cairo (Egyptian archives, Taymour No. 100, 385-451). ¹⁷

Thābit Ibn Qurrah’s most important contribution to ophthalmology was his treatment of amblyopia, or lazy eye, العطش. He proposed closing the normal eye with a patch to “force the visual spirit to go into the lazy eye in order for vision to improve”. This was an outstanding breakthrough in the field of ophthalmology. He also added a diagram to explain the diseases of the “visual spirit.”

Unfortunately, no manuscript of this book could be found. The author was mentioned by Usaybi‘ä, “Khalaf Al-Tuluni is the first Muslim among the authors of Arabian books on ophthalmology.” 18 It is to our surprise that Khalifah referenced Al-Tuluni in his book “The sufficient in Ophthalmology”, 19 indicating that Al-Tuluni’s book had a good reputation among ophthalmologists. 20

1/6: Abū 'Abdullāh Moḥammad Ibn Sa‘īd Al-Tamīmī Al-Maqdesī (D. 980 CE/369 AH)

Mohammad Ibn Sa‘īd Al-Tamīmī Al-Maqdesī was a famous physician who practiced in his hometown, Jerusalem, around 980 CE. He later moved to Egypt where he remained for the rest of his life. Though he mainly treated diseases of the digestive system, he wrote a book on Ophthalmology entitled, “Treatise about the Essence of Ophthalmia, Its Types, Causes, and Treatment”. 21

1/7: A’yan Ibn A’yan Al-Maṣrī (D 385 AH/995 CE)

“The Book about Eye Diseases and Their Treatment”

Unfortunately, this book did not survive time, as no mention of the author or the book could be found elsewhere, except by Usaybi‘ä: “A’yan Ibn A’yan of Egypt, who died in 385 AH, wrote a book about ophthalmology entitled “A Book about the eye diseases and their management.”” 22

There is some confusion about this author’s last name. Usaybi‘ä mentions two similar names: Zahroun Ibn A’yan Al-Basrī, Zezrūn ‘Abī A‘īn al-Mṣārī, from Basra, who was the teacher of Masjarwa’i and lived at the time of the Marwani dynasty, and A’yan Ibn A’yan Al-Maṣrī, ‘A‘īn A’īn al-Mṣārī from Egypt. 23 J. Hirschberg could not differentiate between the two names with certainty. 24 In his book Nūr Al-‘Uyūn, Salāḥ Al-Dīn gave quotes from Ibn A’yan Al-Basrī’s 25

---

18 Usaybi‘ä, 544.
22 Usaybi‘ä, 546.
23 Ibid.
24 J. Hirschberg, vol. 2, 82.
25 Salāḥ Al-Dīn Al-Kaḥhāl, Al-Ḥamwī, 655.
book, “Examination of Ophthalmologists”. Samarrai, however, mentions A’yan Ibn A’yan Al-Maṣrī briefly, as well. 26

1/8: ’Ammār Ibn ‘Alī Al-Mawsīlī (D 400 AH/1010 CE)

The author, as his name indicates, was born and raised in Mawsil, also referred to as Mosul, Iraq. It is here he studied medicine and excelled in ophthalmology. He also travelled extensively treating patients, as mentioned in his book. He gained fame after he invented and used the hollow couching needle to extract the soft cataract (congenital and/or traumatic), which is considered a major breakthrough in the management of cataracts throughout the history of mankind.

Max Meyerhof 28 translated the six different techniques ’Ammār used to treat the cataract surgically, which demonstrated ’Ammār’s skills in modifying the procedure as deemed fit for each case. The book gained fame and attention by several scholars who specialised in the history of ophthalmology. Hirschberg, Lippert, and Mittwoch extensively reviewed, surveyed, and evaluated all the known manuscripts of ’Ammār’s book, specifically No. 894 which may be found in the library of the Royal Monastery of Saint Lorenzo of Escorial in Spain. 29

Four more manuscripts were obtained from:

• The general library of Rabat, Morocco No. 782.
• The Cairo Egypt Tub Tal’at No. 618.
• The British Library of London No. 10257.
• Istanbul, Ahmad III No. 208.

’Ammār’s book was translated into Latin as Tractatus de oculis canamusalli.

Emilie Savage-Smith wrote extensively on Ophthalmology in Seventeenth-Century Islamic Medicine. Of interest are her two excellent papers on Ibn al-Nafi’s treatment of Trachoma and its sequelae (see: E. Savage-Smith, ‘Ibn al-Nafis’s Perfected Book on Ophthalmology and His

26 Samarrai, vol. 2, 571; N. Hamarne and I. Rajab, 149, 210, 394.
Treatment of Trachoma and its Sequelae’, Journal for the History of Arabic Science, 1980, 4, 147–204 and (Emilie Savage Smith, 'Drug Therapy in Trachoma and its sequelae as presented by Ibn al-Nafis’, Pharmacy in History, Vol. 14, No. 3, 1972, pp. 95-110). Most of the information contained in these papers, can be found in Arabic in the book "Al-Muhadhab" edited by the present author in collaboration with his colleague, late M.R Qalaji, published by (ISESCO), Rabat-Morocco, 1988. Professor Emilie Savage-Smith is to be commended for the schedule of simple medications and her efforts to translate the numerous names into English, which would have required considerable amount of time and resources. Of particular interest is her outstanding paper on 'Drug Therapy of Eye Diseases in Seventeenth-Century Islamic Medicine: The Influence of the "New Chemistry" of the Paracelsians’, Pharmacy in History, Vol. 29, No. 1 (1987), pp. 3-28. It centres mostly on a physician and occultist called (Ibn Sallum D.1670 CE) and contains a meticulous comparison with the work of Oswald Croll (D 1709CE). Of particular interest is her comment on cataract where she diligently and carefully documented the use of the hollow couching needle and attributing its initial use to Ammar Ibn Ali Al-Mawsili. However, In 2000, she wrote an exhaustive article entitled ‘The Practice of Surgery in Islamic land: Myth or Reality’ 30 in which she discussed several surgical procedures mentioned in ancient Arabic medical books. In this she questioned the validity of those procedures and whether or not they were truly performed. Particular attention was paid to the aspiration of the cataract using the ‘hollow couching needle’ as described in 'Ammār’s book, “Chosen Eye Diseases and Their Treatment”.

On page 318 Savage-Smith wrote:

“The tenth-century Egyptian oculist ‘Ammār Ibn ‘Alī Al-Mawṣili claimed to have designed a hollow couching needle for the removal of cataract by suction, and he presented case histories in which he claimed to have had much success with this technique.”

She continued saying:

“Rāzī had briefly described the procedure and the hollow instrument, attributing its invention to the Greek physician Antyllus of the second century,” as if she is questioning Ammar’s honesty and integrity in claiming the invention to himself.

Furthermore, Savage-Smith doubts his results when mentioning:

“Contemporary and later doctors such as Al-Zahrāwī (fl.1000) and Al-Shāzili (fl.1350-1390) doubted the efficacy of 'Ammār’s instrument.”

A few remarks are worth mentioning in response to the above view:

'Ammār was not an Egyptian, from his name we can deduce that he was from Mawsil, Iraq but worked in Egypt. The actual statement referred to in Al-Ḥāwī is: “Antyllus reported that some people introduced in the couching location a glass tube to aspirate the cataract, but they aspirated the aqueous humor along with it.” There are two problems with this statement. There does not seem to be a source on Antyllus other than this sentence in Al-Ḥāwī. The other is the level of technology at the time of Antyllus to produce a very small diameter glass tube.

Al-Ḥāwī Fī Al-Ṭib, however, was compiled by Al-Rāzī’s students and admirers years after his death. This places some of the originality of some of its content under legitimate questioning. Furthermore, the fact that Al-Rāzī did not dwell on the authenticity of this invention may be that he was neither a surgeon nor a recognised ophthalmologist. He passed away at least 75 years prior to ‘Ammār’s book being known and famous.

Mentioning Al-Shāzīlī’s name with Al-Zahrāwī as doctors is inappropriate as Al-Shāzīlī was not an ophthalmologist, and he bought the instruments from the market, whereas ‘Ammār claimed he made the instrument himself.

‘Ammār was very sure of himself, as is clear in the beginning of his book: “For my ability and knowledge of this field surpasses everybody else.” He finished most of his chapters with “and I say...,” indicating that his opinion was the final word. Such over confidence in his knowledge and experience caused some authors to accuse him of arrogance. The following are samples of his statements:

- “I did not write anything in this book that I did not try, and I have treated people all of my life, so be certain that my treatment will work.”
- He recommended, for the first time in history, to scratch the iris to create a blood clot in order to prevent the cataract from re-ascending.
- He was the first to warn surgeons of dislocating the cataract into the anterior chamber, as doing so will touch the corneal endothelium, causing irreversible corneal edema, which is now called corneal decompensation.
- He was a pioneer in the advocacy of fragmenting and aspirating the cataract.
- He was the first to use the word “pupil” to refer to what was previously called the “hole of the iris.”
- He used the term “airy cataract” to describe a superiorly dislocated cataract that is stuck at the upper edge of the pupil.
- Above all, he invented and skilfully used the hollow couching needle, stating, “Nobody ever did it prior to me.”

'Ammār described the characteristics of a good surgeon as being one who is “able, experienced, sharp-sighted and steady-handed.” He claimed that experience is what is required from a surgeon: “He who has no experience has not profession,” “ومن لا درية له فلا صنعة”. He was an extremely observant clinician and meticulous in inventing surgical instruments with very detailed measurements. Due to dietary habits of consuming excessive amounts of fish, observing the cataract was very common in Egypt. A major shortcoming of his book is the lack of illustrations, anatomical and surgical instruments, and that he did not explain the mechanism or causes underlying strabismus. He also failed to discuss the pathology of vitreous or the retina. However, these minor setbacks do not diminish the value of the book or the contribution of the author. ³³

‘Alī Ibn ‘Isā Al-Kaḥḥāl (D 400 AH/1010 CE)

علي بن عيسى الكحالي تذكرة الكحاليين

“Memorandum Book for Ophthalmologists”

‘Alī Ibn ‘Isā Al-Kaḥḥāl spent his life in Baghdad as a practicing ophthalmologist. His book, “Memorandum book for Ophthalmologists”, 34 is one of the oldest textbooks of ophthalmology that has been preserved in its entirety and original language. Hirschberg listed ten manuscripts in different European National libraries. 35

‘Alī Ibn ‘Isā Al-Kaḥḥāl preserved the information in the lost works of ancient Grecian authors such as Oribasius, Aetius, and Paulus. This knowledge would have been lost were it not for Ali Ibn Isa’s book. He added to the Grecian methods and concepts both what he gained from his teachers and experiences in his own practice - contributing new insight beyond what was known to the ancient Greeks. ‘Alī Ibn ‘Isā Al-Kaḥḥāl is known to European translators as Jesu Hali and his book as Tractatus de Oculis.

34 Uṣaybi‘ā, 333.
The book exemplifies the ideal textbook of Arabian Ophthalmology. Later, many oculists quoted the book as a reference to all practicing ophthalmologists, even those in Europe, where original manuscripts or incomplete translations were scattered in different libraries. The book survived over 800 years. 'Alī Ibn 'Isā emphasizes meticulousness and caution in the performance of surgery which was not present in Grecian books. For the following 800 years, no other book was its equal or surpassed 'Alī Ibn 'Isā’s work, for it contained good teaching and the practical aspect of the profession. The first to present new ideas after 'Alī Ibn 'Isā Al-Kāḥḥāl’s work was Kepler, who, later in the 18th century, presented the theory of the dioptric power of the eye and lenses.  

What made “Memorandum Book for Ophthalmologists” unique and such a major reference for so long was the elegant manner in which it was written. The book consists of four different sections:

1. In the first section, 'Alī Ibn 'Isā Al-Kāḥḥāl discusses the anatomy of the eye with comments regarding physiology. He explains the concept, the use, and the nature of the eye.
2. The second section deals with external eye diseases and their treatment.
3. The third section deals with the diseases of the eye that are not apparent, in example the diseases of the visual mechanism, crystalline fluid, vitreous, optic nerve, night blindness, day blindness, and abnormalities of the extra ocular muscles.
4. At the end of the book, 'Alī Ibn 'Isā Al-Kāḥḥāl lists 143 simple medications in alphabetical order, as well as their effect on the eye and 80 additional prescriptions of compounded medication.

Included in the book are 130 eye diseases and thorough descriptions of the signs, symptoms, and phases of some of the diseases and medical—and possibly surgical—management with extensive details. This is why the book is regarded as the Arabian Dogma of Ophthalmology.

36 ibid, 58-59.
38 Ghawth M. Al-Qaderi Al-Sharafi, Editor, Tathkirat Al-Kahhalin by 'Alī Ibn 'Isā (D 400 AH/1010 CE). Othmania Department of Education, Haydarábad Al-Dakan, India, 1383 AH/1964 CE.
1/10: Aḥmad Ibn 'Abdul-Raḥmān Ibn Mandwayh Al-Aṣfāhānī (D. 410 AH/1019 CE)

 أحمد بن عبد الرحمن بن مندوب الأصفهاني

This author is not mentioned by pre 20th century historians other than Uṣaybi’ā, 39 who wrote about him briefly. Uṣaybi’ā mentioned that Al-Aṣfāhānī wrote two books on ophthalmology: “Treatise about the construction of the eye’s coats” and “Treatise about the treatment of Mydriasis”. Samarrai, however, wrote a more detailed biography of Al-Aṣfāhānī, listing thirty three books and treatises in almost all aspects of medicine. Among these treatises are two books concerning eyes mentioned by Uṣaybi’ā. Al-Aṣfāhānī was the first to write about paediatric ophthalmology in his book, “Treaties about Illness in Children”. This effectively makes it one of the earliest books on paediatric ophthalmology. 40

1/11: 'Alī Ibn Ibrāhīm Ibn Bakhtyashu' Al-Kafarṭābī (D. 460 AH/1067 CE)

 علي بن إبراهيم بن بختياشو الكرطابي

“Anatomy of the Eye, Its Shape, and Treatment of Its Diseases”

'Alī Ibn Ibrāhīm was born and raised in Kafarṭāb, كفرطاب, which is a small town between Aleppo and Ma'arat Al-No‘ūman معرة النعمان, in northern Syria. He travelled to Egypt, where he practiced ophthalmology and died in Cairo around 460 AH/1067 CE. His father was also an ophthalmologist and 'Alī Ibn Ibrāhīm copied several compounded medications from his

39 Uṣaybi’ā, 459-461.
father’s handwritten prescriptions. He was a descendent of a Christian family that produced many scholars throughout the Abbasid Dynasty, beginning with Georges Ibn Bakhtyashu’, a brilliant practicing physician from Jundishapur. Caliph Al-Mansour hired Ibn Bakhtyashu' to be his personal physician around 155 AH/776 CE. 'Alī Ibn Ibrāhīm’s father converted to Islam, as his name indicates, which could be reason for Ibrahim’s frequent travelling in the middle of northern Syria. It is possible that he was considered an outcast by his wealthy Christian family, which may also be the reason historians overlooked him.  


No known libraries around the world that contain Islamic manuscripts include a manuscript of this book. He is, however, mentioned by Uṣaybi‘ā.  

---

41 Samarrai, vol. 2, 512 ,N. Hamarneh and I. Rajab, 153, 212-213
42 “Ten treatises on the eye”, ascribed to Hunayn Ibn Ishāq, translated by: Max Meyerhof. (Cairo Amiri press, 1928), XIV.
43 Uṣaybi‘ā 341; Samarrai Vol. 2,496; N. Hamarneh and I. Rajab, 156, 214.
1/13: Abū Al-Faraj 'Abdollāh Ibn Al-Ṭayyeb (D. 468 AH/1075 CE)

أبو الفرج عبد الله بن الطيب تعاليق في العين

“Comments about the Eye”

None of the known libraries containing books on medicine from Muslim Civilisation hold a manuscript of this book. ⁴⁴


أبوالمطرف عبد الرحمن بن محمد بن وافد اللمحي تدقيق النظر في علل حاسة البصر

“Close Observation in the Diseases of the Visual System”

Abū Al-Muṭarref, known to Latin translators as Abengefit, worked and died in Toledo, Spain. He came from a very prominent family and gained the respect and trust of Amir Ibn dhi Al-Nun, so much so that he held the post of two ministries as dual minister ذو الوزارتين.

During his time, he was a prominent physician and wrote several books on general medical topics, including his famous book on simple medications and a book on ophthalmology titled “Close Observations about the Diseases of the Visual System”. ⁴⁵ Unfortunately, the book was not preserved, but the author’s name was mentioned in Khalīfā’s list. ⁴⁶


(زارين داست.) أبو روح محمد بن منصور بن عبد الله بن منصور اليماني نور العيون

“The Light of the Eyes”

Zarrin-Dast (The Golden Hand) was a Muslim from Persia, who wrote his book, “The Light of the Eyes” to revive Persian culture after the Arabic language dominated the scientific scene

⁴⁴ ʿUṣaybīʿā 323-325; Samarrai, vol. 1,501-504; N. Hamarneh and I. Rajab, 390.
⁴⁶ Khalifah’s book ( Al-Kafi Fi Al-Kuhl) 31-32.
due to the Muslim conquest of Persia around 636 CE. This could be the reason early Arabic biographers did not mention him. According to Hirschberg, the book was discovered in the Bodleian Library under No. 1575 and was written in the form of questions and answers. Zarrin-Dast did not give any credit to the books or authors he quoted frequently, and the 30 eye operations he mentioned in his book are almost identical to those mentioned in the "Memorandum" by 'Alī Ibn 'Isā. 47

1/16: Abul Al-Faḍāil Ibn Al-Nāqed (D. 577 AH/1181 CE)

"The Experienced in Ophthalmology"

No manuscript of this book was found. 48

1/17: Moḥammad Ibn Qassūm Ibn Aslam Al-Ghāfiqī (D. 595 AH/1197 CE)

"Guide to Ophthalmology"

Al-Ghāfiqī was born and raised in Ghafiq, now known as De Quijo, a suburb of Pedroche near Cordoba in Spain. Max Meyerhof translated part of “The Guide to Ophthalmology” into French 49 which I managed to compare with the Arabic text.

The experienced in Ophthalmology

1/18: Moḥammad Ibn Aslam Al-Ghāfiqī (D. 595 AH/1197 CE)

"Guide to Ophthalmology"

Al-Ghāfiqī was born and raised in Ghafiq, now known as De Quijo, a suburb of Pedroche near Cordoba in Spain. Max Meyerhof translated part of “The Guide to Ophthalmology” into French 49 which I managed to compare with the Arabic text.

Hasan 'Alī Hasan edited 50 the entire book as part of a dissertation for a degree in medicine at the University of Madrid in 1977. Hirschberg, Lippert, and Mittwoch studied manuscript No. 835 in Escorial Library, yet did not publish anything about it. 51 In addition to this manuscript, we located and obtained microfilm No. 3319 from the National Library in Cairo, it was copied in 1937 from another manuscript - No. 1808, this is a copy of the Esorial No. 835.

While editing the book, M. Rawwas Qal’aji and the present author noted that the book appeared to be more of a general medical book, rather than one which specialised in

47 J. Hirschberg, vol.2,67-68; N. Hamarneh and I. Rajab, 156.
50 Tesis Doctorar Resumen, La Ophthalmologia De Al-Ghāfiqī, SIGLIO XII, por Hasan Alī Hasan.
ophthalmology. The author extensively discusses the anatomy and physiology of the eye and stresses the effect of the patient’s psychological condition on his eyes. The author listed 23 Arabian physicians and their books as references in his book.

Furthermore, Al-Ghāfiqī listed over 500 simple medications known in his region and 59 compounded prescriptions that he personally used to treat his patients with. This signifies that Al-Ghāfiqī had great experience in the field of ophthalmology. Although he wrote a full chapter about wine and alcohol, Al-Ghāfiqī did not use any medication that is forbidden by Islam (such as pig extracts and alcohol). He illustrated 13 surgical instruments which he created, supporting the claim that he was an ophthalmologist rather than a general practitioner. In addition, in his chapter called “Diseases of the Visual Spirit” 52, he drew several figures to explain the refractive error of the eye.

Overall, Al-Ghāfiqī’s “Guide to Ophthalmology” was an outstanding contribution to ophthalmology and a reference for future generations. 53

1/18: 'Abdullāh Ibn Qāsim Al-Ḥarīrī Al-Iṣbīlī Al-Baghdādī (D. 646 AH/1248 CE)

عبد الله بن قاسم الحريري الأشبيلي البغدادي نهایة الأفكار و نزهة الأبصار

“The End of Thoughts and the Joy of Vision”


(م 1259 هـ 657 تـ) أبو العباس أحمد بن عثمان بن هبة الله القيسي نتيجة الفكر في علاج أمراض البصر

“Final Thoughts about the Treatment of Eye Diseases”

Al-Qaysī was born and raised in Damascus. He moved to Egypt with Malik Al-Azīz, where he was appointed Head Physician. He stated that he wrote his book upon the order of Sultan Ṣāliḥ Najm (السلطان صالح نجم 1240-1249 CE). Dietr Bischof, who translated Al-Qaysī’s book into German, listed several manuscripts in different national libraries. He made an impressive statement in his introduction:

“We owe our knowledge in ophthalmology to what we inherited from the Arabian Ophthalmologists, we still discover books and treatises, but unfortunately, most of them still need to be discovered, copied, edited, and indexed. The pioneers in this field are the ophthalmologist, J. Hirschberg, and Max Meyerhof, who died in 1945. Nothing was published in the field of Arabian Ophthalmology worth mentioning after his death”.

In his book “Light of the Eyes”, Ṣalaḥ Al-Dīn said Al-Qaysī’s book was a collection, or summary, of all the knowledge gathered prior to his time. He commented that his book was well written, organised, and that Al-Qaysī was very thorough in his description of the diseases and their medications and applications. Despite the fact that he did not add anything new to the field, Al-Qaysī attempted to describe the glaucoma and diseases of the aqueous humor. Moreover, he was hesitant to oppose the old theory about the cataract, stating that it is the disease of the crystalline lens, leading one to assume that he performed the couching of the cataract himself.

In praise of this book, Hirschberg concluded, “If among all ophthalmic books in Arabic, this one alone would have survived, it would have been quite sufficient, as it excelled all similar books in medieval Europe. Although in comparison to other Arabian books, this book may be

---

55 Uṣaybi‘ā, 585; Samarrai, vol. 2, 520.
considered mediocre, the author speaks of ‘rare cases and wonderful experience,’ but we detected very little of this in the text.”

1/20: Khalīfah Ibn Abī Al-Maḥāsin Al-Ḥalabī (D. 656 AH/1256 CE)

خليفة بن أبي المحاسن الحلبي الكافي في الكحل

“Sufficient Knowledge in Ophthalmology”

Khalīfah lived and practiced ophthalmology in his hometown of Aleppo around 654 AH/1252 CE. He wrote his book in the middle of the 13th century. It was considered a comprehensive review of most, if not all, books written prior to his time.  

Medical historians and biographers ignored Khalīfah’s book for a long time until Leclerc mentioned it for the first time. Leclerc wrote a brief review of the book in 1876 based on the only copy known to him, which was available in Bibliothèque Nationale in Paris under No. 1043d Arabe, now listed under Arabe 2999. Brockelmann’s history of Arabic literature in 1902 soon followed Leclerc’s review, mentioning another copy of this book in Istanbul’s Yeni (New) Cami (Mosque), The New Mosque, No. 924. In 1905, J. Hirschberg, J. Lippert, and E.

---


60 G. Brockelmann, Geschichete Der Arabischen Literatur, (Berlin, Germany: 1902).

The following are highlights of “The Sufficient Knowledge in Ophthalmology”:

1. The book contains quotations from 73 books, written by 41 physicians, and referenced all authors and books.
2. It is amongst the earliest books to contain a very elegant and detailed illustration of the eyes, the optic chiasm, the cerebral ventricles, the peri cranium, the dura mater, the pia mater, the olfactory nerves, and the petrosal bone. In this drawing, the conjunctiva seemed to originate from the peri cranium, and the sclera from the dura mater. He drew the optic nerves as hollow, parallel lines, stemming from the back of the sclera to meet the optic chiasm and continue their course posteriorly through the brain tissue until finally reaching the occipital lobe.

As far as the eyeball itself is concerned, he drew the lens in the middle of the globe, as Galen believed it to be the proper positioning of the lens. The lens, however, looks far too large in comparison to the size of the globe itself, which made the vitreous too small relative to the size of the globe. Moreover, he drew the pupil in the middle of the iris, in front of the aqueous humor, and for the first time, the zonules were clearly illustrated in a medical book. The cornea looks as if it consists of one layer, and it is smaller than it should be, about one sixth of the globe surface. Two parallel lines extend from the back of the lens to the sclera and optic nerve, almost nearing the description of Cloquet’s canal. All of the ocular coats (cornea, sclera, choroid, zonules, and the retina) and three humidities (vitreous, crystalline lens, and aqueous) are clearly illustrated and labelled.

Although Khalifah drew a small circle in the middle of the triangle behind the chiasm, he did not mention or give the pituitary gland a name. The drawing is so elegant, and all of the yellowish colours are made of gold.

This drawing deserves to be reproduced in larger sizes and posted in every medical school and department of ophthalmology throughout Arabic and Muslim Majority countries. The American Academy of Ophthalmology used a modified version of Khalifah’s drawing as the emblem for the 1987 annual meeting without giving credit to Khalifah. The drawing remained a reference to all the books dealing with the anatomy of the eye until Dr. W. Sömmering drew a cross section of the eye in 1827.  

3. Khalīfah’s book is the first to draw the surgical instruments in organised tables with each instrument in a labelled small box with its usage described below it. The Paris manuscripts contain 36 instruments in two pages, whereas the Istanbul manuscript has the same 36 instruments in two and a quarter pages.

4. His work is novel in arranging the eye diseases into tables for eyelid diseases, different eye diseases, and the mechanism of vision.

5. Khalīfah wrote a chapter concerning the various procedures involved in reviewing the volume and measurement of medication used during his time.

6. He wrote a special chapter describing blood-letting, or venesection، and its technique in meticulous details - surpassing what Ibn Sīnā wrote about the topic in his major book Al-Qānūn.

7. Khalīfah was the first known surgeon to use a magnet to remove a broken piece of the couching needle from the eye, indicating how skilful and confident Khalīfah was as a surgeon.
The book cover as edited by Wafai and Qal'aji.

The first page from the Istanbul manuscript.
The cover page of the Istanbul manuscript.

The last page of the Istanbul manuscript.
Pictures of the surgical instruments as appear in the Istanbul Manuscript


(ابن النفيس) علي بن ابي الحزم القرشى المهذب في الكحل المجرب

Al-Muḥadhab Fi Al-Quḥl Al-Mujarrab
Ibn Al-Nafis may be considered as one of the most knowledgeable and innovative Muslim polymath scholars in Muslim Civilisation. He was born near Damascus, where he studied medicine under Ibn Al-Dakhwār. He later moved to Cairo where he headed Al-Nāṣirī hospital and Al-Manṣūrī hospital. He was born near Damascus, where he studied medicine under Ibn Al-Dakhwār. He later moved to Cairo where he headed Al-Nāṣirī hospital and Al-Manṣūrī hospital. He excelled in more than one field and wrote on just about every one of these fields: explaining the Quran and Hadith (Prophet Muhammad’s sayings), on philosophy, Islamic Fiqh (Jurisprudence), and on medicine and anatomy. He became well known for novel scholarship. What is more, he is famed in rejecting the well-established understanding at the time that there were holes in the wall separating the right and left ventricles of the heart. In his “Explanation of the Anatomy in Al-Qānūn” by Ibn Sīnā, he states, “This is wrong. There are no holes in the heart, the thick blood arises to the lungs, where it mixes with air and gets purified and then returns to the left ventricle to go through the circulation.” This pioneering discovery became the subject of debate whether it constituted the discovery of a pulmonary circulation prior to Michael Servet and William Harvey in 1622, four hundred years later, or was merely a description of the blood passage via the lungs. The dispute is in the naming of the process as a circulation as opposed to a transit. However, all agree that it is a huge leap in anatomy knowledge.

It is strange that most biographers of his time ignored Ibn Al-Nafis, despite the fame he gained in different fields of knowledge. His observations in ophthalmology can be found in his book Al-Mudhādhāb. Five microfilms of Al-Mudhādhāb that have been examined are found in:

- The Vatican Library No. 307 Arabo.
- Al-Żaheriyah Library in Damascus, No. 8435.
- The National Library in Cairo, Tib Tal’at No. 593.
- The National Library in Cairo, Tib Taymūr No. 405.
- Sulaymaniyeh Library: Haji Mahmoud 5515. Istanbul.

N. Hamarneh mentioned two other copies of this book in Berlin and Sbat Library in Aleppo, without disclosing any name or catalogue number given.

While editing this treasure of Ibn Al-Nafis’ original contribution to ophthalmology, it became evident that Al-Nafis was probably the first to:

1. Explain the third/depth dimension phenomenon.
2. Modify the couching needles.
3. Explain, with great accuracy, the differential diagnosis between the corneal laceration and the corneal abrasion.
4. Relate the hypopion to irido-cyclitis.
5. Recommend the aspiration of the hypopion from the eye.
6. State that the cataract is located behind the iris.

---

7. Recommend lowering the intraocular pressure by extracting the aqueous humor to facilitate the repositioning of the prolapsed iris surgically.
8. Describe the aniseikonia in patients with a dilated pupil of only one eye.
9. Describe papillary dilation and the inability to constrict during the acute glaucoma attack.
10. Describe the corneal flattening due to intraocular hypotension, as seen with severe dehydration.
11. Advise purging and vomiting to treat elevated intraocular pressure attack.
12. Describe the monocular diplopia due to lenticular subluxation.
13. Describe the incipient cataract induced myopia.
14. Describe the cataract secondary to glaucoma, *glaucomfleken*.
15. Insist the importance of light perception in the eye before performing the cataract surgery to ensure the success of the procedure.
16. Describe the consensual papillary reaction to differentiate between pre and post chiasmal optic nerve injury.
17. Advocate fragmenting, expressing, and irrigating the cataract, avoiding the loss of the aqueous humor.
18. Describe the bullous corneal edema secondary to trauma to the corneal endothelium during cataract surgery.
19. Warn that chronic hypotony due to wound leaks may result in phthisis bulbi, or shrinking of the eye.
20. Refuse to perform bilateral cataract surgery in the same sitting fearing the possibility of contamination.
21. Warn that irritating cancerous lesions can spread the cancer locally or systematically.
22. State clearly and firmly that congenital strabismus should be treated as early as possible and describe five different types of strabismus, namely: congenital, acquired, spastic, paralytic, and strabismus fixus.
23. Describe and explain the after-image phenomenon.
24. Describe, in detail, the subconscious and the human ability to save information and use it in the subconscious.
25. Classify the eye and give it 25 different names based on the size, colour and shape.
26. Describe the visual cone with a drawing to illustrate it.

Furthermore, Ibn Al-Nafis made a table, identifying the different eye conditions. Furthermore, he set very rigid conditions required for the couching of the cataract, and advocated the use of the feather to mark the penetrating location of the couching needle.

Shortcomings of Ibn Al-Nafis’s book include the lack of illustrations of the surgical instruments, the lack of anatomical drawings to explain the ocular coats and the humidities or
sketches to explain the visual rays, despite the presence of one that illustrates the visual cone. *Al-Muhadhab* by Ibn Al-Nafis is a permanent landmark in the history of ophthalmology.  


1/22: Șalâh Al-Dîn Al-Kaḥāl Al-Ḥamwî (D. 696 AH/1296 CE)

صلح الدين الكحال الحموي نور العيون و جامع الفنون

“The Light of the Eyes and the Collector of the Arts”

Șalâh Al-Dîn was born in Hama, Syria, where he practiced ophthalmology. He must have studied ophthalmology under his father, whom he quoted repeatedly when mentioning some eye medications and ointments in his book “The Light of the Eyes and the Collector of the Arts”. نور العيون و جامع الفنون.

In addition, he quoted a teacher named Al-Ḫākim Nu’mān الحكيم نعمان. He did not only list eye medications from his predecessors, but he described several of his own inventions and praised their effectiveness. Șalâh Al-Dîn condensed most of what was written prior to his time. He quoted 94 physicians and scientists, copied 31 books, beginning with Galen and Euclides and ending with Al-Hasan ibn Al-Haytham’s *Kitab Al-Manazir*.

J. Hirschberg praised the book in his encyclopaedia and in his collaborative work with J. Lippert and E. Mittwoch, “The Arabian Ophthalmologists”. Șalâh Al-Dîn explained with great detail the theory of vision with drawings to illustrate the following three theories:
1. The mathematician’s theory
2. The external and surrounding air theory
3. The naturalist theory

“The Light of the Eyes and the Collector of the Arts” is significant as it:

1. Summarises most of what was written prior to the author’s time.
2. References most original authors.
3. As it is divided into chapters and subchapters, it is well organised.
4. Is the first book to include a coloured picture of a cross section of the eye.
5. Uniquely features seven diagrams to explain the theory of vision and two diagrams to explain the strabismus.
6. Contains a drawing of 18 surgical instruments scattered throughout the chapter on surgery.
7. Depends heavily on 'Alī Ibn 'Isā’s Book Memorandum تذكرة الكحالين and on the second volume of Al-Rāzī’s book Al-Ḥāwī. 67

Four manuscripts of the book can be found at:

• The National Library of Paris No. 1042 Arab.
• The Gotha Library No. 1994.
• Alexandria Library in Egypt No. 1098.
• Istanbul Hamediyah No. 1038.

---


Ibn Al-Akfānī was a famous scholar in more than one field of science. He excelled in physics, mathematics, Islamic Fiqh, medicine, and philosophy. He was well versed in the writings of his predecessors. Ibn Al-Akfānī lived and practiced medicine in Cairo, where he was the head physician of Al-Manṣūrī hospital. Unfortunately, little is known about him, perhaps because he lived after the time of the great biographer Ibn Abī Ṭabīb. However, his student and close companion Abū Al-Ṣafaa' Al-Ṣafadī did write about him. 68

Ibn Al-Akfānī wrote a book on Ophthalmology entitled, “Uncovering Disorders of the Eye”, this was extensively reviewed by Hirschberg. 69

Wafai and Qal‘aji reviewed Ibn Al-Akfānī’s book and felt that it cannot be considered as academic and comprehensive as the books written prior to his time, yet they confirm that it contains a few interesting and accurate observations. 70

Ibn Al- Akfānī was probably the first to:

1. Describe anthrax or charbon accurately and named it “Persian fire” or “Persian fever”, as severe pustules affect the eyelid.
2. Describe a knot (ةﺓدﺩ) among the eyelid lesions.
3. State that the pterygium consists of two layers, the epithelium and the endothelium.
4. State that giant papilla, or chemosis (الوردينج), is one of the retinal diseases, which is an erroneous assumption, as it is an eyelid lesion.
5. Describe the ocular migraine, as a separate entity, the clinical description and symptoms of which are valid till today.
6. Classify the optic nerve diseases and lesions to prechiasmal, within the chiasm and posterior to the chiasm, which are still valid classifications.
7. Describe day blindness. It is clear, however, that what he was actually describing was congenital blindness caused either by a congenital bilateral optic atrophy or by congenital corneal opacity.

Ibn Al- Akfānī also mentioned the hollow couching needle, indicating that he was aware of the instrument and possibly used it. It was obvious that Ibn Al- Akfānī was very sure of himself and confident in his knowledge. His book, unfortunately, lacks illustrations of surgical instruments as well as tables to classify the diseases. In addition, it is evident from his works that Ibn Al-Akfānī was a believer in spiritual or magical powers of healing. This was mentioned by his student Al-Ṣafadī. 71

1/24: Šadaqah Ibn Ibrāhīm Al-Maṣrī Al-Ḥanafī Al-Shazīlī

صدقة بن إبراهيم المصري الحنفي الشاذلي

العمدة الكحلية في الأمراض البصرية

“The Ophthalmologic Support for Diseases of the Visual Organ”

---

Little is known about this author and his book “The Ophthalmologic Support for Diseases of the Visual Organ”. He was alive toward the second half of the 14th century. Hirschberg wrote a detailed chapter about the book in his encyclopaedia “The History of Ophthalmology” and praised the author very highly as “the most knowledgeable of the writings of his predecessors.” 72 Although the author lived during the decline of the Arabic and Islamic civilisations, his book illustrates as much independent thought as those written prior to his time.

Hirschberg highlighted a few important points about Sadaqah Ibn Ibrahim, including the fact that he was the first to write a paragraph about the comparative anatomy and physiology of the eye; a subject about which little or nothing was written or commented upon until 1876. 73 He was also the first to use the term “ophthalmia” in Egypt, describing the Egyptian eye diseases, or what is now known as trachoma. 74 According to Hirschberg, two manuscripts are extant, one in the Royal Library in Munich No. 834 and one in Leningrad, Rosen No. 175, exist. 75


(الصفدي) علي بن عبد الكريم بن طورخان الحموي الصفدي القانون في أمراض العيون

“The Law in Eye Diseases”

Nothing is known about this author or his book except for the fact that Samarrai mentioned him. 76

PART II

This part appears in chronological order and discusses chapters concerning ophthalmology in general Arabic textbooks of medicine.

2/1: 'Alī Ibn Sahl Raban Al-Ṭabarī (D. 247 AH/861 CE)

علي بن سهل ربن الطبري فردوس الحكمة

---

74 N. Hamarne and I. Rajab, 173.
75 Hirschberg, 93.
76 Samarrai, vol.2, 512.
“The Paradise of Wisdom”

This author was born in Tabaristan on the southern shore of the Caspian Sea, northern Persia. His father, Raban Al-Ṭabarī, was a prominent Jewish physician. 'Alī Ibn Sahl Raban Al-Ṭabarī later converted to Islam and became so famous that he became the teacher of the prominent Arabian physician Al-Rāzī. He also served in the court of Caliph Al-Mu'tasim (833-842 CE) and of his successor Al-Mutawakkil (847-861 CE). His book, “Paradise of Wisdom”, was a voluminous book on general medicine, consisting of 30 volumes with 360 chapters. Al- Rāzī quoted him extensively in the second volume of Al-Ḥāwī.

The director of the Arabic Division of Luknau University in India, Moḥammad Zayd Al-Siddiqi, edited “The Paradise of Wisdom”. The Aftab Printing shop in Berlin printed this edition in 1928. Siddiqi reviewed five manuscripts: three of them were in Europe and two were in India in a private collection. Both Aḥmad Ibn Moḥammad Al-Ṭabarī, author of “The Hippocratic Treatments”, and 'Alī Ibn Sahl Raban Al-Ṭabarī wrote about ophthalmology, and their writings were compiled into one volume.


(الرازي) أبو بكر محمد بن زكريا الرازي

77 J. Hirschberg, vol. 2, 104.
78 Muḥammad Zayd Al-Siddiqi, (Berlin: Aftab Printing, 1928).
Al-Rāzī was and still is believed to be one of the most respected and admired physicians of all time. He, Aristotle and Galen are considered to be the three forefathers of high medical knowledge, ethics, and practice. Al-Samarrāi^{80} counted 113 books written by Al-Rāzī, the most famous of which are Al-Ḥāwī, the deuxième livre sur l’œil or Continens, and Al-ʿManṣūrī المنصوري, which were the fundamental sources of knowledge in Europe until the late 17th century. The second volume of Al-Ḥāwī deals with ophthalmology, but is unfortunately very disorganised, with valuable knowledge scattered and without reasonable classification of treaties. Hirschberg commented, “It reads like an accumulation of file cards, which has been collected to form an encyclopaedia of practical medicine.”^{81} These pitfalls do not reduce the value of the book however, as it contains numerous quotations of Greek and Arabian authors.

Uṣaybiʿā mentioned Al-Rāzī’s treatises about the eye as follows^{82}:

1. Treatise about the Advantage of the Eye Over the Other Senses رسالة في فضل العين على سائر الحواس.
3. Treatise about the morphology of the eye رسالة في هيئة العين.
4. Treatise about the Surgical Management of the Eye Diseases رسالة في علاج العين بالحديد.
5. A Book about the Eye Drugs and its Treatments كتاب في أدوية العين و علاجاتها.
6. Treatise about Why the Pupil Constricts in Light and Dilates in Darkness مقالة في العلة التي من أجلها تضيق الناظور في النور و تنسى في الظلمة.

Al-Rāzī’s most famous book, Continens, is comprised of 20 substantial volumes, dealing with all aspects of known diseases and their management. The second volume deals with the eye. It was praised by almost all the physicians following Al-Rāzī. The main contributions of Al-Rāzī to ophthalmology^{83}, as found in this volume may be summarised as follows:

1. He rejected Galen’s theory of vision that “a ray exits the eye to touch the object or objects in front of it and then return to the eye where the vision takes place.” Al-Rāzī denounced this theory and put forward his own explanation of vision that rays are emitted by the object or objects and enter the eye.
2. Another milestone in this book is the treatment of pubic lice and lice of the eyelashes by applying mercury ointment.
3. He explained that the cataract lies in the hole of the iris between it and the crystalline lens.

---

^{80} Al-Samarrāi, vol. 1, 437-464.
^{82} Uṣaybiʿā, 414-427.
^{83} Osmania Department of Education, Hyderabad Al-Dakan-India, (1960); N. Hamarne and I. Rajab, 65, 135-137.
4. He maintained that if there is a disease of the optic nerve, a visual disturbance derived from the brain will be accompanied by headaches and tinnitus. The pupil of this side will be dilated and the pupil of the other eye will be constricted.

5. He advised that the pupil has to be carefully evaluated before attempting to couch the cataract.

2/3: Yūḥanna Ibn Ṣarabyūn (D. 322 AH/935 CE)

Ibn Ṣarabyūn was a prominent physician, born in Damascus, Syria, where he also practiced medicine. Although he was not as famous as Al-Rāzī, his book Practica, which was written in Syriac and was later translated into Arabic by an anonymous author, was quoted repeatedly and extensively - even by Al- Rāzī. The eleven chapters of his book that deal with ophthalmology are excellent and comprehensive. Gerard De Cremona translated the book into Latin and then Andreas Alpago did the same.

2/4: Abū Al-Ḥasan Āḥmad Ibn Moḥammad Al-Ṭabarī (D. after 366 AH/ 976 CE)

Little is known about this genius physician, though his most important work has been preserved in the original Arabic language in many European libraries. He was born and raised in Tabaristan in Northern Mesopotamia, where he died after 366 AH/976 CE. Uṣaybī‘a mentioned his name briefly, stating that he was a respected scholar in medicine. He served as a private physician to Prince Rukn Al-Dwla Al-Bowayhi, where he explored and discussed diseases and their treatments. Al-Samarrai wrote a more extensive review about him and his book.

Hirschberg wrote the most thorough review of this book and stated, “Although the author was not very famous or well known, his book is an encyclopaedia in medicine of the second half of the 10th century” The author’s successors extensively quoted the fourth treaties of the book that dealt with eye diseases and their management, perhaps because the Arabic manuscripts were preserved, while no Latin translation was found.

---

84 J. Hirschberg, 116.
85 Uṣaybī‘a, 158; Andreas Alpago, Serapionis Practica Quam Al-Pago. (Leon, 1925), in Hirschberg, 116; Samarrai, vol.2, 544-545; N. Hamarne and I. Rajab, 66, 100, 147.
86 Al-Samarrai, vol. 1, 531-535.
87 J. Hirschberg, vol. 2, 27, 52, 116-123.
The fourth treaties of this book dealt with the eye diseases and their management, making up 54 chapters. The following are some of his original contributions:

1. Remaining in dark places for long periods of time, like prison, could lead to total blindness.
2. He was one of the first to state, "The cataract is a thick humidity that affects the crystalline lens and makes it opaque." He was, therefore, 800 years ahead of Hermann Borhaff (1668-1738 CE), who is accredited for being the first to state that the cataract is the disease of the lens. Although Al-Rāzī and others insinuated something similar vaguely, the exact anatomical location was not disclosed until Al-Ṭabarī mentioned it in his works.
3. He gave a description of ocular migraine signs and symptoms.
4. He uniquely stated, "There is a true congenital type of squint which is not curable because it represented an organic disease, which originates in the womb and is hereditary." He advocated wrapping the baby’s head with a black thick cloth with two openings in front of the eyes to realign and straighten them.
5. He is the first to relate eye diseases to contact with animals and described the entrance of gnat-like flies in the eye.
6. Al-Ṭabarī may have been the first to describe snow blindness as “extensive exposure of the eye to reflected sunlight.”
7. He pioneered the description of biconvex lenses, calling it the burning pebble.
8. He described the solar eclipse and related it to the passing of the moon between the sun and the earth. Subsequently, he warned from looking at the eclipsed sun to avoid permanent blindness.
9. He described in detail the ability of the patient to see his own ocular circulation after rubbing the eyes and pressing on them.
10. He attempted to describe the “black water” which is now known as a glaucoma and stated, "No treatment can be successful."

Hirschberg cited three manuscripts of this book and gave their locations at:

- Indian Office in London No. 773.
- Munich No. 810.

---

89 N. Hamarne and I. Rajab, 139, 206.
'Alī Ibn Al-'Abbās Al-Ahwāzī lived and practiced medicine in Baghdad, where he was a very prominent, comprehensive, and precise physician. He dedicated a book called “The Royal Book” (Latin translation Liber Regius) to his mentor Caliph Adud Al-Dawla (عهد الدولة) to whom he acted as private physician to. Shorter than Al-Hāwī (الحاوي في الطب) or Continens, and longer than Al-Manṣūri, “The Royal Book” was well known to practicing physicians for its completeness, orderly presentation, and precision. It served as a real handbook of medicine until it was replaced by Ibn Sinā’s Al-Qānūn. It remained a great reference until the late 13th century. Several Latin translations of this book were scattered in European libraries. Stephanus Antiochenus (إسطفان الإنتوكي) was the first to translate it into Latin around 1127 CE. A chapter in the book deals with ocular diseases and their management in anatomical sequences.

---

90 Hirschberg, 18, 27, 123-124.
91 Ibid., 124.
2/6: Abū Al-Qāsim Khalaf Ibn 'Abbās Al-Zahrāwī (D. 400 AH/1013 CE)

(الهراوي) أبو القاسم خلف بن عباس الزهراوي التصريف لمب عجر عن التأليف

“The Explanation for He Who Is Unable to Write Books”

Al-Zahrāwī spent his entire life in Cordoba as a famous physician and a great surgeon. 93 He invented and manufactured all of the surgical instruments that he used in practice.

Al-Zahrāwī wrote a huge encyclopaedia of medicine, consisting of 30 treatises, the last of which is the most famous treatise about surgery. This treatise was divided into three parts: the first dealt with cauterisation, the second with dissection, and bloody procedure in general, and the third with the setting of bones. In the second part, he listed 16 chapters, describing 25 eye operations in great detail and precision.

His book was well known and widespread around Europe. Guy De Chauliac (d. 1363) quoted him extensively, Gerard de Cremona translated it into Latin, and J. Jenning published a combined Arabic and Latin translation in Oxford in 1778. L. Leclerc translated the book into French in Paris in 1861, 94 and Spinks and Lewis were the last to translate the 30th treatise into English. 95

93 Hirschberg, 28, 125-127.
94 Ibid.
Ibn-Sīnā was born in Bukhara where his father was the governor. He studied philosophy, theology, and medicine. He is known to have memorised the entire Holy Qur’an at the age of ten. He was a walking encyclopaedia, considered to be a polymath. He wrote over 100 books as well as monographs, treatises and several poems, in many fields of knowledge.

Ibn-Sīnā made some great strides in the history of medicine, these included:

1. Accurately described clinical manifestations of meningitis.
2. Differentiated between pleurisy and the effusion pleurisy.
3. Advised applying ice on the forehead of a patient to reduce fever.
4. Advocated tasting the urine of a patient to ensure or deny diabetes mellitus.

Although he was not an ophthalmologist, he wrote extensive and complete treaties on ophthalmology. “Dogma” was a textbook about the entirety of medicine, including surgery. His book differs from the ancient Grecian books, which were collections, excerpts, and summaries, whereas “Dogma” was a complete unit that remained the principle textbook of medicine for over 500 years. “Dogma” was printed in Arabic in Rome in 1593 and later, in Bulaq, Egypt in 1877. Gerard of Cremona translated “Dogma” into Latin and Andreas Alpago of Belluno published another Latin translation in 1547.

Ibn-Sīnā’s chapter on eye diseases was a reference to just about every ophthalmologist to follow him. J. Hirschberg and J. Lippert translated all of “Dogma” into German in 1902, making Al-Qānūn accessible to a large medical community.

---

97 The Princip, The Head, Ibn-Sīnā, Al-Qānūn Fi Al-Ṭib, (Beirut, Lebanon).
98 Hirschberg, 124-125.
Ibn Al-Haytham was born in Basrah, Iraq. The Caliph Al-Hakim (996 – 1021 CE) invited Ibn Al-Haytham to Egypt, asking him to regulate the water of the flooding after the annual flood of the Nile River so as to increase the fertility of the land. After seeing the land on either side of the river, he decided not to go ahead with the project; saying that the previous cultures were intelligent and able to do this but they chose not to. He was subsequently included in the Caliphs court as a consultant. He eventually felt uncomfortable with the erratic and aggressive nature of the caliph. In order to be ousted he started acting irrationally and feigned madness. He was then placed under house arrest with domestic staff at his disposal. This isolation provided him with the time and opportunity to concentrate on his interest in the theory of light, as well as other scientific endeavours. When the caliph died he was told he can leave the house. He earned his living by copying several books and selling them for almost 150 dinars a year. Among the books he copied was “The Elements by Euclid (الاستفسات لاقليدس) and Almagest by Ptolemy (الرياضيات و المجسطي لبطليموس). Ibn Al-Haytham passed away in Cairo around 1038 or 1039 CE.

Before his death, Ibn Al-Haytham wrote an outstanding and original book on optics which included the theory of vision entitled Al-Manazir. The original manuscript was temporarily lost and only Latin translations of several parts remained scattered. Risener published these Latin translations in 1572 with the title Opticae Thesaurus Al-Hazeni, Libri VII, 101 which contained three chapters of Al-Manazir. The first chapter dealt with the concept of vision and anatomy

101 J. Hirschberg, 167-173.
of the eye, with its three coats and three fluids according to the anatomy books of that time. However, it differs from other books as it draws upon a new illustration of a cross section of the eye. The second chapter dealt with the theory of reflection, and the third with the theory of the refraction of light. Ibn Al-Haytham was one of the original geniuses of his time, as his contributions included the following:

1. He vehemently argued against the theory that vision is due to the rays emitted from the eye, rejecting Galen’s theory. Al-Rāzī argued Galen’s theory 100 years before Ibn Al-Haytham’s time in his monograph About the Nature of Vision.

2. He gave a pioneering discussion on how the eye distinguishes objects, including the factors required of the object and the media between the eye and the object for vision to be possible. Factors included brightness, colour, distance, location, substance, and shape.

3. He was probably the first to mention optical illusions.

4. Ibn Al-Haytham expanded upon Ptolemy’s discussion of single and double vision.

5. He explained the theory of reflection and the several different types of reflection of light.

6. He listed five different types of mirrors (plain, circle, conical, convex and concave).

7. In his book, he answered one of the most famous questions of his time, which became known as Al-Hazen’s Problem: If the location of the object and the mirror is known, how can the location of the reflected point from a spherical mirror be calculated?

8. He experimented with the location and distortion of reflected images.

9. He was the first to calculate the location of the focal point and longitudinal distortion of a concave mirror.

10. He used a dark room (Al-baitul Muzlim) for his experiments. The word camera obscura is a Latin translation of this. It was later named the pinhole camera.

11. As he used systematic experimentation to verify theories, he was considered as the father of experimental science. Some even named him the father of modern optics.

Regrettably, many Arabian oculists and authors ignored Ibn Al-Haytham’s book Al-Manazir and his brilliant work on optics besides Kamaluddin al-Farisi who used his work extensively, albeit almost a couple of centuries later. On the other hand, Nūr Al-‘Uyūn by Ṣalāh Al-Dīn and Al-Kāfī by Khalīfah did mention Ibn Al-Haytham briefly. Ibn Al-Haytham’s reclusive style of life was probably the reason he was overlooked. Joseph Ibn-Yahuda Ibn Aknin, who died in Aleppo in 1226 AD, ranked Al-Manazir above books of Euclid and Ptolemy.

Thuringopolonous Vitello translated Al-Manazir into Latin in the 13th century and called it Opticae Al-Hazeni, which remained as famous as Euclid’s book. The world had to wait 600 years until Johannes Kepler published optical investigation and experiments, similar to those of Ibn Al-Haytham, in 1604. 102

---

The Medical Code of Ethics of Arabian Ophthalmologists

The medical code of ethics of Arabian ophthalmologists, in general, is based upon the Grecian principles founded by Hippocrates, which Ḥunayn translated into Arabic. In a well-known story, the Caliph Al-Mutawakkil asked Ḥunayn to prescribe a lethal poison for one of his enemies. Hunayn refused the order, despite the consequences, declaring adherence to the medical code of ethics. Ḥunayn’s ethical behaviour made him a trusted and private physician to the same Caliph. \(^{103}\)

All Muslim physicians took a modified version of the Hippocratic oath, stating, “I shall never give a lethal poison.” An additional sentence was added for ophthalmologists, “…or an ointment, which could diminish or abolish vision.” \(^{104}\)

In his book *Al-Murshid*, \(^{105}\) Al-Ghāfiqi stated that all physicians should act in accordance with the following:

- Respect one’s teachers as one respect’s his own father, and treat teacher’s children as one’s own.
- Care for his patient with the best available treatment, diet, and medication.
- Not to care about financial gain and accumulate wealth, but to ask for divine compensation and expect reward from Almighty Allah.
- To fear God, be clean, honest, religious, and never make derogatory remarks. One should behave in an exemplary manner and avoid immoral activity, like looking at a patient’s female relatives with bad intentions.
- Not to disclose a patient’s secrets, even to one’s family.
- To be charitable and benevolent, especially toward poor patients, by not charging them for services, and giving them medications and food from one’s own money.
- To visit patients in the morning and evening if needed.

Ṣalāḥ Al-Dīn Al-Kaḥḥal wrote the following in his book *Nūr Al-ʿUyūn* \(^{106}\) as advice to his son:

- The physician should become an intermediary between God and the patient by restoring health.
- Wear the garment of purity and chastity, and above all, fear God.
- Work hard to excel in your field of practice.
- Do not follow useless and vain desires of the body.
- Associate oneself with other scholars.

\(^{103}\) Max Meyerhoff, Introduction to the English Translation of “Ten Treatises on the Eye” xxi Noor Al-ʿUyūn, Ṣalāḥ Al-Dīn Al-Kaḥḥal, 6-7

\(^{104}\) Nūr Al-ʿUyūn, Ṣalāḥ Al-Dīn Al-Kaḥḥal, 6-7

\(^{105}\) Al-Ghāfiqi’s book (Al-Murshid in Ophthalmology) 41-42

\(^{106}\) Nūr Al-ʿUyūn, Ṣalāḥ Al-Dīn Al-Kaḥḥal, 6-7
• Dedicate oneself to the well-being of patients by always thinking of their treatment and ways and means to preserve and re-establish their health.
• If the patient is poor, give him and his family from one’s own money and do so with joy, rather than humiliating the patient and the patient’s family.
• Beware of lethal or harmful medication.

Al-Shazili wrote the following statement in his book *The Ophthalmic Support for Diseases of the Visual Organ*:

*Wasiyah (advice):*

*Every physician; ophthalmologist or otherwise, every sane and noble practitioner should know and be obedient to the divine laws and the laws of the Prophet (PBUH): to be honourable, chaste, truthful, pure-hearted, charitable toward all creatures, and generous. His eyes should avoid what is not permitted to him, such as maids and/or female relatives of the patient. He should never drink alcohol and should keep all secrets of his patients.*

Just about every Arabian physician emphasised the importance of the dress code of the practitioner by being clean, smelling good, and washing one’s hands before and after examining the patient. The physician should present himself to everyone with kindness, change his clothes as frequently as necessary, and be a role model to his patients to alleviate their apprehension. A physician should never predict the final outcome of his treatment, for they believe that all is in the hands of Allah, who will decide on who lives and who will die.
Bibliography


ʿAlī Ibn Al-ʿAbbās Al-Ahwāzī (d. 384 AH/994 CE).

ʿAlī Ibn ʿIsā Al-Kaḥḥal Al-Baghdādī (d. 400 AH/1010 CE).


Al-Rāzī, Moḥammad Ibn Zakaryā (d. 313 AH/925 CE).

Al-Sammarrāī, M.D. Kamal.

Al-Ṭabarī Ahmad Ibn Moḥammed (d. 366 AH/976 CE).

Al-Ṭabarī, ʿAlī Ibn Sahl Rabān (d. 247 AH/861 CE).

ʿAmmār Ibn ʿAlī Al-Mawṣili (d. 400 AH/1010 CE).
Emile Savage-Smith “The practice of surgery in Islamic Land: Myth and Reality”

Hamarne, N. MD and Rajab, I.

Ḩunayn Ibn Ishāq Al-ʿAbādī (d. 264 AH/875 AD).

Ibn Abī Uṣaybiʿa.

Ibn Sinā, 'Abū ʿAlī Al-Ḥusayn Ibn 'Alī (d. 428 AH/1037 CE).
Al-Qānūn Fī Al-Ṭib. Published by Dar Sader, Beirut, 1966.

Ibn Sinā, 'Abū ʿAlī Al-Ḥusayn Ibn 'Alī (d. 428 AH/1037 CE).

Ibn Sinā, 'Abū ʿAlī Al-Ḥusayn Ibn 'Alī.
The Eye Diseases and their Management from Al-Qānūn Fī Al-Ṭib


Julius Hirschberg.
Translated into English by Frederick C. Blodi, published by J. P. Wayenborgh Verlag, Germany 1985.

Julius Hirschberg, J. Lippert and E. Mittwoch.
Khalīfa Ibn Abī Al-Maḥāsin Al-Halabī (d. 656 AH/1256 CE).

Ṣalāh Al-Dīn Al-Kaḥhāl Al-Ḥamwī (d. 646 AH/1296 CE),

Thābit Ibn Qurrah Al-Ḥarrānī (d. 288 AH/901 CE).