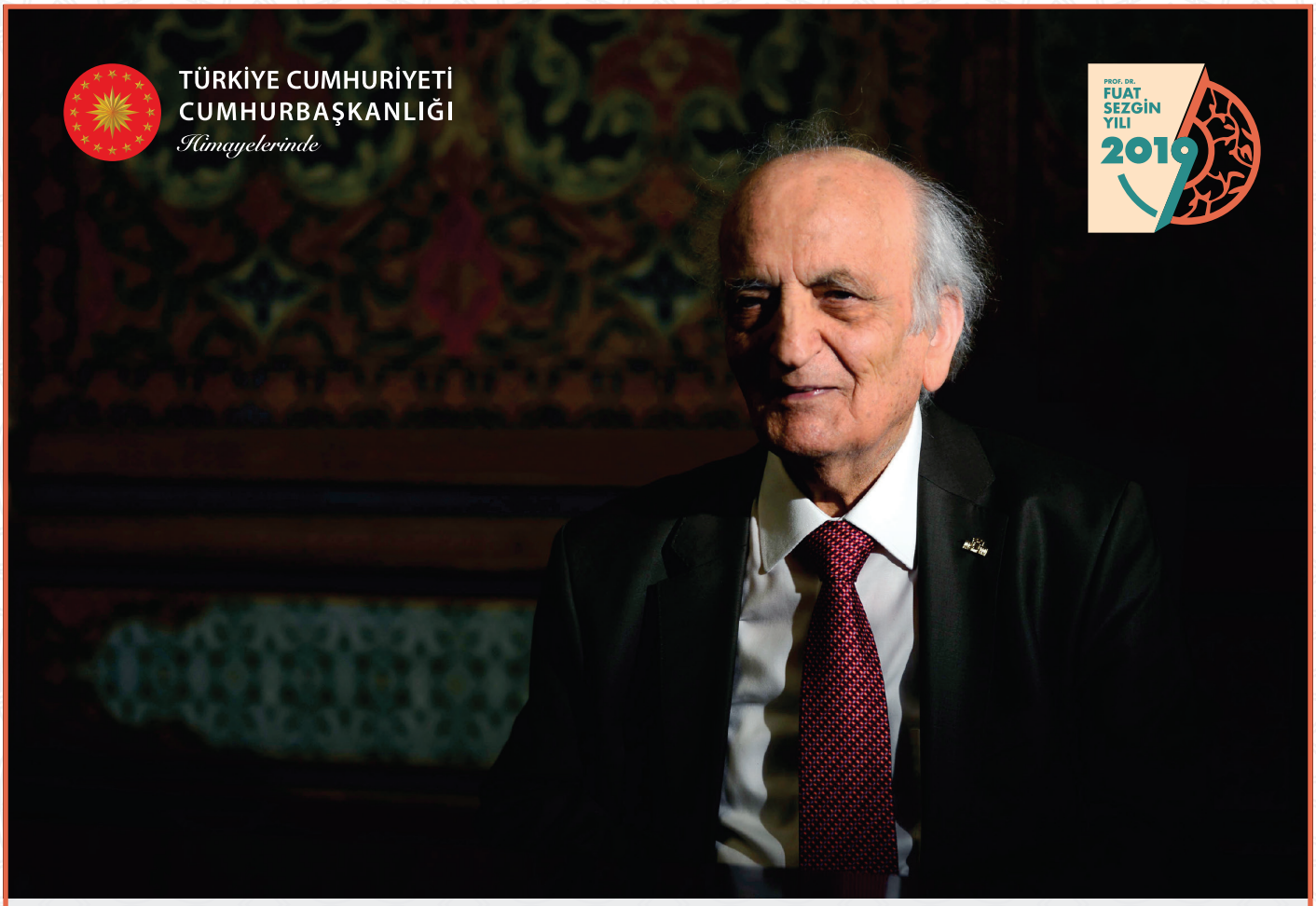
TÜRKİYE CUMHURİYETİ
CUMHURBAŞKANLIĞI
Himayelerinde

PROF. DR. FUAT SEZGİN YILI 2019



1. ULUSLARARASI PROF. DR. FUAT SEZGİN İSLÂM BİLİM TARİHİ SEMPOZYUMU BİLDİRİLER KİTABI

THE 1st INTERNATIONAL PROF. DR. FUAT SEZGIN SYMPOSIUM ON HISTORY OF SCIENCE IN ISLAM PROCEEDINGS BOOK

Editörler / *Editors*

Prof. Dr. Fahameddin Başar, Prof. Dr. Mustafa Kaçar, Prof. Dr. M. Cüneyt Kaya, Doç. Dr. A. Zişan Furat

1. Uluslararası Prof. Dr. Fuat Sezgin
İslâm Bilim Tarihi Sempozyumu
13-15 Haziran 2019
İstanbul, Türkiye

1st International Prof. Dr. Fuat Sezgin
Symposium on History of Science in Islam
June 13-15, 2019
Istanbul, Turkey

İSTANBUL UNIVERSITY PRESS

Yayıncı / *Published by*
İstanbul Üniversitesi Yayınevi / *Istanbul University Press*
İstanbul Üniversitesi Merkez Kampüsü, 34452 Beyazıt, Fatih / İstanbul - Türkiye

www.iupress.istanbul.edu.tr

1. Uluslararası Prof. Dr. Fuat Sezgin İslâm Bilim Tarihi Sempozyumu Bildiriler Kitabı
The 1st International Prof. Dr. Fuat Sezgin Symposium on History of Science in Islam Proceedings Book
Editörler / Editors: Fahameddin Başar, Mustafa Kaçar, M. Cüneyt Kaya, A. Zişan Furat

ISBN: 978-605-07-0752-6 (Sert Kapak / Hardcover)
ISBN: 978-605-07-0751-9 (Karton Kapak / Paperback)
E-ISBN: 978-605-07-0750-2

DOI: 10.26650/PB/AA08.2020.001

İstanbul Üniversitesi Yayın No / *Istanbul University Publication No*: 5275

Online Yayın Tarihi Aralık, 2020 / *Published Online in December, 2020*

Baskı / *Printed by*
Kültür Sanat Basımevi ve Reklamcılık Organizasyon Sanayi Ticaret Limited Şirketi
Litros Yolu 2. Matbaacılar Sitesi ZB7-ZB11, Topkapı, Zeytinburnu, İstanbul - Türkiye
www.kulturbasim.com
Sertifika No / Certificate No: 44153

İlk Baskı, 2020 / First Printing, 2020

PROCEEDINGS PAPER / SEMPOZYUM BİLDİRİSİ

1. Uluslararası Prof. Dr. Fuat Sezgin İslâm Bilim Tarihi Sempozyumu Bildiriler Kitabı

The 1st International Prof. Dr. Fuat Sezgin Symposium on History of Science in Islam Proceedings Book

İSTANBUL UNIVERSITY PRESS

DOI: 10.26650/PB/AA08.2020.001.021

Egyptian, Alexandrian and Arabic Medicine: Trans–Cultural Pathways of Disseminating Healing Knowledge*

Mısır, İskenderiye ve Arap Tıbbı: Tedavi Bilgisinin Yayılmasında Kültürleraşırı Yollar

Alicia MARAVELIA**

ABSTRACT

Ancient Egyptian Medicine is renowned for developing this Science during Antiquity in the Eastern Mediterranean Basin, being also famous at Asiatic sites, where (as the sources prove) ancient Egyptian medical doctors were invited even by royalty to cure their families and people. At that time (during the New Kingdom, *c.* 1550-1070 BC) the *lingua franca* of the Eastern Mediterranean was Assyrian (a Hamito–Semitic language in which the renowned Pact of Peace, after the Qadesh Battle (*c.* 1274 BC), was signed between Ramses II and the Hittite King Hattusili III, nowadays exhibited in the Archaeological Museum of Istanbul), a fact that facilitated the dissemination of Egyptian medical practice and knowledge to be spread around Western Asia, thus significantly contributing to the later development of Hebrew, Persian, Arabic and Turkish Medicine. We must, however, demythologize the ancient Egyptian Medicine that was pioneering in Surgery, Anatomy (through the advanced mummification techniques), some Healing Practices and Ophthalmology, but it never understood the importance of the brain, thinking of the heart (because of purely metaphysical reasons) as the centre and abode of the soul and in general as the centre of the human organism functions. If Egyptian Medicine was so advanced, as many esoterists and apocryphists claim, then it would have cured important illnesses that are observed even in the mummies of Pharaohs, the persons who had immediate access to the best Egyptian medical doctors of Antiquity. In this paper we shall briefly examine the Medicine of the ancient Nile–Dwellers, emphasizing in its healing and metaphysical concepts, Surgery, Ophthalmology and Pharmacopoeia, showing that it consisted of a source of healing knowledge towards the East. We shall also examine extensively Alexandrian and Byzantine Medicine, the Alexandrian Medical Doctors, Surgeons, Schools, its methods and medical instruments, upon which the Arabic/Islamic Medicine was definitely based, progressing and highly developing Medicine during the Middle Ages, a period when the ancient Hellenic knowledge was safeguarded, translated and evolved by Arabic/Islamic Scholars, while in the West people were being burned on the stake by the Roman Catholic Church because of their innovative scientific theories.

Keywords: Ancient Medicine, Egyptian Medicine, Alexandrian Medicine, Hellenic (Hippocratic) Medicine, Medical Doctors, Surgery, Schools of Medicine, Medical Instruments, Asklēpieia, Ailments, Prescriptions, Pharmacopoeia, Drugs

ÖZ

Antik Mısır Tıbbı, (kaynaklar gösterdiği üzere) antik Mısırlı tabiplerin asilzadelerin ailelerini ve ev halkını iyileştirmek amacıyla davet edildikleri Asya bölgesinde meşhur olduğu gibi, Doğu Akdeniz Havzasının antik döneminde bu bilim dalını geliştirmesiyle ünlenmiştir. Yeni Krallık döneminde

Submitted/Başvuru: 14.05.2019 **Accepted/Kabul:** 31.08.2019

* This paper is partly based on Maravelia, 2020 (in press; in Hellenic) and Geroulanos & Maravelia, 2012-2014, pp. 233–248. A contribution on Alexandrian Medicine was presented by the author (during her invited lecture by the Archaeological Society of Alexandria, at the premises of Bibliotheca Alexandrina in April 2013, for the 120 Years Jubilee Conference of this Society: Alexandria: Current Archaeological Research and Future Perspectives. The current paper is the written and complete form of her contribution to honour the unforgettable Prof. Dr Fuat Sezgin, which was presented in Istanbul during the Memorial Conference in June 2019, where the author was one of the invited speakers. The author is indebted to the Organizers for their kind invitation. She also thanks Em. Prof. Dr Stephanos Geroulanos and Dr Detlev Quintern for reading the current paper, and Dr Pauline Norris (UK) for making her text more idiomatic in English.

** **Corresponding author/Sorumlu yazar:** Alicia Maravelia (Prof. Dr.), Hellenic Institute of Egyptology & People's University of Athens, Athens, Greece, E-mail: hieg-aker.org@otenet.gr, ORCID: 0000-0003-3824-3270

Citation/Atıf: Maravelia, A. (2020). Egyptian, Alexandrian and Arabic medicine: Trans–Cultural pathways of disseminating healing knowledge. In F. Başar, M. Kaçar, C. Kaya & A. Z. Furat (Eds.), *The 1st International Prof. Dr. Fuat Sezgin Symposium on History of Science in Islam Proceedings Book* (pp. 273-311). https://doi.org/10.26650/PB/AA08.2020.001.021

(MÖ. Yaklaşık 1550-1070) Doğu Akdeniz'in ortak dili Ünlü Kadeş Savaşı sonrasında (MÖ. Yaklaşık 1274) II. Ramses ve Hitit Kralı III. Hattusili arasında imzalanmış olan ve günümüzde İstanbul Arkeoloji Müzesinde sergilenen Barış Antlaşmasının dili olan Asurca idi. Bu durum Mısır tıbbi geleneği ve bilgisinin Batı Asya bölgesine yaygınlaşmasını kolaylaştırmış ve böylelikle sonraki dönemlerde Yahudi, Farsi, Arap ve Türk tıbbının gelişimine büyük ölçüde katkı sağlamıştır. Ancak bugün cerrahi, ileri seviyede mumyalama teknikleri dolayısıyla anatomi, tedavi pratikleri ve oftamoloji alanındaki ilerlemelere öncülük eden, ancak beynin önemini, tamamıyla metafizik nedenlerden ötürü kalbi ruhun merkezi ve meskeni olarak, genelde ise insan organizmasının işleyişinin merkezi olarak düşünmeyen antik dönem Mısır tıbbını mitolojik unsurlarından ayıklamamız gerekmektedir. Birtakım ezoteristler ve apokriptistlerin savunduğu gibi Mısır tıbbı bu ölçüde ilerlemiş idiyse, antik dönemde en iyi Mısırlı tabiplere ulaşabilecek durumda olan Firavunların mumyalarında dahi görülebilen önemli hastalıkları iyileştirmiş olması beklenirdi. Bu metinde, antik dönem Nil sakinlerinin tıp anlayışını, tedavi ve metafizik kavramlarını, cerrahi, oftamoloji ve ilaç kodekslerini vurgulayarak ve Doğuya doğru yönlenen tedavi bilgisinin kökenini içerdiğini göstererek kısaca inceleyeceğiz. Ayrıca, İskenderiye ve Bizans tıbbını, İskender tıp doktorlarını, cerrahlarını, ekollerini, Arap/İslam tıbbının üzerine kurulu olduğu ve orta çağlar boyunca –ki bu dönemde Batı'da yenilikçi bilimsel teorileri nedeniyle insanlar Roma Katolik Kilisesi tarafından kazıklarda yakılırken Arap/İslam ilim adamları tarafından antik Hellenik bilgi korunmuş ve tercüme edilerek geliştirilmiştir– büyük oranda geliştirdiği metotları ve tıbbi araçları detaylı bir şekilde ele alacağız.
Anahtar Kelimeler: Antik Tıp, Mısır Tıbbı, İskenderiye Tıbbı, Helen (Hipokratik) Tıbbı, Tıp doktorları, Ameliyat, Tıp ekolleri, Tıbbi araçlar, Asclepius, Rahatsızlıklar, Reçeteler, İlaç Kodeksi, İlaçlar

1. Ancient Egyptian Medicine: Its Function and Sources.

In ancient Egypt, where religious piety was particularly prevalent **[Fig. 1(L), 1(C), 1(R), 2(R), 8(L)]**, and where magic (anc. Eg.: *ḥk3*) was perceived as a theophoric and authoritative power offered to humans by the gods to help them in sudden difficult occasions, Medicine (see Μαραβέλια, 2003, pp. 163–178; cf. Grapow, 1954-1962; Lefebvre, 1956; Kamal, ^{2}1964; Ghalioungui, 1965; Ebeid 1990, pp. 7-14; Ebeid, 1999; Gordon & Schwabe, 2004; for an introduction to ancient Egyptian History, see Gardiner, ^{2}1964) as well as other Sciences (e.g.: Botany, Astronomy, Mathematics, & c.) were characterized by a magico–religious texture too. Orthologistic Medicine of the 21st Century uses therapeutic methods deriving from the scientific and reason–motivated cosmovision of nowadays, which are considered objectively correct and true. However, several concomitant practices of ancient cultures, namely of the Egyptians, that might appear paradoxical and even absurd today, were based on a sophisticated network of theories related to the functions of the human organism and/or the classification of (medicinal) substances in different groups (e.g.: in the ancient Hellenic medical cosmovision: the *phlegma*, the *haima*, the *melaina cholē* and the *kitrinē cholē*, & c.). Thus, the emphasis on the importance of the Law of Similarity of magic, as regards the name or appearance, sometimes led to «therapies» that were useless or even dangerous. Of course, for the Egyptians of Antiquity it was rather difficult to determine the cause of failure. Let us not forget that even today there exist certain cases where the harmful action of some «therapies» of our modern conventional Medicine and of the concomitant pharmaceutical treatment becomes evident after some years and in many cases harms innocent victims. Of course, we do not propose to return to primitive medico–pharmaceutical methods and we do accept modern Medicine as scientifically correct, and in any case preferable to the ancient practices. We are just discussing and delimiting the history and achievements and/or faults of ancient Egyptian Medicine, without forgetting that the aforementioned Proto–Medicine has never reached the sphere of pure Science. We must, also demythologize the ancient Egyptian Medicine that was pioneering in Surgery, Anatomy (through the advanced mummification techniques), some Healing Practices and Ophthalmology, but it never understood the importance of the brain, considering the heart (because of purely metaphysical reasons) as the centre and abode of the soul and in general as the centre of the human organism functions (see e.g. Allen, 2005, pp. 41-42, No 39).

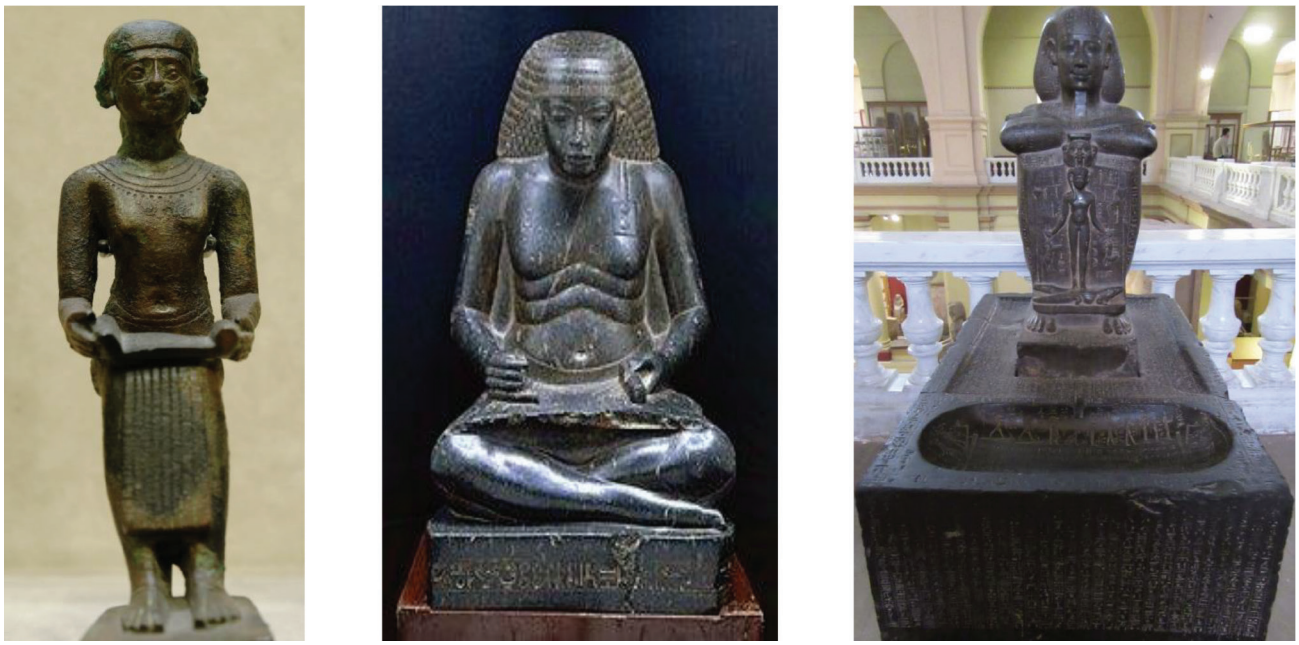


Figure 1: [L] Typical bronze figurine of the Late Period (after 700 BC), to honour the wise and *post mortem* deified Prime Minister and Medical Doctor Imhotep (anc. Eg.: *Ỉi-m-ḥtp*; anc. Hel.: *Ἰμοῦθις*). The Healing «Saint» of ancient Egyptians, who was identified by the Hellenes with Asklēpios, is depicted seating as an Archscribe.
[C] Statuette made of grey granite of the deified Amenophis Son of Hapū (*Ỉmn-ḥtp, Z3 Ḥpw*) as a young adult. The wise Prime Minister and famous Healer/«Ἀκέστωρ Ἅγιος» of the ancient Nile–Dwellers is depicted squatting in the typical position of scribes (*c.* 1370 BC). Museum of Egyptian Antiquities, Cairo (JE 44861).
[R] Elaborate statue of Djed–Hor (*Ḏd-Ḥr*) the Saviour, with integrated Cippus of Horus, as an example of typical magico–medical object of therapy for ancient patients, through the blessing of the flowing water over the hieroglyphic inscriptions that were supposedly imbued with magic (*c.* 320 BC). Cf. also the «healing statue» of Louvre (E 10777). Photo by the Author. Museum of Egyptian Antiquities, Cairo (JE 46341).

It is known that Sciences in ancient Egypt have never been based on the path of reason and orthologism and actually were never scientifically complete, being rather inchoate, as Pre– or Proto–Sciences. On the contrary, they were always empirical and elementary, without freeing themselves from the bonds of superstition, magic and religiosity (only with a few exceptions: **1.** In the case of the medical Papyri Edwin Smith and Ebers; **2.** In the case of the application of purely scientific and calculative Astronomy during the Ptolemaic Period, when the Hellenic Science was transported to Egypt). We must point out, however, that in the context of ancient Egyptian societal norms and structures, the function of Medicine as a Practical Art of Healing, even in relation to the «aid» of magical practices was considered as absolutely reasonable and justifiable. Naturally, it is impossible to admit that there was a general paranoia concerning the «magical component» of Medicine and the concomitant metaphysical beliefs of the Egyptians; if this were the case, then Egypt and its culture would have been driven to a standstill and decay, which has never happened (the ancient Egyptian civilization, one of the greatest worldwide, endured for more than 3500 years). Additionally, the (quasi–) religious symbolism and the divine archetypes, indigenous in the Egyptian *forma mentis*, can explain the connection of certain illnesses with demons, extra–world entities, wicked deceased, and the like. Even nowadays, although we know that many sicknesses are due to viruses, bacteria, cocci, bacilli, funguses, & c., we do depict them in many advertisements (especially in those related to Paediatrics and Dentistry) as wild insects or tiny demons … Finally, the latent xenophobia of modern societies — something that was particularly dominant in ancient Egypt, where Nubians and Asiatics were not so welcome (see e.g. König, 1987; Gödicke 1984, pp. 91–105)—, forces the adoption of modern nomenclature as «African Fever», «Asiatic» or «Russian Flu», even though we are not absolutely sure of the actual origin of these viral infections.

Thus, ancient Egyptian Medicine was consisting of a conflation of magico–religious beliefs and methods together with medical practice and pharmaceutical treatments; and any attempt to separate them would confuse and distort the overall picture of the true status and essence of this Proto–Science. However, because of various factors that will be mentioned later, the development of Medicine in Egypt was favoured **[Fig. 6(C), 7(R)]** more than other Proto–Sciences and more than that of Medicine in the neighbouring ancient states. Hence, while the anatomical knowledge of Babylonian Medical Doctors was lesser due to various socio–political reasons, Egyptian Doctors were not only more experienced in Surgery than their Mesopotamian colleagues, but were also the carriers of more abundant and more advanced knowledge (see Roaf, 1990; Nunn, 1996, chap. 8; Blomstedt, 2014, pp. 670–676; on ancient Egyptian Medical Doctors, cf. Jonckheere, 1958). Let us not forget that the necessity of the best possible preservation of the corpses after death — an outcome of religious and funerary beliefs of the Egyptians — lead to the development of sophisticated methods of embalming and mummification **[Fig. 3(L), 4(L), 5(UL), 5(LL), 8(R)]**, the echo of which is described in the 2nd Book of Hērodotos' *Historiæ* (see Hērodotos, *II*: 85-89; e.g.: in Godley, 1981; on ancient Egyptian Medicine and mummification, see Fournier, 1933; Ghalioungui, 1963; Ghalioungui, 1965; Ghalioungui, 1993; Grapow, 1954-1962; Kamal, 1967; Cocburn & Cocburn, 1980; Leca, 1983; Μαραβέλια, 2003, pp. 163–178, 179-212; Nunn, 1996; also cf. Germer, 1991; Adams, 1998; SGI, 2004; Chhem & Brothwell, 2007) and the results of which (definitely assisted by the particularly dry climate of Egypt) are evident in the archaeologically uncovered mummies. Careful examination of even the best preserved of these ancient bodies (i.e.: those of some pharaohs, high–priests and nobles), the persons who had direct access to the most experienced and effective Doctors of that era, unequivocally proves that these individuals were suffering from various diseases [e.g.: excessive scoliosis of the vertebral column, hernia, dental abscesses, ulcerated gingiva, smallpox (which caused the death of Ramses V **[Fig. 5(LL)]**), rheumatoid arthritis (like the case of Ramses II the Great), *spina bifida* (like the two stillborn mummified embryos **[Fig. 2(L)]** found in the Tomb of Tutᶜankhamūn **[Fig. 3(L), 3(R)]**, who was suffering from flat feet **[Fig. 7(L)**]. It also proves that death was making no exceptions for kings or nobles, but its presence and effects were steadily visible in every social class **[Fig. 4(L), 6(L), 6(C), 7(R)]**. The modern interdisciplinary synergy between Egyptology, Archaeology, Medicine, Archaeo–Medicine, Palynology, Radiology, Medical Physics, Chemistry, Biology, Forensics, Archaeo–Anthropology and the cutting–edge computational techniques of Informatics offers a multitude of information on the illnesses of the pharaonic era, permitting us to re–synthesize even the faces of the pharaohs themselves when they were alive **[Fig. 3(L), 3(R)]** [for the two stillborn embrya at the Tomb of Tutᶜankhamūn (Reeves, 1990), see Leek, 1972, esp. pp. 21–23 & Tab. XXIII–XXIV; for similar matters, see Cockburn & Cockburn, 1980; Harris & Wente, 1980 (radiography of the bodies of pharaonic mummies); Partridge, 1994; Taylor, 1996; for the reconstitution of faces of ancient Egyptian individuals, see Germer, 2000, p. 465, fig. 69-70; Wilkinson, 2004; on ancient DNA studies, see Hermann & Hummel, 1994; Jones, 2001; Lambert & Grupe, 1993; cf. too Taylor & Antoine, 2014; on the Mummy Project of the Hellenic Institute of Egyptology (in collaboration with the National Archaeological Museum of Athens and the Athens Medical Centre), see Maravelia *et al*., 2019, pp. 127–162.]. Additionally, it proves that — *contra* the extreme and unreasonable beliefs of many apocryphists (who think that the «initiation» in the «mysteries» of Isis and Thoth could provide them endless powers)— ancient Egyptians were not in possession of such unearthly «secrets» and inexplicable «forces»; because if they were, they would be at least healthy (if not immortal) **[Fig. 2(L), 3(L), 4(L), 5(UL), 5(LL)]**!

The most important potential advantage of ancient Egyptian Medical Doctors compared to others was that the former (because of the craftsmanship of embalming) had the possibility of studying the anatomy of the human body and of its internal organs, no matter if they had not exploited it fully and adequately. However, most ancient Egyptian Doctors never delved into human anatomy because of mummification, since they were working separately from the embalmers, with whom they were not associated in principle. Egyptian Doctors were indeed aware of the function of some (but not of all) human internal organs. Even if they knew that cerebral injury could induce Paralysis, they never understood that the seat of thought was located in the brain; not in the heart, as they believed, due to (mainly) religious and funerary reasons. Furthermore, they were not aware of the function of kidneys and thought that all bodily fluids (blood, bile, urine, excrement, semen, lymph, & c.) were continuously circulating round the whole human body. However, the fact

that more than 100 medical/anatomical terms were preserved in the ancient Egyptian medical texts proves the capability of the ancient Egyptian Doctors to recognize and distinguish between several internal bodily organs, a capacity that was never attained by their foreign colleagues (at least not before 1000 BC). It is remarkable that the ancient Egyptian medical terminology was — generally speaking — correct, at least concerning the basic description and understanding of the macroscopic anatomy of the human body (see e.g. Dawson, 1933, pp. 133–137; Dawson, 1934a, pp. 41–46; Dawson, 1934b, pp. 185–188; Cave, 1950, pp. 568–571).

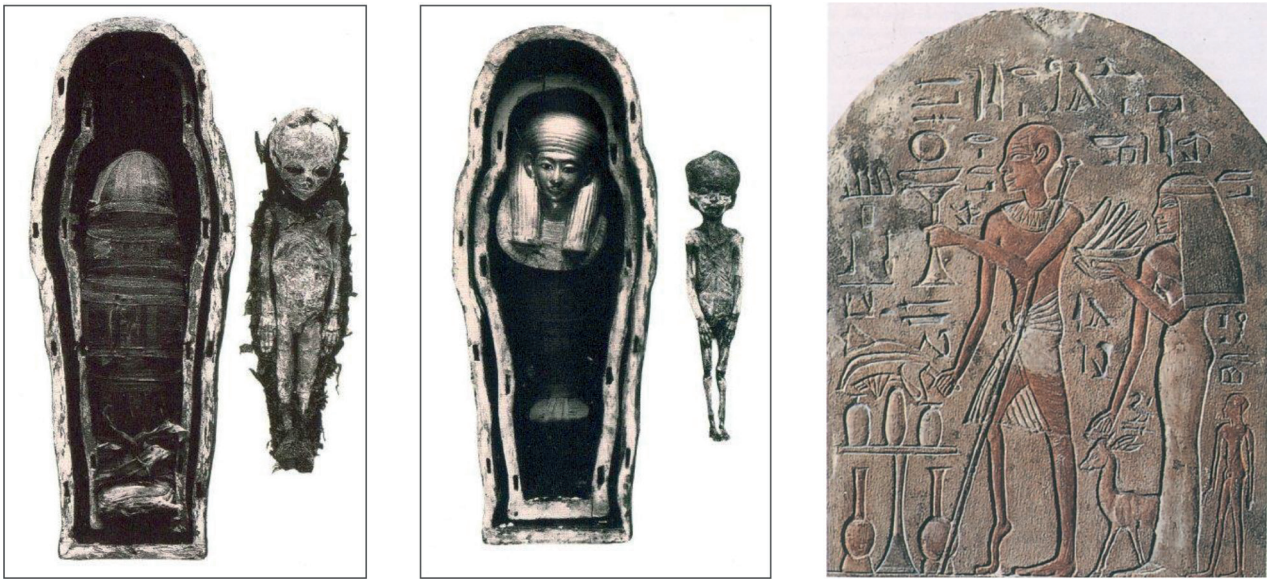


Figure 2: [L] Mummies of the two stillborn embryos from the Tomb of Tutᶜankhamūn, together with their sarcophagi. **[R]** Funerary stele of the priest and door–keeper Ramᶜa (*Rꜣmᶜ*), who is depicted with his atrophic right leg, which is shorter than his left one. This could be the result of his infection from poliomyelitis (Dynasty XVIII, *c.* 1370 BC). Ny Carlsberg Glyptotek, Copenhagen, Danemark (ÆIN 134).

The ancient Egyptian Proto–Science (or rather Art/Craft) of Medicine developed and evolved in this context, to its maximum potential. The relation of this medical «craft» with magic was close, since the «philosophical» background of Medicine was religious, and the cause of many illnesses was considered as «metaphysical». Ancient Egyptians were after the *direct* as well as the *indirect* or *fundamental* cause of a disease: for instance, a wound could have been due to a snake–bite (*direct* cause), however the snake attack could have been the result of the malicious aggression of an evil spirit, disguised as a serpent, or of a demon (*fundamental* cause). Thus, while the *direct* cause of a sickness was explaining *how* this happened, the *indirect* cause was trying to perceive *why* it occurred. This is how modern Anthropologists visualize and study the development and application of Medicine in various primitive and ancient societies. Actually, it is this consideration that impelled ancient Egyptian thought to try to explain various apparently unthinkable events in a dual manner (e.g.: intense weather conditions, rare astronomical epiphanies, illnesses, and even death itself), through their belief in magic. This fact explains the close relation between Medicine and magic in the ancient Egyptian theocratic state, a relation that was considered very important. The privileged position that Medicine held in the ancient Egyptian temples [more specifically, in the *Houses of Life* (*Prw-ᶜnḫ*), closely related and adjacent to the Great Temples, these being virtual ancient Egyptian «Universities», «Scriptoria» and «Clinics», sheltering various proto–scientific «disciplines» of that era] demonstrates that efforts to maintain public *health* (anc. Eg.: *snb*; anc. Hel.: *ὑγίεια*) were a principal and integral concern of the ancient Egyptian State. This was considered a moral obligation of the pharaoh/state to its subjects, emanating from the religious consideration of the Egyptians related to their adherence to the notion/principle of Universal Harmony, Truth and Justice (*Mꜣᶜt*) and its consequent expression in the proper and favourable function and life of everything: institutions and laws, human life and health.

It is a happy coincidence that many of the ancient Egyptian medical sources and texts have survived until today. In the British Museum, for instance, there are eight medical papyri (BM EA 10756-7-8), three of which are dated from the Middle Kingdom (Dynasty XII, *c.* 1850 BC); they were discovered in the Ramesseum (Thebes West) and belong to the most ancient medical texts ever detected (for the Ramesseum papyri, see Gardiner, 1955). Indeed, Papyrus BM EA 10758, written not in hieratic (as was usually the case), but in cursive hieroglyphic script, proves its older age and its possible provenance from the period of the Old Kingdom (2575-2134 BC). This papyrus deals with the stiffness (*rigor*) of human bodily members. Papyrus BM EA 10757 contains both magical spells and prescriptions for pregnancy and infants **[Fig. 10(L)]**. Another related text can be found in the London Medical Papyrus (BM EA 10059), which is dated to the early period of Dynasty XIX (*c.* 1250 BC) and contains 63 parts of which ⅔ are magical spells, while ⅓ are purely medical prescriptions (for the edition of this papyrus, see Wreszinski, 1912). This papyrus could be considered, *mutatis mutandis*, as the precursor of modern Holistic Medicine, because of the method of treatment of various illnesses. It contains a combined mixture of incantations and medico–pharmaceutical treatments, both of which were considered important for the recovery of patients. The medical Papyrus Chester Beatty VI (= BM EA 10686), as well as three more papyri of lesser importance [Chester Beatty X (= BM EA 10690), XV (= BM EA 10695) and XVIII (= BM EA 10689)], date from Dynasty XIX. The first of these papyri (*c.* 1200 BC) deals with venereal diseases and with conditions of the anus (on these papyri, see Gardiner, 1935; on the magical Papyrus Leiden, cf. Griffith & Thompson, 1974).

Figure 3: [L] The mummified head of King Tutᶜankhamūn (*c.* 1323 BC), unwrapped from the linen bandages of mummification: *en face* view, taken by the renowned archaeological photographer Mr Sandro Vanini.
[R] Reconstruction of the face and head of the same pharaoh (silicone model with a probability of identification > 85%), based on modern archaeo–anthropological and forensic techniques. Most probably, his death was the result of a fall from his chariot, fracture of his leg and further strong contamination of his wound. A special privilege of Egyptologists is the direct and face to face contact with the preserved bodies and faces of ancient pharaohs! Cf. too Allen, 2005, pp. 36-37, No 31.

Let it be noted that the holistic approach and treatment of sicknesses was a general characteristic of the ancient Egyptian medical practice, which accepted — as in modern holistic practice — that the spiritual and emotional condition of patients plays an important part in the course and development of a disease and possibly in their faster recovery. Hence, the Egyptians believed that the magic ritual practices and the concomitant prayers, survived until today in various medical (and magical) papyri, effectively contributed toward the therapy and recovery of patients, influencing positively their psychology (cf. Placebo effect). On the other hand, magic was considered as the most effective method to cure various illnesses and malaises, since many of them — according to the ancient Egyptian beliefs — were due to the malicious influence of demons, the evil eye, wicked dead or the *Poltergeister* [for the so–called «dangerous dead» and ghosts, see e.g.: Posener, 1958, pp. 252–270; Posener, 1981, pp. 393–401; so too in Μαραβέλια, 2003, pp. 266–268; on the *evil eye* (anc. Hel.: *βάσκανος ὀφθαλμός*) of ᶜApophis, see Borghouts, 1973, pp. 114–150; on the relation between Medicine and magic, cf. Hand 1986]. For this reason, in similar cases, the appropriate incantations, spells or ritual recitations were interspersed with the related prescriptions of drugs (medicated during the incantations) and methods of treatment. In several cases some alternative prescriptions were given, so that the cure could proceed just in case the medicine of the initial treatment was proved unsuccessful. We must point out that the administration of drugs through the mouth was, *mutatis mutandis*, symbolizing and alluding to the Opening of the Mouth Ritual (*Wp-Rꜣ*), which was performed on the mummies of the deceased just before their burial by special funerary priests and was supposed to recover all the vital functions of the dead body, and especially the capacity for eating food, breathing and talking (see Μαραβέλια, 2003, pp. 182–186; see also Roth, 1992, pp. 113–147; Roth, 1993, pp. 57–79; as Dr Roth has shown, the Opening of the Mouth Ritual was combined with the symbolic insertion of the small finger of a priest in the mouth of the mummy, thus imitating the as of old obstetric practice of examining the mouth cavity of a baby by the Obstetrician, alluding to the expected re–birth of the deceased in the hereafter as a newly–born baby; cf. too Allen, 2005, p. 28, No 18).

The use of surgical operations took place almost exclusively in the case of injuries. A medical papyrus from the Collection of the New York Medical Academy, known as Papyrus Edwin Smith, exhibits the surgical treatments for wounds of the head and thorax, for fractures, dislocations, and the like (on the edition of Papyrus Edwin Smith, see Westendorf, 1966; Breasted, 1980; cf. also Allen, 2005, p. 70 ff, No 60). This important papyrus (*c.* 1600 BC) refers to the systematic classification of the various ailments and their related diagnoses in three main categories: **1.** Curable conditions (e.g.: a joint injury); **2.** Relatively treatable conditions (e.g.: a patulous wound on the head); and **3.** Non–curable illnesses (e.g.: *angina pectoris*, cancer, & c.). In the third case, the patients probably resorted to the use of magical spells and religious practices. The famous Papyrus Ebers (for Papyrus Ebers, see Ebers, 1875; Wreszinski, 1913; Bryan, 1930; Ebbell, 1937; Ghalioungui, 1987) **[Fig. 5(LR)]**, which is kept in Leipzig (*c.* 1555 BC), as well as another papyrus from Illahūn (Kahūn) (see Griffith, 1898, Tab. 5-6; on Obstetrics in this papyrus, also see Steven, 1975, pp. 949–952), belonging to the Petrie Collection and dating from the Middle Kingdom (Dynasty XII), include information related to Surgery: the former refers to the treatment of furunculi and cysts, while the latter deals with various gynaecological conditions (e.g.: endometrial ailments, pregnancy determination, contraception, & c.). An ancient Egyptian method of contraception combines either the consumption of a mixture of crocodile's excrement and sour milk or the rubbing of the vagina with a mixture of honey and natron. Papyrus Ebers, the most renowned ancient Egyptian medical papyrus (the length of which was over 20 m), comprises a catalogue of 876 prescriptions of therapy and medicaments for stomach and gynaecological conditions, wounds, lesions and skin diseases **[Fig. 5(LR)]**. The Great Berlin Medical Papyrus (*c.* 1550 BC) contains the most ancient known pregnancy test (for the Great Berlin Medical Papyrus, see Wreszinski, 1909; on Obstetrics and gynaecological ailments, therapies and medicaments, see Strouhal *et al.*, 2014, pp. 97–185; and the extended study Bouwer, 2012): the use of barley and oats! Indeed, this papyrus advises the woman to be tested for pregnancy to moisten the seeds of these cereals with her urine; if both seeds flourish, the woman is pregnant; if only the oats seeds flourish, the woman will give birth to a girl; if only the barley seeds flourish, the woman will bear a boy; if, finally no seeds flourish, the woman is not pregnant. No matter how paradoxical this method seems to be, we note that modern experiments in the UK have shown that the urine of pregnant women (with high levels of estrogens) do favour

the flourishing of barley, while that of non–pregnant ones do not (see e.g.: Ghalioungui *et al.*, 1963, pp. 241-246; cf. also the URL: http://sitn.hms.harvard.edu/flash/2018/pee-pregnant-history-science-urine-based-pregnancy-tests/; on Obstetrics, gynaecology and women's health in Egypt, see Bouwer, 2012). Finally, concerning the various snake– and scorpion–bites (considered as temporal incarnations of dangerous dead or of the forces of chaos), which were particularly common in ancient Egypt, special magical spells were used, that were recited during the cleansing of the wounds with blessed water that had flowed over a Cippus of Horus or a sacred statue (bearing the necessary hieroglyphic inscriptions that would imbue the water with healing power), like the one of Djed–Hor the Saviour **[Fig. 1(R)]**. In the next Sections, we shall briefly touch upon various medical sources and upon their contents (on the ancient Egyptian medical papyri, see Grapow, 1935; Nunn, 1996: Chap. 2 & Tab. 2.1; for the Medical Papyrus Carlsberg VIII, see Iversen 1939; *BMD* 1996, p. 176; on the Medical Papyrus Brooklyn, dealing extensively with serpent bites, cf. *op. cit*., 176; on the healing statue of Djed–Hor, the Saviour, see Jelínkova–Raymond, 1956).

2. Medical Doctors in Ancient Egypt and the Applications of Medicine and Pharmacopoeia.

Ancient Egyptian students of Medicine were obliged to study with experienced Doctors–Priests in the Houses of Life, while nepotism and possible continuation of the father's profession by the son (much more rarely by the daughter, since we know only of 2-3 certain cases of Women–Doctors) were evidently present. Of course, all Doctors were priests (*wʿbw*; of the lowest order), but not all priests were Medical Doctors; they were literate and some were very experienced and knowledgeable [for Doctors, see Ghalioungui, 1993; Hērodotos refers to the partition of medical specialties and to Medical Doctors (*II*: 84); on the Doctors–Priests of Sekhmet and the Exorcists of Serqet (*Ḥrpw-Srḳt*), cf. von Känel, 1984a; von Känel, 1984b; concerning the Houses of Life, see Gardiner, 1938, pp. 83–91; on the priests in ancient Egypt, cf. Sauneron, ³2000]. Many Doctors (especially Surgeons) were also priests of Sekhmet (*wʿbw nw Sḫmt*), goddess of war and pestilence, who was the consort of Ptah in Memphis, related also to the solar god Rēᶜ. There were also Pathologists, Ophthalmologists, Dentists **[Fig. 9(R)]** and Veterinarians. The ancient Egyptian term for a Medical Doctor was  (*Zinw*/*Zwnw*; anc. Hel.: *ἰατρός*), while the few cases of female Doctors dating mostly from the 3rd Millennium BC (Old Kingdom) once more corroborate the relatively better position of women in the ancient Egyptian society. Indeed, if we take into account that even though the Egyptian theocratic society was rather patriarchal in structure, the fact that we have certain cases of honoured female Doctors with their names mentioned in epigraphic sources, could be a clear indication that there were probably more of them, even though their names have not been preserved. Some male Doctors possibly had female assistants, almost like today's nurses. Also, it is possible that an educated lady of the higher class and especially noble ladies (*nbwt-pr*) could have been trained to provide elementary medical assistance (like our first aid) with the help of her hand–maids. Various so–called *wise women* (*rḫwt*) were also occupied, especially in rural areas (more specifically at Deir ʾel-Medinah), with resolving cases of suffering due to the «evil eye» and «possession» of bodies by demons and/or evil spirits. While in various medical and magical texts mentions of demoniacal «possession» or «possession by ghosts» are known, there is never even the slightest description of the «diagnostic» method(s). We know that in several similar cases ceremonial exorcisms were taking place, performed by people of a rather «low» social status, as for instance poor women, children and dwarfs **[Fig. 4(R)]**.

Based on the inherent dualism of ancient Egyptian Medicine and its division in *practical medical craft* and *magic therapeutic ritual*, we could claim that the successful Medical Doctor would be the one who was well aware of both aspects of his profession. During the New Kingdom (1550-1070 BC), especially during the Ramesside Dynasties, and also because of the weakening of Egyptian power in the Middle East and the rise of the Hittites, a kind of relative «scientific» specification of certain experienced Doctors started to appear. The consequence of this tendency was the partial internationalization of ancient Egyptian Medicine and the growth of fame of some Egyptian Doctors even further than the boundaries of their own country. Here, it will suffice to mention the characteristic case of Djehuty–em–heb (*Ḏḥwty-m-ḥb*), who lived during the kingship of Ramses II the Great (*c.* after 1280 BC), said to have cured a Hittite princess with the help of the supposedly «therapeutic» statue of the Egyptian god Khonsū–nefer–hotep (*Ḫnsw*

Nfr-ḥtp), member of the Theban Triad (for a thorough discussion on this matter, see Μαραβέλια, 2003, pp. 259-261; see also Budge, [3]1971, pp. 207–213; Kitchen, [2]1997, pp. 91–92, mainly pp. 228–229; for similar issues, cf. Jelínkova–Raymond, 1956; Lacau, 1921-1922, pp. 189–209; on the Hittites, see also MacQueen [2]1986). However, the most known and famous Medical Doctor, the legacy of whom is lost in the depths of History, is none other than Imhotep (anc. Eg.: *Ỉi-m-ḥtp*; anc. Hel.: Ἰμοῦθις), who lived during the kingship of Pharaoh Djoser (*c.* 2630 BC) in the Old Kingdom, who was also the Prime Minister (*Ṯ3ty*) of that king, his Chief Architect (builder of the Step Pyramid at Saqqarah), a great and very wise polymath, Chancellor, High Priest of Heliopolis and many more … Imhotep **[Fig. 1(L)]**, who was deified by the Egyptians of later periods, had also his own cult as a god of Wisdom and of Medicine, as early as the Late Period (712-332 BC), while during the Ptolemaic Period (304-30 BC) the Hellēnes identified him with their god of Medicine Asklēpios (on Imhotep and pictures of his statuettes, see *BMD*, 1996, pp. 139–140: s.v. «Imhotep»; Posener, [2]1992, pp. 138–139: s.v. «Imhotep»; see also Wildung, 1977a; Wildung, 1977b; on Asklēpios and his cult, see Avalon, 1927; Walton, [3]2003).

Ancient Egyptian Medical Doctors used many practical methods of therapy, e.g.: binding of wounds with bandages after the application of medicaments (see related text, *infra*), fumigations, delivery of drugs (in either liquid or solid form) through the mouth, enemas, compresses, suppositories, massaging, lavages, all of which are described in various medical papyri, without simultaneous magical incantations. However, in other cases, several magic spells are mentioned too which should accompany some of the former curing methods. A characteristic example of a related magical incantation is mentioned, dating from the 2nd Millennium BC, which should be pronounced during drugging a certain medicine: this very spell describes Medicine as a form of the *theophoric authoritative force* (*ḥk3*), i.e.: of *magic* itself, that could be capable of repelling the harmful substances or actions that were provoking *illness* (anc. Eg.: *mr*; anc. Hel.: ἀσθένεια) out and far from the human body (*ḫt*). The same spell is also met in the (mythological) contendings between the gods Horus and Seth, in the recovery and reconstitution of the divine and apotropaic *Eye of Horus* (𓂀 *Ỉrt-Ḥr* ≡ *Wḏ3t*; an important archetypic symbol, also related to the unitary fractions of ancient Egyptian Mathematics, the corn–measure and the Phases of the Moon), and even in the recovery of wounded gods. There were also more general incantations, due to be recited during cleansing and bandaging the wounds, and so on.

As is evident, the list of ancient Egyptian Medical Doctors was not numerous, although they were a very important and useful component of the ancient Egyptian society **[Fig. 1(L), 1(C), 1(R), 9(R)].** Egyptian Doctors had self–confidence and methodology, a fact that was discriminating them against their Mesopotamian colleagues. Their methodicality is evident in various medical papyri, the texts of which were standardized, since they contained prescriptions classified in normal order; indeed, in any case, they had a title, a list of symptoms, a diagnosis (with suggestions for a probable cure), and of course the therapeutic method, several times interspersed with exorcisms and magical incantations. Let us now see a typical example (without magic spells) from the great Medical Papyrus Ebers [see *pEbers*, 78: 6–10; for a variant of this text, cf. *pHearst*, 12: 1–3; for the phonetic transliteration, see *EG*, [3]1988: 349 (the transliteration is given to the right of the hieroglyphic text); for the edition of *pEbers*, see Ebers, 1875; Wreszinski, 1913; for the edition of *pHearst* (*c.* 1550 BC), which between its 250 prescriptions it also deals with fractures and various bites (even from hippopotami and humans!), cf. Reisner, 1905; Wreszinski, 1912]:


ỉr gm.k ḏbˁ, sȝḥ r-ꜥpw,


mr.sn,


pḥr mw ḥȝ.sn,


ḏw sty.sn,


ḳm(ȝ).sn zȝ;


ḏd.ḫr.k r.s:


«mr ỉry.ỉ».


ỉr.ḫr.k n.f zpw nw sm(ȝ) zp:


sỉȝ Šmˁ, r-32,


sỉȝ Mḥw, r-32,


sft, r-8;


nḏ(w),


wt(w) ḥr.s.

The translation of the previous medical text, line to line, is the following [translation from the original; the unit of measure of the substances that are referred to as fractions in the text is the ancient Egyptian *hin* (*hnw*), which is approx. 0.503 ℓt; that is a unit of volume measurement for liquids; on this, see e.g.: *EG*, [3]1988, p. 199 (end of § 266); Μαραβέλια, 2014, p. 140; line 5 in *pHearst* has the following variant: «and were caused by a *zȝ*–worm» (*ḳmȝ.n zȝ*), which seems more plausible; on hygiene and Aesthetic Medicine in ancient Egypt, see too Riad, 1979, pp. 44–49; on the mineral substance *sỉȝ*, see Hannig, [5]2009, p. 719]:

If thou findest a finger or a toe,

(Which) are (*sic*!) *painful,*

(And) around which liquid (lit.: *water*) *circulates,*

(And) their smell is evil,

(And) they create a zȝ–worm;

(Then) thou shalt say concerning it:

«(It is a) disease (I must) cure».

(Then) thou shalt make for him (i.e.: *the patient*) *treatments for killing a zp–worm:*

1/32 parts Upper Egyptian sỉȝ,

1/32 parts Lower Egyptian sỉȝ,

1/8 parts sft–oil.

It is (to be) ground up (and mixed).

(The wound) is (to be) bandaged with this (i.e.: *mixture*).

At the beginning of this text the disease and its symptoms are described. After that a practical prescription is given with a method of treatment, comprising one of the seven sacred oils (namely the *sft/sft*–oil) and two substances or medicaments of mineral origin. Finally, directions for their application are given to cure the sickness (perhaps infected wound with pus?), after grinding the mineral substances into a mortar and mixing them with the oil, then applying them to the wound and bandaging it. If an illness was simple, no magical incantations were «prescribed»; however, in other more complex and difficult diseases this was not the case.

Figure 4: [L] Part of the royal mummy of Queen Iᶜaeh–mes–Nefert–iry (*ʾIʿḥ-ms*, *Nfrt-iry*), wife of King Amasis I (founder of Dynasty XVIII), in profile (left) and *en face* (right) views (*c.* 1550 BC).
[R] Composite statue of an ancient Egyptian family, dating from the Old Kingdom. To the left, seated and embraced by his wife, is shown the achondroplastic dwarf Soneb (*Snb*), at the expected place of the feet of whom the artist has cleverly placed his two children (*c.* 2475 BC). Egyptian Museum, Cairo (JE 51280).

According to Papyrus Ebers (see Posener, [2]1992, p. 167; the translation of the quoted excerpt is freer and we intentionally transposed the sequence of sentences; on death, its confrontation and funerary beliefs in ancient Egypt, see Spencer, [3]1986): «the secret of Medicine is to know the heart and its motion […], examining the pulse at different parts of the body, like the head, the hands, the heart […], since there are (blood) vessels that end in the heart from every part of the body […]». This observation indicates that ancient Egyptian Doctors had noted and probably ascertained the correlation between the pulse at different parts of the body and the pulsation of the heart. However, the description of the aforementioned «vessels» in the same papyrus, which — according to the Egyptian opinion — were transporting «air, water, mucus, semen», as well as other secretions, demonstrates the complete ignorance of the actual mechanism of function of the living human organisms. Nevertheless, we must point out that the purely surgical sections of the medical papyri were not only much more thorough, but also more scientifically formulated, while (amongst other problems) they were treating various injuries, wounds, stomach diseases, furunculi and gynaecological cases (e.g.: the Papyrus of Illahūn). Another remarkable fact is that some medical papyri (supposedly written by male Doctors, addressing other male colleagues or priests) describe satisfactorily the method of intravaginal examination of women, for both obstetric and digestive disturbances.

There are colossal statues and also relief depictions of King Akhenaten (*ʒḫw-n-ʾItn*), dating from the Amarna Period (Dynasty XVIII, *c.* 1350 BC), which depict him with eunuch–like characteristics **[Fig. 5(UR)]**. Some scholars tried to explain these hermaphroditic features (namely the acromegaly of the facial bones, a slight gynaecomastia and the broad steatopygic pelvis) as the result of Fröhlich Syndrome (Pituitary Hypogonadism). However, most Egyptologists consider that these paradoxical representations of the so–called «heretic» pharaoh, who tried to establish a henotheistic cult, were simply symbolic, hinting to his virtual identification with the primordial creator–god Atūm–Rēᶜ (*ʾItm-Rʿ*), who was also virtually a hermaphrodite: furthermore, this was a good allegory related to the abundance of Nature, namely of the Nile [whose god Hᶜapy (*Ḥʿpy*) was also represented symbolically with slight hermaphroditic characteristics and gynaecomastia].

However, Diagnosis, Clinical Medicine and Therapeutic Methods, as sub–domains of the ancient Egyptian Medicine, were never as methodical and thorough as Surgery (see Nunn, 1996, chap. 8; cf. Pinch, 1994, chap. 10; see mainly Strouhal *et al.*, 2014, pp. 19–95; Blomstedt, 2014, pp. 670–676). Even though there are no written sources concerning Surgery

from Mesopotamia, Egypt compensates for this with several important surgical texts (for a short review and interesting cases concerned with cancer, see Γκιάλας, 1978, pp. 124–131; on circumcision, cf. Bardis, 1967, pp. 22–23). The fact that ancient Egyptian Medical Doctors were writing down their empirical and experimental knowledge, taking systematic notes of the medical know–how, as opposed to the habits of their foreign colleagues, proves that the level of their Medical Practice was much more advanced and higher than that of the hesitating empiricism of Babylonian Surgeons.

Figure 5: [UL] Head, thorax, forearms and hands of the royal mummy of King Ramses III (coeval with the Trojan War), who was slaughtered by certain palace conspirators (*c.* 1180 BC). Observe his neck, unusually covered with broader linen bandages.
[UR] Statue of King Akhenaten/Amenophis IV with symbolic hermaphrodite characteristics (*c.* 1350 BC).
[LL] Aspect of the upper part of the royal mummy of King Ramses V, who was suffering from smallpox (*c.* 1160 BC).
[LR] Part of a page from the famous great Medical Papyrus Ebers (*c.* 1555 BC).

However, we shouldn't overestimate the ancient Egyptian Medicine, for it had never been detached from the application of magical techniques, but also completely misapprehended some of the basic functions of the human body and of its basic structure. Nevertheless, even the application of Surgery in ancient Egypt was not absolutely advanced (also cf. Ζηρογιάννης & Προβατοπούλου, 2009, pp. 14–44). For instance, fractures were straightened and immobilized, injuries were bandaged and various therapeutic substances were used for healing them, abscesses were opened, while small surface tumours were removed, even though some of them were considered incurable and were left without therapeutic treatment. A method of clitoridectomy, known as *nymphotomia* (anc. Hel.: *νυμφοτομία*), referred to by Strabōn and described by Aetios (and later by the renowned Paulos of Aighina or Aighinitēs) was also being performed. Operations were performed with a special knife or scalpel, or with an incandescent piece of iron, in order to destroy tumours and to block haemorrhage. Perhaps Surgery was not particularly developed due to superstitious reasons, because — as is mentioned by Diodorus Siculus — Doctors were curing patients following the written law that was enacted by many wise Doctors of Antiquity [see Diodorus Siculus, *I*, 82: 3; for Amenophis Son of Hapū, as a typical example of deification or «sanctification» in ancient Egypt, as *saving healer* (anc. Hel.: *ἀκέστωρ*) and prototype of a righteous Therapist, see Simmance, 2014]: if they failed to save the patient, having followed strictly the laws of their holy manuals, they were declared innocent; however, in the case where they prescribed therapies opposite to the traditional norms of the written texts, then they were considered guilty and were executed.

Before ending our discussion in this Section, we must also refer to Pharmacopoeia and to the most important ancient Egyptian drugs and medicines. The medical papyri were giving a whole series of possible therapeutic medicaments for several cases, leaving however the final choice of the appropriate drug to the Medical Doctor, or even exhorting him to try all of them, selecting himself the most efficient. The main ingredients of medicaments were fat and the blood of various animals, vegetal substances and certain vegetables, honey (*bit*), as well as all common liquids [e.g.: olive oil (*mrḥt*), water (*mw*)], assorted ground minerals, and even morning dew that was believed to cure paralyzed members, as a manifestation of divine dew [anc. Eg.: *i3dt*; interestingly the same word also meant *pestilence* (anc. Hel.: *ἐπιδημία*)]. The use of different types of excrement and manure (of at least 19 kinds, usually from animals, birds and insects, as e.g.: crocodiles, ostriches and flies!) as ingredients of many medicines is surprising. On the other hand, urine was also used due to its antiseptic properties [even nowadays urine is used, in cases of insect bites, because of the ammonia (NH_3) it contains]. This strange practice was based on the application of the Law of Similarity of magic that is to compete against a similar using another similar, that being a basic principle of modern Homœopathetic Medicine too. This was because ancient Egyptians considered that many diseases were due to defects during digestion, which was paralleled to the putrefaction of corpses: therefore, if rotting remnants of food remained in the body, they would induce problems. For this, as they believed, the use of drugs or fumigations, containing excrement as basis, would combine to bring about the removal of harmful substances and their exit from the body during defecation. Apparently, all these peculiar therapies were the result of a whole process of thought and reflections, which were considered absolutely reasonable for the ancient Egyptian standards and social norms, as well as typical of the deeply religious cosmovision they expressed.

Unguents (*drogue*) in general were mixed with honey or vegetal– or animal–fat (e.g.: goose fat), which constituted the inert carrier (base) of the medicine (see Posener, 1992, pp. 165–168: s.v. «médecine»; on honey, as a medicine, see Zumla & Lulat, 1989, pp. 384–385). In the ancient Egyptian *medicaments* (*pẖrw*) vegetal ingredients were predominant (as drogue), as well as a variety of mineral constituents, whose therapeutic value was noticeably great (on minerals in ancient Egypt, see Harris, 1961; Aufrère, 1991; on various chemical compounds, see Merck, [14]2006). The use of a kind of natron (*ḥsmn/nṯri*), is to be noted: this was a mixture of mineral sodium chloride (approx. 83%) and also of sodium carbonate, bicarbonate (mainly) and sulfate (approx. 17%, in total), which had a lot of applications, but was mainly used in mummification (on natron and its ample use in mummification, see Lucas, [4]1989, pp. 263-267; Sandison, 1963, pp. 259-267; [c]Abd ʾel-Maksoud *et al.*, 2011, pp. 130-134; natron has the chemical formula $Na_2CO_3.10H_2O$ and is extremely hygroscopic; cf. Pollard & Heron, 1996). Natron is a natural mineral salt met in Egypt, mainly in Wādi ʾel-Natrūn. Modern experiments (*in vitro*) at the University of Manchester have shown that this substance is an excellent embalming material,

because when absorbed by the bodily tissues, for at least 40 days, it dehydrates them, desiccating the corpse and suspending entirely the *post mortem* putrefaction. Furthermore, several alkalic compounds, various chemical salts, mineral metals and alums were used. Concerning the vegetal substances, the most important for pharmaceutical use were coming from mustard [*Sinapis alba* L. ([DEM]*ḥltm*)], wine [*Vitis vinifera* (*irp*)] and raisins (*wnšw*), *Papaver somniferum* L. (*špn*), *Atropa belladona*, *Mandragora officinalis* L. (*rrmt*), *Ruta graveolens* L., *Chamæmellum nobile*, *Acacia nilotica* Desf. (*šnḏt*), *Juniperus phœnicea* L. (*wꜥn*) or *Juniperus drupacea* L., garlic [*Allium sativum* (*ḫtn*)], *Pseudoconium* (wherefrom originated the toxic alkaloid cicutine), *Althæa* sp., & c. They were also using *Helleborus cyclophyllus* (even for fumigations), as well as other pharmaceutical and colouring herbs, as the following: linen [*Linum usitatissimum* L. (*mḥy*)], papyrus [*Cyperus papyrus* L. (*mḥyt*/*ṯwfy*)], myrrh [*Commiphora myrrha* Ergl. (*ꜥntyw/ḫry*)] **[Fig. 9(L)]**, incense [*Pistacia terebinthus* L. (*snṯr*)], frankincense or oliban [*Boswellia* sp. (*snṯr* ?)], *Carthamus tinctorius* L., cinnamon [*Cinnamomum zeylanicum* (*tišps*), *Cinnamomum/Laurus cassia* (*ḳdt*/*ḫzʒyt*)] and many others [on ancient Egyptian Botany, see Manniche, 1989; cf. also Jacq, 1985, pp. 125-127; on papyrus, see Parkinson & Quirke, 1995; on lotus (white lotus: *Nymphæa lotus* and blue lotus: *Nymphæa cærulea*; anc. Eg.: *zšn*; anc. Hel.: *σοῦσον*), see Harer 1985, pp. 49–54; on vegetal medicines, cf. Germer, 1979; the *kyphi* was also used as medicine (Maravelia & Filianos, 2020, pp. 257–303)]. We must observe that magic played a major part in the ancient Egyptian Medicine and many naïve Egyptians were considering the action of drugs adverse against «evil spirits», who «had caused» the sickness, according to their beliefs, and of course they were not regarding medicines as chemically or pharmaceutically efficient (Placebo effect). This very fact explains easily the use of magical incantations and exorcisms during medicating various patients (see Pinch, 1994, 133 & *passim*; on the later Coptic Pharmacopoeia, cf. Till, 1951). We could say that — in general — Pharmaceutics and Pharmacology, in both ancient Egypt and Mesopotamia, could not be considered entirely as pure Sciences (see Pinch, 1994, p. 133 ff; cf. also Roaf, 1990; *BMD*, 1996, pp. 175–176: s.v. «Medicine»).

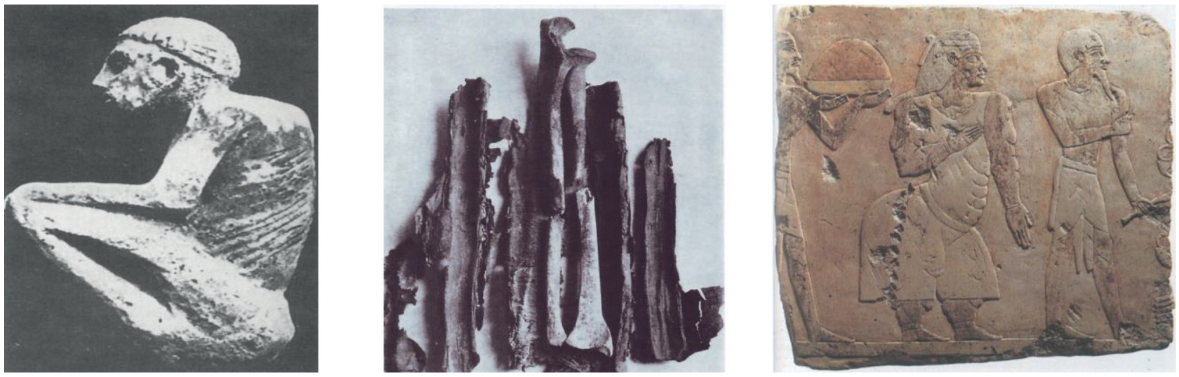


Figure 6: [L] Pre–Dynastic statuette made of red clay, originating from Aswān. It depicts an ancient individual suffering from Tuberculous Spondylitis (Pott's Disease). Private Collection, Paris.
[C] Compound fracture of the forearm with unwrapped bark splints (after Smith, 1908, pp. 732–736; Blomstedt, 2014: 671–672). Even though the wooden narthex would be efficient, the patient died due to open fractures (Dynasty V, *c.* 2465-2323 BC).
[R] Fragment of a painted relief made of limestone, from the Mortuary Temple of Queen Hat–shepsūt (*Ḥʒt-špswt*) at Deir ʾel-Bahri, dated from Dynasty XVIII (*c.* 1460 BC). The Queen of Pūnt (*Pwnt*: probably modern Somalia or Erythraia) is depicted with excessive obesity, wrinkles of fat at the limbs and conspicuous Lipodystrophy.

3. The Essence and Evaluation of Ancient Egyptian Medicine.

The development, route and evolution of Medicine as a Proto–Science in ancient Egypt is very interesting, both under the prism of empirical (but relatively systematic/methodical therapeutic technique) and through the viewpoint of magical or (semi)religious approach. The experience of ancient Egyptian Medical Doctors was a factor of progress, prevalence and mastery of their Medicine against that of other Middle Eastern nations (e.g.: Mesopotamia, Mitanni, Hatti and Assyria). Certainly, magic and Medicine were interrelated — at least apparently —, to such an extent that the use of medicaments

was not considered as effective *per se*, but activated by the magico–religious ritual with which it was often accompanied, by the simple–minded ones. This is why many of the prescriptions and therapeutic methods were interspersed with exorcisms, magical incantations and prayers. However, notwithstanding this fact, in cases of (major or war) injuries or accidents, whose causes could be hardly ascribed to «evil spirits», demons or «dangerous dead», Medical Doctors could easily do as they thought best, thus gaining self–confidence and the appropriate experience. Furthermore, there were enough bright, enlightened and intelligent minds among their classes, who were possibly thinking in a clever and practical way, without believing in naïve superstitions, nevertheless due to their theocratic society they had to pretend to be «believers».

Therefore, as was noted *supra*, Surgery was systematized and developed more than any other branch of Medicine in the antique country of the Nile. The culmination and apex of this progression *coincides with* and *is due to* the Hellenic presence in Egypt during the Ptolemaic Period (304-30 BC), and indeed it was generated by the cultural and scientific revival of Egypt under the Enlightened Monarchy of the Laghid Dynasty [for the sophisticated surgical tools of this era, see **Fig. 8(L)**, *infra*; on ancient Hellenic Medicine, see Fuchs, 1902; cf. too Geroulanos & Maravelia, 2012-2014: 233–248; there was also a cultural boom of the literacy in ancient Egypt, which rose up to 10% during the Ptolemaic Period, while before (since the Old Kingdom) it was only 1%], an era during which ancient Egyptian empirical methods approached the clarity and the reason of ancient Hellenic Spirit. Alexander's cultural conquest was the starting point for this (see *infra*) and the love and respect of later Arab and Muslim Scholars for the Hellenic Culture and achievements was the irresistible driving force for the later trans–cultural pathways that were opened and disseminated ancient knowledge **[Fig. 20]**, evolving and developing it, several times in true excellence, by the Islamic Culture that was respecting Science and scientific achievements during the Medieval Dark Ages, when in Europe the Roman Catholic Church was burning scholars and innocent people at the stake for promoting Science or for suspecting them of being witches … It is a real blessing that in Eastern Europe, in the Byzantine Empire, in the realm of Orthodox Christianity, such atrocities have never happened.

Figure 7: [L] Reconstruction of the orthopaedic sandals of King Tutʿankhamūn, who was suffering from flat feet. The real shoes were made of vegetal materials, combined with semi–precious stones.
[R] Prosthetic big toe for the right foot of a female individual (who probably lost her toe due to Ischaemic Gangrene), made of wood [see Wagle, 1994: pp. 999-1000; Nerlich *et al*. 2000, pp. 2176-2179; Finch *et al*. 2012, pp. 181-191], which was found attached on the mummy's foot with leather straps (Third Intermediate Period, *c.* 1070-712 BC). Egyptian Museum, Cairo.

It was during that era when Imhotep **[Fig. 1(L)]** was identified with Asklēpios and the Asklēpieion (*Ἀσκληπιεῖον*) at Saqqārah constituted an important healthcare centre. The method of *incubation* (*ἐγκοίμησις*), used by various Asklēpieia in Hellas, was introduced into Egypt too [e.g.: in the Temple of Bes, at the same area): patients were spending the night inside a special chamber, expecting to dream a *divine dream* (*θεῖον ἐνύπνιον*), which would release and cure them (see *BMD*, 1996: p. 176; concerning «dream therapy», see *BMD*, 1996, p. 87: s.v. «dreams»; for incubation/*somnus* in the ancient Asklēpieia, see Walton, [3]2003: Chap. III; on the constellation of Asklēpios as *Serpentarius* (*Ophiuchus*), see Maravelia, 2010, pp. 79-92]. Additionally, during the Late Period (712-332 BC), inside the precincts of great temples (e.g.: the Temple of Hathor at Denderah), *sanatoria* were often functioning [see *BMD*, 1996: p. 176; for the Temple of Hathor, featuring also a perfume laboratory, see *BMD*, 1996, pp. 84-85: s.v. «Dendera»; on the ancient Egyptian

kyphi (anc. Eg.: *kȝpt*; anc. Hel.: *κῦφι*), see Maravelia & Filianos, 2020, pp. 257-303]. Of course, we must not forget to acknowledge the (small, as is evident from the purely Hellenic terminology of the related medical texts) debt of both ancient Hellenic and ancient Roman Medicine to the ancient Egyptian Medicine, a debt that is doubted by several Scholars, as this is explicitly mentioned by Galēnos (*c.* 129-199 AD), who notes that many Hellenic and Roman Medical Doctors were advising the ancient medical archives of the Egyptian temples in Memphis. Finally, Dioskoridēs Anazarbeus or Pedanios (fl. *c.* 60 AD) provides much useful information on the use of various vegetal substances (herbs, & c.) in ancient Egyptian Medicine [see Γαληνός (Marquardt, J. *et al.*, eds), 1884-1893 and Διοσκορίδης (Wellmann, M., ed.), 1914; for a representation of Dioskoridēs Anazarbeus, originating from an ancient Arabic manuscript, cf. Manniche, 1999: p. 13; on herbs, cf. Ody, 1993].

«Magical» Medicine in ancient Egypt constituted a theoretical and experimental practical craft, or Proto–Science, whose basic criteria were the wish to keep the human body in harmony with the surrounding environment during the lifetime of humans and to preserve the human corpse for ever after death as a receptacle of the soul (which triggered the exquisite embalming techniques): hence, the human entity could function in both lives as a vehicle or carrier of those divine «vital forces» that created and crafted the Cosmos, attaining finally immortality. If any human individual was inflicted by an illness, suffered by pain or disease, this negative effect was considered — according to the ancient Egyptian *forma mentis* — as an intruding disruption of the *Universal Order* (*Mȝʿt*) at a local level, a form of *chaotic sin* (*isft*), which was interpreted as the aggressive invasion of some hostile deity (Seth, ᶜApophis, evil spirits, demons). Consequently, the Doctor–Priest–Virtual Magician should primarily cure the *fundamental cause* of the sickness, not its *direct cause* (i.e.: the result of the malicious intrusion), being obliged to fight against the metaphysical force pestering the human organism and manifesting as a sickness.

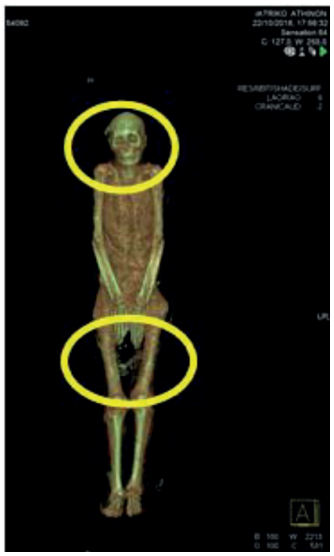


Figure 8: [L] A unique Ptolemaic wall relief, from the Temple of Sobek (*Sbk*) at Kom Ombo in Upper Egypt, featuring various highly sophisticated surgical and medical instruments (3rd Century BC), between which scalpels, tweezers, pincers, needles, cauterization irons, spoons, balance, suction cups, but also amulets, are depicted. Ptolemaic Period.
[R] From the Mummy Project of the Hellenic Institute of Egyptology: CT–Scanning mapping of Mummy 3346 (Egyptian Collection, National Archaeological Museum of Athens), belonging to the male individual Ta–di–thed–Amūn, who lived during the Late Ptolemaic Period (*c.* 150-30 BC) in Panopolis. During the gradual virtual unwrapping of the mummy, not only anatomical/embalming details, but also a faience bead «shroud», were uncovered (cf. Maravelia *et al*. 2019, pp. 140-141, 151 & fig. 9).

A basic prerogative to comprehend the essence of the metaphysical philosophy of «magical» Medicine is to bear in mind that the ancient Egyptians —contrary to what is customary in the later Religions (e.g.: Judaism, Christianity and Islam)— have never formulated absolute moral aphorisms of the type *Good/Evil*, *God/Devil*, and the like. Thus, a healing divinity was neither «good» nor «evil»; and the same was true of an «extra–world entity» causing illness. Therefore,

a healing deity was not necessarily «good», as also an attacking divinity provoking an infliction was not necessarily «bad» (cf. Jacq, 1985, p. 106; on «magical» Medicine, cf. Majno, 1975; Nunn, 1996, chap. 5). Both were considered, according to the ancient Egyptian *forma mentis*, as different hypostases or expressions of a *magical creative force* (anc. Eg.: *Ḥkꜣ*) that was immanent everywhere, joining and pervading everything in the Universe, flowing like a divine fluid, whose manifestations were not only the gods and goddesses, but human beings too. Egyptian mentality and Metaphysics, full of cosmic allegories, symbols and archetypal *signifiants*, considered that human beings responded in harmony or disharmony with their ambience, and consequently with that supposed «magical force». Yet, they believed that these same humans were independent and able to accept/manage to their advantage (or opposite) the various «friendly» or «inimical» divinities, through magic. Nowadays, living in a world of reason and evolved Science, we distinguish Medicine (as a methodological Science) from magic (as an unsubstantiated and unproved belief); however, the ancient Nile–Dwellers would rather naïvely intermingle these two considerations, associating them with each other. We must note, though, that notwithstanding this, indeed they laid the foundations for Proto–Science and for a particularly advanced civilization, to which not only Medicine but Sciences and Theology do owe a lot. Though, no matter how great was the ancient Egyptian culture, it would be exaggerated and absurd to consider that there were enormous reserves of «hidden/secret knowledge», latent behind apparently naïve symbols, in the ancient Egyptian Medicine and Proto–Science [for a single opposite opinion of a certain, non–mainstream, Egyptologist, which is presented, however, without essential and scientifically acceptable arguments, see Jacq, 1985, p. 107; we point out that the Egyptians did not even know the Theorem of Pythagoras (at least as we conceive it today; see e.g.: Gillings, ²1982, pp. 238, 242); nor had they ever created theoretical and methodological scientific prototypes, as the ancient Hellēnes; on the contrary, they always remained bound to practical applications and to their direct experience; thus, all strange and unproven beliefs concerning Architecture, the supposed–to–be «hidden power» of the pyramids, as well as other similar fictional opinions are absolutely unsupported and imaginary; see e.g.: Lauer, 1948; Lauer, 1974; Μαραβέλια, 2014, pp. 107-08, 152-54; finally, in Veiga, 2009, where the author deals with ancient Egyptian Medicine as a magico–religious «science», in a rather esoteric way, similar fictional opinions are given, which were the object of severe criticism by the current author (*contra* Veiga, see Maravelia, 2012, 163-170); on the impact of ancient Egypt in medieval Arabic writings, cf. ʾEl-Daly, 2005]. But now let us turn our attention to Alexandrian Medicine, the product of the fertile interaction between ancient Egyptian and ancient Hellenic Medicine.

Figure 9: [L] Detail of a painted limestone relief from the Mortuary Temple of Queen Hat–shepsūt (*Ḥꜣt-špswt*) at Deir ʾel-Bahri, dated from Dynasty XVIII (*c.* 1460 BC), where is depicted the careful transportation of myrrh–trees from Pūnt, the *Land of God* (*Tꜣ-Nṯr*), by Egyptian soldiers/sailors. Myrrh (*ʿntyw/ḫry*) was used both for religious (as incense) and medical (as a pharmaceutical and an embalming substance) purposes. Compare to Fig. 6(R), *supra*. **[R]** Detail from a wooden funerary panel, depicting the noble official, royal scribe and Chief–Dentist Hesy–Rēᶜ (*Ḥsy-Rʿ*) (cf. Forshaw, 2013: 181-202.), dating from Dynasty III (*c.* 2650 BC). Egyptian Museum, Cairo (CG 1426).

4. Ancient Alexandrian Medicine and Famous Physicians.

A major step in the evolution of Hellenistic Medicine and Surgery resulted from the victories of Alexander the Great (356-323 BC), who conquered — more or less — the whole Eastern World, including today's Turkey, the Middle East, Iraq, Persia, Afghanistan and Pakistan, as also Egypt, Sudan and Libya. With the founding of new cities, Hellenic Science and Culture were firmly implanted in these countries with their ancient civilizations. At the same time scholars were able to collect the pre–existing knowledge from the newly embodied or surrounding countries. An impressive cross–fertilisation took place, which became even more profound as all the gold and silver found in the cellars of the palaces of the Great Kings of Persia and Egypt, as also of all local princes, were struck into coins. This immense amount of money was thrown into the Economy and major new cities were erected. By founding all these new towns (for example at least 22 towns named *Alexandria* were erected), huge amounts of money were released into circulation and finally reached every citizen. This caused an impressive expansion and flourishing of the Economy and even more. Poor people, who were unable before to reach a Physician or a «Medical Centre», were now able to choose the best ones. This resulted in a concentration of patients in major «Medical Centres/Schools» called *Asklēpieia* **[Fig. 14(R)]**, causing an excessive accumulation of medical experience and knowledge. At least 400 temples of the god Asklēpios, called also *Asklēpieia*, have been excavated; from Spain to the Himalayas and from the Danube down to Ethiopia. The most important place of medical thought and practice became very early the famous Centre of Hellenic knowledge, the city of Alexandria in Egypt (*Alexandria ad Ægyptum*). Alexandria, founded personally by Alexander the Great in 331 BC, became very quickly the most important city. It was governed by a Dynasty which descended from Alexander's General Ptolemaios I, surnamed *Laghos* or *Sōtēr* (305-284 BC) and his successors Ptolemaios II and III. These three Kings founded and greatly promoted both Arts and Sciences. They even built a Botanical and Zoological Garden, a so–called *Mouseion*, a Museum, which however served all Nine Muses, as also Medicine, and a *Serapeion*, a temple of the supreme syncretistic god of that era (Serapis: bearing traits of Osiris, Ploutōn, Zeus *et al*.). Each of them was adorned with a vast library. The *Library of the Mouseion*, well known as the *Alexandrian Library*, became the biggest library of the whole Antiquity. This Library was for more than 600 years (300 BC-342 AD) the true Centre of Knowledge of the whole Antique World and included about 900,000 book–scrolls! There, the most renowned Scholars, Scientists, Writers and Physicians of all possible cultural backgrounds could assemble to study and to teach in a cosmopolitan and trans–cultural fertile amalgamation. The *préstige* of having studied in Alexandria concentrated numerous scholars, teachers and students, making of Alexandria the greatest city *par excellence* of the Hellenistic World. A contemporary rival centre of learning existed in Perghamos of Asia Minor, though only after 250 BC, during the reign of Eumenēs I. However, the Ptolemaic Pharaohs jealously guarded the supremacy of Alexandria by forbidding the export of the papyrus plant or its products. It is said that because of this forced shortage of papyrus, Perghamos developed a material derived from animal skin, subsequently called *perghamēnē* (*περγαμηνή*), i.e.: *parchment* (see Lyons & Petrucelli, 1987, p. 223; on ancient and medieval Medicine, see Baas, 1889; Πεντόγαλος, 1983; Ευτυχιάδης, 2001; Majno, 1975; Walton, ²1979; Μαρασλής, 1983; French, 2003). Medicine flourished extremely well both in Perghamos (mainly due to its famous *Asklēpieion* **[Fig. 14(R)]**) and of course in Alexandria, due firstly to the *Mouseion* and the consecutive concentration of knowledge, and secondly due to the possibility of dissecting human corpses. As mummification of the dead bodies was practiced for centuries in Egypt (see *supra*; **[Fig. 3(L), 4(L), 5(UL), 5(LL)]**) it was easy to extend dissection as a *post mortem* examination. Anatomy and Surgery prospered enormously from these dissections, reaching their peaks with Galēnos of Perghamos, better known in the West as Galen (*c.* 130-200 AD) some centuries later. His treatises became the basis of medical knowledge for more than 1300 years. In this study we are going to examine thoroughly the principal Medical and Surgical Schools of Alexandria, with emphasis on the work of Celsus (Kelsos), Paulos of Aighina, Dēmētrios, Hērophilos, Erasistratos, Galēnos *et al*. After the founding of the Museum with its famous Library, scholars flocked from all over the World to Alexandria, including personalities like Eukleidēs (fl. *c.* 300 BC), Archimēdēs of Syracuse (*c.* 287-212 BC), Kallimachos (305-240 BC), Hērōn (fl. *c.* 62 AD), and many others. The same was true in Medicine, which attracted all possible scholars. The most famous were Hērophilos of Chalkēdōn, who flourished around 280 BC, and Erasistratos of Kea, who flourished a little later, around 250 BC.

Hērophilos: He was the virtual Nestōr of the Alexandrian School. He was born around 330 BC in Chalkēdōn opposite Byzantium, today's Istanbul (Constantinople). He is considered as the founder of the Medical School of Alexandria. He was a student of Praxagoras of Kōs and Chrysippos of Knidos. According to Galēnos he was a unique Anatomist and an excellent empiric practicing Physician. He wrote several books of which unfortunately only some titles have survived; at least three dealt with Anatomy, one with the pulse, two with therapeutical subjects, another with commentaries on the *Aphorisms* and the *Prognōstikon* of Hippokratēs, as also a *Lexicon* on the Hippocratic vocabulary. Although only fragments of his writings have survived in the books of others, we can conclude that an immense amount of knowledge was added to Medicine and Surgery by his contribution. He described and named various parts of the brain (including the ventricles and the cerebellum), the nerves, the lymphatics, the eye, the duodenum, the pancreas, the parotids, the cardio–vascular system, including the heart valves, as well as many other parts of the human body, like for instance the hyoid. Some of his discoveries still bear his name e.g.: *calamus scriptorius Herophili*, or *kalamos Hērophilou* in the East. He considered the brain as the seat of thinking (contrary to the ancient Egyptians who considered that the heart played this role) and in contrast to Aristotelēs also as the seat of the soul. In addition, he was an excellent Gynaecologist and Obstetrician and described for the first time the ovaries (*ōophoron*) and the cervix, the ovaries being already mentioned by Hippokratēs. He had also described a birth of quintuplets. Hērophilos was considered as the Father of Anatomy up to 1543 AD, when Andreas Vesalius (1514-1564) published his famous Anatomy *De Corporis Humani.* Hērophilos was (definitely) the greatest Anatomist of Antiquity. However, about his surgical knowledge only very little is known. He understood much of the actual mechanics of Operative Surgery, but he was pragmatic in his use of these techniques (see Rutkow, 1993, p. 29; Wiltse & Pait, 1998, pp. 1904–1914; cf. also Scarborough, 2010, 235–260; Yannakopoulos–Salili, 2011; on Alexandrian and Byzantine Medicine, see also Fournier, 1933; Geroulanos, 2007, pp. 129–134). He postulated that dislocation of the hip cannot be healed permanently, due to the rupture of the *ligamentum teres*, the intra–articular round ligament that carries the vessels to the head of the femur. He knew how to reduce the dislocation but believed that due to the rupture of the ligament a relapse was always possible. He thought that the ligament was holding the head of the femur in the *acetabulum*. Interestingly enough, the *Encyclopedia Britannica* has still much the same opinion (cf. *Encyclopedia Britannica*, 2006, p. 995: s.v. «Joints and Joinery»)! The observation and description of all these parts of the human body could not have been performed without a systematic *post mortem* examination. Unfortunately, his many treatises have been lost. However, about his knowledge several authors have left written evidence like: Bakcheios of Tanagra, Hērakleidēs of Erythraia, Apollōnios Mys, Aristoxenos, and many others. That is how we know so much about him and his significant discoveries.

Hērophilos' School and Students: From his students many continued his work, and illnesses like Ascites, Diabetes, Goiter, as well as many other Gynaecological Diseases were enlightened by them. Eudēmos became a famous Anatomist and Neurologist. He is mentioned by Galēnos [see *VIII*: 212] and Oreibassios. Hēgētōr is considered by Galēnos [see *VIII*: 955] as a Surgeon. Another famous Surgeon of this School was Apollōnios Mys, who wrote 31 books on Medicine including Surgery. Other students wrote different medical books, e.g.: Dēmētrios of Apameia twelve books; Kallimachos (a relative of Hērophilos) a *Compendium*; Kallianax a book with *Questions and Answers*; Bakcheios of Tanagra and Kydias commented on the *Hippocratic Corpus*; Chrysermos (the teacher of Hērakleidēs) wrote a book on *Pulsations* and Dioskoridēs Phakas wrote 21 medical books. Zēnōn worked mainly on Anatomy and Pharmacology; Hērakleidēs commented on the *Books on Epidemics* by Hippokratēs; Andreas of Karystos, another famous Physician who is depicted in Dioskoridēs' renowned book *De Materia Medica*, wrote at least 3 more books. Zeuxis and Alexandros Philalēthēs made out of the School of Hērophilos a real legend. Kleophantos of Kea, probably a brother of Erasistratos and a student of Hērophilos, founded his own School. Gaïos and Dēmosthenēs (also surnamed *Philalēthēs*) became Ophthalmologists, who performed cataract– and other eye–operations. Philinos of Kōs founded the Empirical School and Mantias is considered by Galēnos as a major Pharmacologist of his time. From the surviving texts of the School of Hērophilos one can conclude that Hērophilos himself had a deep knowledge of Surgical Pharmacology, Wound Surgery, Orthopaedics, Operations' Techniques; he also applied modern gynaecological and obstetric methods.

Figure 10: [L] Wall relief from Deir ʾel-Medinah, showing a birthing room with the pregnant lady delivering her newborn, while squatting on bricks, allowing gravity to assist her (after Bouwer, 2012, p. 178, fig. 41).
[R] Hellenistic surgical instruments from the G. Tsolonidēs' Collection at the Benaki Museum, Athens, Hellas.
On ancient surgical instruments, see Bliquez, 1984, pp. 187–204; Milne, ²1970; Schöne, 1903, pp. 280–284.

Erasistratos: The other major Alexandrian Physician was Erasistratos. He flourished in *c.* 250 BC. He was born in the town Julia on the Island of Kea. His father, Kleombrotos, was a Physician and his mother, Krētoxenē, was sister of the famous Anatomist Mēdios. He studied Medicine in Kōs. His teachers were Chrysippos of Knidos, Mētrodōros and Theophrastos. His brother Kleombrotos was also a Physician and probably the above–mentioned Physician Kleophantos, student of Hērophilos and founder of his own school, was also his brother. Erasistratos became famous for his writings (after the Byzantine *Lexicon of Souidas*). He wrote apparently nine books, unfortunately all lost. However, at least twelve titles of his books have survived: two on Anatomy, two on causes of diseases, three on fevers, three on abdominal diseases, one on Gout, one on deadly illnesses, and one on Paralysis and Paresis. Many other titles survived, but these could have been only titles of chapters from his books. His main field was (like Hērophilos') Anatomy and Physiology. Erasistratos is considered as the Father of Experimental Physiology. He experimented a lot and operated on criminals condemned to death. Strong pain–killers, like opium, were already available and were administered during his operations [see Celsus, *On Medicine* I: *Proœmium*, 23 (cited by Rutkow, 1993, pp. 29–30): «Hērophilos and Erasistratos proceeded by far the best way: they cut open living men–criminals they obtained out of prison from the kings and they observed, while their subjects still breathed, parts that nature had previously hidden, their position, colour, shape, size, arrangement, hardness, softness, smoothness, points of contacts and finally the processes and recesses of each and whether any part is inserted into another or receives the part of another into itself»].

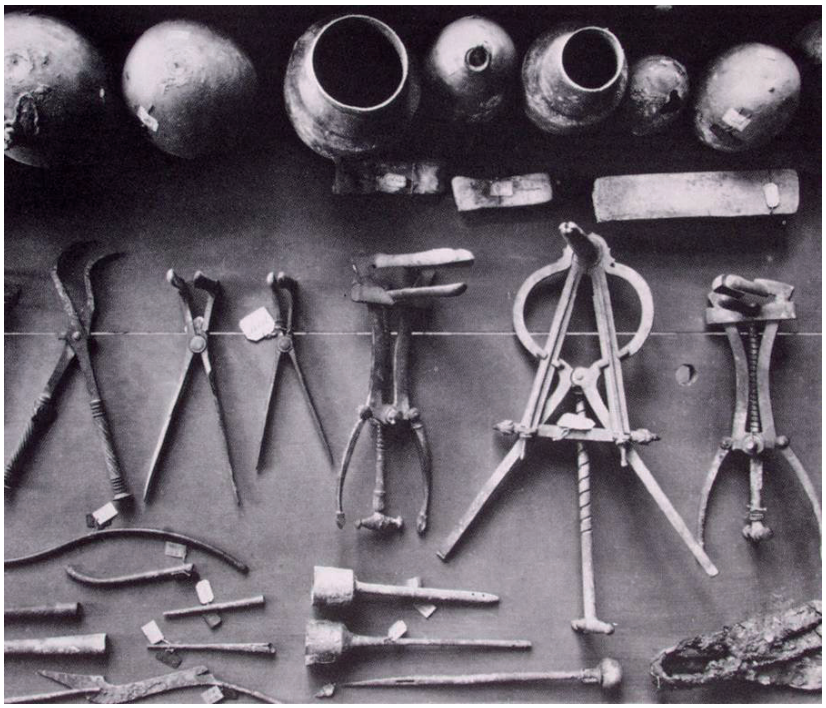


Figure 11: Roman Surgical instruments from the so–called *House of the Surgeon* in Pompeii (before 78 AD). On the top copper cupping–glasses are depicted, in the middle forceps, two anal (endoscopes) and three vaginal *specula* (metroscopes). On the bottom, we see different catheters, trocar, drainage needle and on the right a pair of scissors.

This information of Celsus (see Celsus, *On Medicine*, I: 23; for a complete study, see Spencer, 1935-1938) concerning both, Hērophilos and Erasistratos, is however not duplicated. They definitely used corpses of executed criminals for dissection. However, if these body–openings were actual operations under painkillers or vivisections is (after this passage of Celsus) not absolutely clear. The accurate observations of Erasistratos were extended to the structure of the brain, the intra–thoracic and intra–abdominal organs as also to the vascular system. He described the brain, its gyri and its nerves, with special emphasis on the *nervus acusticus* and the *nervus opticus*. As also Hērophilos, Erasistratos differentiated between sensory and motoric nerves, described the heart and the heart valves, the trachea and the epiglottis and explained its function, the bronchial tree and the bronchial arteries, the lymphatic vessels and the lymph nodes. He also related Ascites to a hard liver (Liver Cirrhosis). However, he mistakenly thought that the seat of the soul was the cerebellum. He was renowned for his abdominal operations, for his drainage of empyemas, and for the treatment of urethral strictures with an S–shaped catheter (see Rutkow, 1993, p. 29). In order to reduce post–operative infections Erasistratos placed the hands before surgery in vinegar. Today we know that the polyphenoles, included in wine or vinegar, are extremely good antiseptics. One part of wine in nine parts of water kills in less than four hours *Escherichia coli*, *Salmonella typhimurium* and *Vibrio choleræ*, disinfecting in this way the drinking water. In case of urine retention, he considered the placement of a catheter in the bladder of life–saving importance. He also used a pessary for the prolapsed uterus. Erasistratos was also the discoverer of the blood circulation. He believed in the connection of the arteries with the veins through invisible small vessels, today's *capillaries*, which he described in the lungs and suspected them in the periphery. He described that blood was circulating in the veins, but in the arteries *pneuma*. Unfortunately, the word *pneuma* was wrongly translated in Latin with *air*. Thus, all the following generations of Western scholars thought and still think that the Ancients believed that air was circulating in the arteries. However, *πνεῦμα* derives from the Hellenic words: *πνέω* and *αἷμα* = *air* and *blood*, i.e.: *blood* mixed with air and not air alone! In the Hellenic Language *pneuma* has several meanings as other words too. This is not uncommon. *Loghos* (*λόγος*) has for example 80 different meanings. Its meaning is varying from the term *word*, the term *reason* … to the *Word of God* (i.e.: Christ as the incarnated Divine Word and 3rd Person of the Holy Trinity). *Pneuma* stands, still today, for *air*, *wind*, *breath*, *blowing*, *spirit*, *ghost*, the *Holy Ghost* (*Ἅγιον Πνεῦμα*), *intellect*, *wit*, *genius*, *mind*,

and most probably in Antiquity also for *arterialized blood*. *Ana–pnoē* means *breath*, *pneusis* means *breathing*, *pneumōn* the *lung*, *pneumonia* the *infection of the lungs*, and *pneuston* is a *brass* or other *wind musical instrument*. Erasistratos puts it clearly that when the *pneuma* stops reaching the brain we cannot think any more and we die. *Pneuma* can better be compared in English with the word *spirit*; *inspiration* that stands for both: *breathing in*, but also for *being inspired*. Erasistratos even postulated that the «atoms» of the body, the smallest unities of the body, the *cells* of today, required *pneuma* from the inspired air in order to live and to be activated.

5. Ancient Alexandrian Surgery: Subspecialties and Surgeons.

The major progress in Anatomy and Physiology in Alexandria changed the whole philosophy and practice of Medicine. However, the big beneficiary of the huge expansion of the anatomic knowledge was Surgery. From a mainly trauma– and wound–care Surgery of the Hippocratic School, a more operative Surgery was developed. Unfortunately, no major texts of these Surgeons have reached us and we have to gather our knowledge about Hellenistic Surgery by referring to authors of the Helleno–Roman, Byzantine or Arabic Periods. However here we have three major authors' groups respectively that beautifully illustrate the surgical knowledge of the Hellenistic Period. Unfortunately, they all lived much later.

1. Aulus Cornelius Celsus: Celsus, a Roman citizen, was born approximately in the year that Alexandria fell in the hands of the Romans (30 BC) and he died around 50 AD. He was not a Physician but an Encyclopaedist. He collected the knowledge of his time in a major series of books called *The Art*. Of this major *Engyklopaideia* only 8 books survived which are all about Medicine (*De Medicina*). Two of these books are dedicated to Wound– and Bone–Surgery. These two books are by far the best collection, illuminating the Alexandrian Surgery. Here he describes many 1st Century surgical procedures including the removal of a cataract, treatment for bladder–stones and the setting of fractures. These two books were written 30-50 years after the Fall of Alexandria. However, during Celsus' era, and up to 642 AD, Alexandria continued to be the centre of knowledge of the whole Roman Empire. Celsus' works contain detailed descriptions of the symptoms and different varieties of fever. He is credited with the recording of four of the cardinal signs of inflammation: *calor* (warmth), *dolor* (pain), *tumor* (swelling) and *rubor* (redness and hyperaemia). However, as was said before, he was not a Physician. He must have copied them from a Surgeon of his time, most probably an Alexandrian one. The fifth cardinal sign of inflammation, the *functio læsa* (loss of function), is credited to Galēnos. Celsus also goes into great detail regarding the preparation of numerous ancient medicinal remedies, including the preparation of opioïds.

2. Galēnos of Perghamos: He is the second author who refers to the Alexandrian Surgery. He lived between *c.* 130 and 200 AD and wrote 300 books. Of these treatises approximately 120 have survived. Galēnos often refers to Alexandrian Surgeons. He particularly liked attacking them, especially when he was of a different opinion. He is considered as the greatest of the ancient Hellenic Physicians and his works influenced, for more than 1300 years, Roman, Byzantine, Arabic and Western Medicine. He contributed greatly to the understanding of numerous scientific disciplines, including Anatomy, Physiology, Pathology, Pharmacology and Neurology, as well as Philosophy and Logic. Galēnos was a highly skilled Surgeon, and he performed several surgical operations on human patients, including simple ones, like *venæ sectio* and bloodletting, then unknown in Rome. Many of the procedures and techniques that he utilized would not be used again for centuries. Of particular note are procedures that he performed on patients' brains and eyes. In order to correct cataracts in patients, Galēnos performed an operation that was similar to what is performed by contemporary Ophthalmologists. Using a needle–shaped instrument, he attempted to remove the cataract from behind the lens of the eye.

Figure 12: Pincer with finger–like ending, engraved with the latinized name of its Hellenic maker ΑΓΑΘΑΓΓΕΛΟΣ.

3. Paulos of Aighina: The third one is the Byzantine Scholar Paulos of Aighina (*c.* 625-690 AD). He lived 700 years after the conquest of Alexandria by the Romans and was also there when the Copts of Alexandria opened the doors of the fortification of Alexandria to the Arabs in 642 AD. Paulos' major offer to the Alexandrian Surgery is that he is not only describing the exact techniques, but he is citing the original texts too, as also the author that first described them. His book on Surgery is not only a masterpiece because of the detailed description of the surgical methods, but also a unique example for his medico–historical exact citations. Together with Sōranos of Ephessos, Oreibassios and Aetios of Amida (on Oreibasios, see Molinier, 1851-1876; for Aetios, see Ἀέτιος Ἀμιδηνός, 1534), who also cited with exactitude, we are offered through his works some very accurate information about many Surgeons who lived centuries before, as also about their surgical techniques and tools. Paulos described the following Operations in Ophthalmology: **1.** Blepharotomy; **2.** Blepharoplasty (in cases of Dystrichiasis or Lagophthalmous); **3.** Operations (in cases of Eyelid–Sty, Anabronchism, Chalazion, Pterygium, Hypopium). He also described the Cataract Operation very precisely, performed very similarly to both the ancient and the one used down to the 19th Century AD. According to him, at least 10 surgical instruments were used in Ophthalmology: **1.** *Βλεφαροκάτοχον* (Eye–Lid Retractor); **2.** *Βλεφαροδιαστολεύς* (Eye–Lid Opener); **3.** *Βλεφαροτόμος* (Eye–Lied Scalpel); **4.** *Βλεφαρόξυστον* (Scarifier); **5.** *Ἀναῤῥαφικὸν Σμίλιον* (Eye–Lid Knife); **6.** *Μηλωτίς* (Perforated Probe); **7.** *Ὀφθαλμοστάτης* (Eye Speculum); **8.** *Πτερυγοτόμος* (Keratome); **9.** *Πτῖλον* (Cilia Forceps); and **10.** *Βελόνη Καταράκτου* or *Παρακεντήριος Βελόνη* (Cataract Needle). At the University of Paris Sorbonne, starting from 11th July 1607 until the end of the 18th Century, all surgical texts (written by Paulos Aighinitēs) were, by special Decree of the Senate, obligatorily taught to the students of Medicine. Through the French (1820) and the English translations (1833-1846) of Paulos' work on Surgery, the knowledge of the Alexandrians and the early Byzantines was brought to Western Europe **[Fig. 19(L), 19(R)]**. As Rutkow pointed out (Rutkow, 1993, p. 4; on the transport of medical knowledge to the West, see Γερουλάνος, 2012, pp. 32–46): «Paulos intended his books to be a compendium of Hellenistic Medicine and succeeded in achieving his purpose»; and as Adams noted [cf. Adams, 1846: Editor's Preface to the 1st Edn. of Paulos Aiginētēs' translation of 1833; Ibn Sinna (Avicenna: *c.* 980-1037 AD) referred to Paulos Aighinitēs too, thus whether based on Galēnos or not is yet not fully examined]: «However he never thought that he would influence the entire Surgery for more than 1100 years […] Paulos belongs to these unfortunate writers to whom posterity has not done justice».

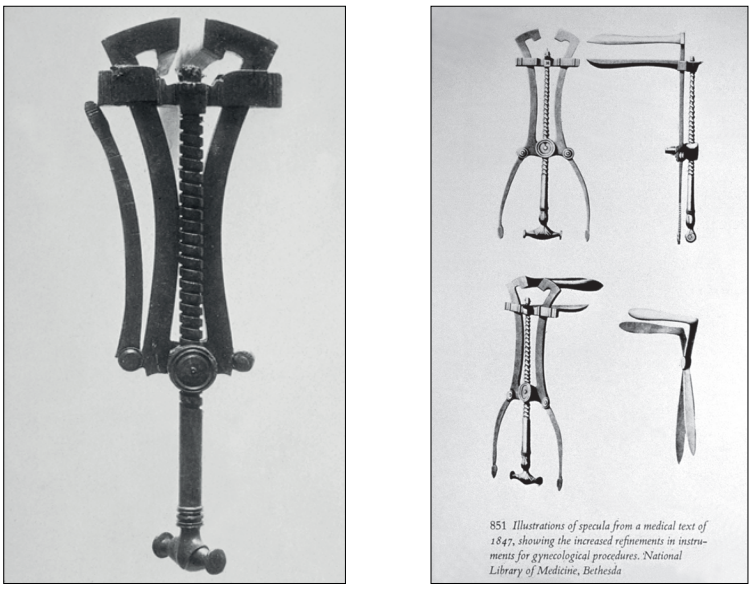


Figure 13: Two vaginal *specula*, with 2000 years of difference, identical to the ones from Pompeii.
On the left from the Asklēpieion of Dion (Macedonia, Hellas, 2nd Century BC).
On the right from a German textbook of 1847 [cf. Παντερμαλής, 1999; Lyons & Petrucelli, 1987].

Archaeological excavations have also brought evidence of huge amounts of extremely refined surgical instruments **[Fig. 10(R)]** or depictions of instruments **[Fig. 8(L)]** correlating to the written sources. All this helps us to make a more accurate picture of the Alexandrian Surgery in its entire spectrum. A major treasure trove is also the *House of the Surgeon* in Pompeii (78 AD). There hundreds of surgical instruments were found **[Fig. 11]**, some of which bear on them the name of their maker, e.g.: Agathaggelos **[Fig. 12]**. This instance is recorded about one hundred years after the Fall of Alexandria in the hands of the Romans (30 BC), but they absolutely reflect the knowledge and the spirit of their Alexandrian predecessors **[Fig. 13]**.

Surgical Subspecialties: As Surgery was still part of Medicine, more or less all Alexandrian Schools were practicing it. However, in his introduction to the *7th Book on Surgery*, Celsus tells us that during the Alexandrian Era, Surgery was separated from the rest of Medicine and since this time we have also Surgeons as Teachers and Surgical Authors: «And later, when Surgery was separated from the rest of Medicine, it started to have its own Teachers. In Egypt the influence of Philoxenos was very strong. He wrote a very accurate book in several volumes on Surgery. But also Gorgias and Sōstratos and the two Apollōnii and Ammōnios from Alexandria and very many other famous Medical Doctors made important discoveries. Also, in Rome there were some major Teachers in Surgery like Tryphōn the Father and Euelpistos. But if we look at their writings, the greatest of all was Mēgēs **[Fig. 18]**, who together with the others have added a lot to their discipline and changed it for the better» (see Celsus, VII, *Proœmium*, 3; for a complete study, see Spencer, 1935-1938).

During the Alexandrian Era the development of refined instruments and very specific machines, gave also impetus to the development of specialized surgical tools. The development of new instruments and machines was so immense that the surgical specialty was for the first time divided into two major subspecialties: the *Surgeons* (*Χειρουργοί*) and the *Orthopaedists* (*Ὀργανικοὶ* or *Μηχανικοί*). The translation of the words *Ὀργανικοὶ* and *Μηχανικοὶ* into *Orthopaedists* is not absolutely correct but corresponds best to the job these sub–specialized Surgeons were performing, i.e.: reposition dislocations of joints or fractures of bones with the aid of specialized machines. The development of these new machines, the *orghana* (*ὄργανα*) was something very specific for the Hellenistic Period, although already Hippokratēs described some early forms of them, as e.g.: the *skamnos*, the *ambē* or *bathron* (i.e.: the «extension bench») of Hippokratēs **[Fig. 14(L)]**.

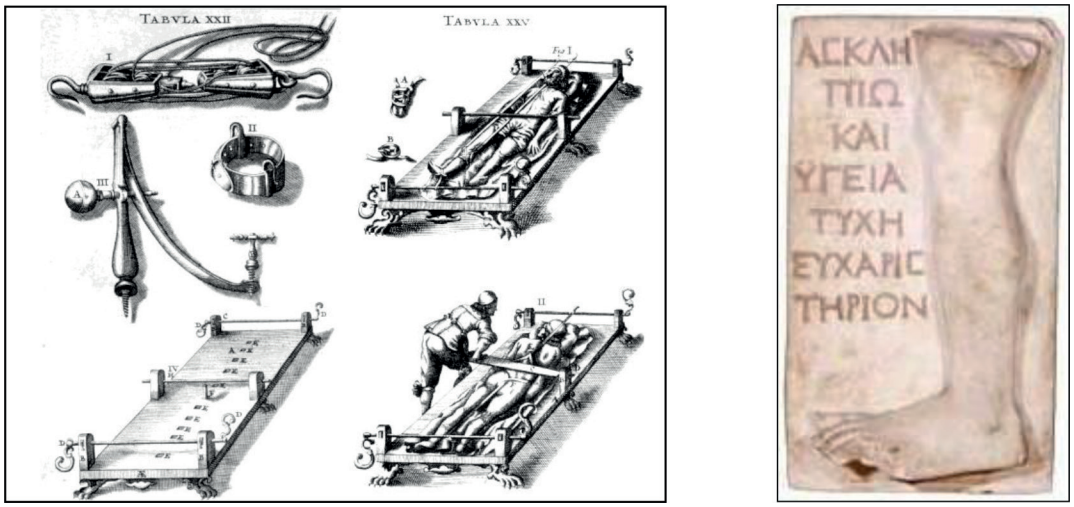


Figure 14: [L] The Hippocratic bench as was modified by Aristōn the Senior and is still in use. Design from the J. Scultetus' *Armamentarium Chirurgicum* of 1653. From Em. Prof. Dr S. Geroulanos' private collection.
[R] Typical dedicatory stele (depicting the healed foot) of an ancient patient, to Asklēpios and his daughter Hygieia–Tychē, as thanksgiving for his recovery. Such stelae have been found *en masse* in various Asklēpieia in Hellas and other (Mediterranean) sites.

The surviving texts speak very often of *Mechanical Surgeons* (*Μηχανικοί*). Andreas (3rd Century BC), Nileus (3rd Century BC), Molpis (2nd Century BC), Prōtarchos (2nd Century BC), Nymphodōros (2nd-1st Centuries BC) and Apollōnios of Thēra were renowned Mechanical Surgeons (Orthopaedists). However, in the same time — as was already mentioned

above — we read also of Surgeons, who were called *Ὀργανικοί* (*the ones using apparatuses*, i.e.: *ὄργανα*). Some of them like Apollōnios Orghanikos, were even famous in this very specialty. Others like Hērodotos, Aristiōn Senior, Passikratēs, Aristiōn Junior, Amyntas, Perigenēs and Hērakleidēs of Ephessos, were classified as *Orghanikoi*, without obtaining the related nickname like Apollōnios.

Unfortunately, today we cannot distinguish between Surgeons named *Μηχανικοὶ* and the others called *Ὀργανικοί*. The sources are unclear and often contradictory, and a bigger confusion is created as Hēliodōros in the 1st Century AD says that the *Μηχανικοὶ* were not Physicians but the *Ὀργανικοὶ* were indeed Surgeons. Oreibassios (*c.* 320-400 AD) again — school–colleague and friend of Julian the Apostate — writes: «Apellēs and Archimēdēs were not Physicians, but *Μηχανικοί*, who invented the *ὄργανον*, i.e.: the machine that lifts the boats with the mechanical power and not with the power of hands. The Physicians of this era reduced the size of the *ὄργανον* and made this *τρίσπαστον* (= tri–partite apparatus): a medical extension instrument for the reduction of the dislocations of the joints and the fractures of the bones» (see Oreibassios, *Coll. Med.* XLIX, 23; for a complete study, see Molinier, 1851-1876). We do hope that future research will be able to clarify the current situation and distinguish the difference between these two classes.

Famous Surgeons: Between the foundation of Alexandria in 331 BC and its fall into the hands of the Romans in 30 BC, several hundreds of Physicians are known of which at least 44 are declared since the Antiquity as Surgeons **[Table I]**. Of the known ones, twelve lived during the 3rd Century BC, 7 during the 2nd Century and 12 during the 1st Century BC. Another 13 Surgeons are also known, but we do not know the exact time they lived.

Table I. Alexandrian Surgeons (after Geroulanos & Maravelia, 2012-2014, p. 245, Tab. I)
3rd Century BC
Andreas of Karystos, Apollōnios of Memphis, Aristogenēs of Knidos, Bakcheios of Tanagra, Kleophantos of Kea, Molpis of Taras, Neilos or *Nileus, Nymphodōros, Philinos of Kōs, Prōtarchos of Alexandreia, Stratōn the Erasistratian* and *Xenophōn of Kōs* alias *Alexandrian.*
2nd Century BC
Amyntas of Rhodos, Dēmētrios of Apameia, Glaukias of Taras, Mantias, Philoxenos of Alexandreia, Ptolemaios and *Tharseas.*
1st Century BC
Ammōnios Lithotomos (Urologist?)*, Apollōnios of Kition, Apollōnios Mys, Aretaios of Kappadokia, Aristos, Gorgias of Alexandreia, Hērōn, Leōnidas* or *Leōnidēs of Alexandreia, Mēnodōros, Sōkratēs, Sōstratos* and *Zōpyros.*
Of an Uncertain Era
Apollōnios Orghanikos (Orthopaedic?)*, Apollōnios of Thēra, Aristiōn Senior* and *Aristiōn Junior, Dionysos, Diophantēs of Lykia, Glykōn, Hēliodōros, Hērakleidēs of Ephesos, Hērodotos, Pasikratēs, Perigenēs* and *Soklēs of Attikē.*

To the ones listed in Table I (*supra*) one should add the names of *Asklēpiadēs of Proussa, Euelpistos, Hērakleidēs of Taras, Mēgēs of Sidōn, Tryphōn the Father*, who lived during the 1st Century BC, worked however mainly in Rome. Most — if not all of them — were probably at least partly educated in Alexandria.

Of the above Surgeons, the most famous was Andreas of Karystos who constructed a new machine for the reposition of dislocations and fractures. His portrait is depicted in the Byzantine copy of *De Materia Medica* by Dioskoridēs. Neilos made another apparatus for the reposition of hip dislocations called *plinthion*. This apparatus was later on ameliorated by Hērodotos and Passikratēs. Nymphodōros built also, for the same reason, an apparently even better one, naming it *glōssokomon*. Xenophōn of Kōs wrote a book on cancer and tried to classify cancer according to the anatomical localization, its form, its therapy and its prognosis. Dēmētrios wrote a Book on Obstetrics and Sōranos of Ephessos, the Father of Gynaecology, copied in his book, significant parts of the Book of Dēmētrios especially from the Chapter on *Dystokia*. On the other hand, Glaukias described the *empirical tripod* (see Section VI, *infra*). Mantias is also depicted in the Vienna

Dioskoridēs' manuscript and Galēnos cites his opinions on Tonsillectomy: «Tonsillectomy should be avoided at the time of the acute inflammation as a deadly *phlegmonē* can follow». Galēnos also mentions another Surgeon, namely Tharseas, who used a so–called «Indian» plaster. Celsus cites Philoxenos, who apparently wrote an excellent *Book on Surgery* and Gorgias who worked and operated on umbilical hernias. Finally, Mēnodōros had removed compressed bones from the skull and Ammōnios got the surname *Lithotomos*, the *Stonecutter* (i.e.: the early name for Urologists). He clearly states that big stones of the urinary bladder had to be trimmed before extraction. If not, the danger to injure the perineum would be extremely high.

Figure 15: Reposition of a bilateral *Mandibula Luxatio*; two reductions of Shoulder Dislocation; two repositions of a Hip Dislocation; left a *Luxatio Suprapubica* in the middle a *Luxatio Ischiadica*. On the lower left reposition of a lower Leg Fracture. Dating from an 11th Century Byzantine copy **(***Nikētas Codex***)** of the commentaries of Appolōnios of Kition on the book of Hippokratēs *Peri Arthrōn* **(***Codex Laurentianus LXXIV*, Bibliotheca Laurentiana, Florence).

However, the greatest book that has survived from these times is the 9th Century Byzantine copy of the commentary of Apollōnios of Kition (1st Century BC), about the work of Hippokratēs *Peri Arthrōn* (see e.g.: Βοσκός, 2007, pp. 96–293, 344–565; on Byzantine Hospitals and Medicine, cf. Σκαμπαρδώνης *et al.*, 2012, pp. 47–60). This book, housed today in the Bibliotheca Laurentiana in Florence, deals with dislocations of all possible joints. The illuminations are of a unique quality and most of the methods described are still valid today **[Fig. 15-16]**. Apollōnios mentions that he had learned some of these methods from Zōpyros, who was practicing in Alexandria.

Unfortunately, no other major surgical book has survived from these times. However, innumerable names of Surgeons, operation techniques, and surgical instruments that date back to the Alexandrian Surgery are named or described by Hellenic, Roman, Byzantine, Hebrew and Arabic authors **[Fig. 23, 25]**. Here a huge field is open for serious research; it requires though, next to English or German or French, a good knowledge of Hellenic, Latin, Arabic and Hebrew, a combination that is nowadays extremely difficult. The best translations of Arabic or Hebrew books on Medicine are in Latin, but

unfortunately with the medical knowledge of the Medieval Period they present many misinterpretations. One must return to the originals, in order to perform a serious study. Translations in other languages are unfortunately only of superficial help, as most of them are for exact research either biased or inaccurate, or even secondary translations from Latin.

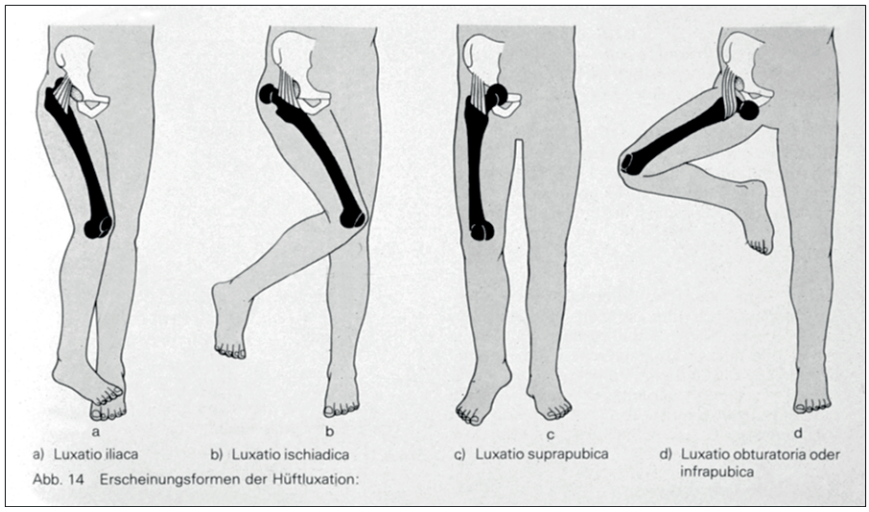


Figure 16: The four different dislocations of the hip (from a modern German textbook on Orthopaedics). Compare the position of the right foot in (c) showing a slight rotation towards outside and the shortening of the leg, with the similar position of the leg and the foot in the Byzantine manuscript [cf. **Fig. 15**].

6. The Principal Alexandrian Schools of Medicine.

As old knowledge was put in question by the new discoveries in Anatomy, Physiology and consecutively in the rest of Medicine, major related discussions emerged. Even Hippocratēs' writings were challenged. The result was that different Schools appeared that would last for centuries after, namely the following: The Empirical School, the Erasistratos' School and the Dogmatic School. After the 1st Century even more Schools were founded, such as the Methodical, the Pneumatic and the Eclectic Schools; the last two Schools were actually an evolution of the older Dogmatic School.

The Empirical School: It was created by the disciples of Hērophilos, with Philinos of Kōs (3rd Century BC) on the top. The Empirical School was based on *ἐμπειρία*, i.e.: *experience*. Empiricists emphasized the importance of physical practice and experimentation, or «active learning». Glaukias, for instance, from today's Taranto (2nd Century BC), who was Philinos' disciple and successor, formulated the so–called *empirical tripod*. This tripod was based on three main pillars: *perception* (*αἴσθησις*), *experience* and *practice* (*πεῖρα*) and *inspection* or *autopsy* (*αὐτοψία*). However the *knowledge of others* (*μετάβασις τοῦ ὁμοίου*), which could be applied in a new case was also considered extremely precious. After Celsus (see Celsus, VII, *Proœmium*, pp. 40 ff; for a complete study, see Spencer, 1935-1938), the Physicians of the Empirical School were excellent Surgeons and — except Phillinos and Glaukias — we do know Kleophantos of Kea (3rd Century BC), Hērakleidēs of Taras (1st Century BC), Zōpyros (1st Century BC) and Apollōnios of Kition (1st Century BC), who were also famous Surgeons and belonged to this same ancient School.

The Erasistratos' School: The students of this Medical School, the *Erasistratians*, continued the work of their Teacher in both Anatomy and Physiology. They formed somewhat of a middle ground between the Empirical and the Dogmatic Schools. They were not as experimental as the Empiricists, nor as theoretical as the Rationalists of the Dogmatic School. They mainly used pure observation and showed greater interest in studying the natural course of ailments. They were making less effort to find new remedies. Their School was highly interested in Surgery and there is important proof that they were skillful Surgeons too. Several Physicians are thereby mentioned, like Stratōn (3rd Century BC), Ptolemaios (3rd/2nd Century BC), Philoxenos (2nd/1st Century BC), Mēnodōros (1st Century BC), and others. For the first time in the History of Medicine the word *surgeon* (*χειρουργός*) is *expressis verbis* used for a Physician and in particular for Ptolemaios.

Figure 17: *Fœtus in utero*: from a 10th Century manuscript in Latin, based on writings of Sōranos of Ephesos (dating from the 1st Century AD). His writings on Gynaecology and Obstetrics were considered authoritative for many centuries.

The Dogmatic School: Later on, both Hērophilos and Erasistratos and their followers were included in the Dogmatic School. This was probably done by the followers of the Empirical School who included all other Physicians that — following the Aristotelian thinking and the Stoa — were trying to interpret medical problems with the logic/reason and not with practical experience. They were named *Λογικοὶ* from *Λόγος* (*loghos* = *word*, *dogma*, *logic*). Later even Hippokratēs, together with his sons, Thessalos and Drakōn, his son in law Polybos, and even Dioklēs of Karystos, were considered to belong to the Dogmatic School, although they had preexisted the founding of that School. It seems as if all Physicians that did not belong to the Empirical School were thrown into the Circle of the Dogmatic School, because they were interpreting medical problems with Hippocratic, Platonic or Aristotelian theories. This School was mainly interested in Semiotics, Etiology, Physiology, Hygiene, Therapeutics and also Pharmacology. However their devotion to Anatomy made them also strong in Surgery.

The Methodic School: Two centuries later, during the 1st Century BC, the Methodic School appeared. This School was founded by Themisōn of Laodikeia, a student of Asklēpiadēs of Proussa (1st Century BC), who is well known for his description of Tracheotomy, and a successful resuscitation in the *Via Apia* in Rome. Followers of the Methodic School mainly utilized pure observation like the Dogmatists. They showed a greater interest in studying the natural course of ailments, and again making fewer efforts to find new remedies. The Methodists formed somewhat of a new middle ground. The most famous follower of this School was Sōranos of Ephessos, who is considered today, thanks to his *Compendium* on Gynaecology and Obstetrics, as the «Father of Gynaecology» **[Fig. 17]**.

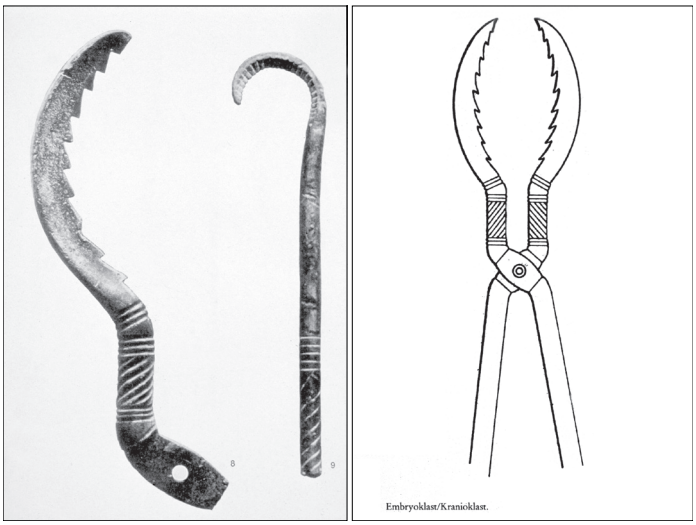


Figure 18: On the left, part of embryo– or cranio–clast of Mēgēs of Karystos, dating from the end of the 4th Century BC and foetal hook, most probably from the same manufacturer. On the right reconstruction of the embryo–clast.

The Pneumatic School: It is considered to have been founded by Athēnaios of Attaleia (1st Century BC - 1st Century AD). However, the basic doctrine of the School, which considered *pneuma* as the central principle of life and that without *pneuma* no life could exist, preexisted already since the 3rd and 2nd Centuries BC. Thanks to the Pneumatic School this theory survived long after the Medieval Era. After the discovery of the importance of Oxygen (1777 AD) for the respiration by Antoine Lavoisier (1743-1794 AD), the *pneuma*–theory is again very close to our patho–physiological thinking, as it puts in the centre of Physiology the blood enriched with air (today's Oxygen). Aretaios of Kappadokia, Archigenēs of Apameia, Rufus of Ephessos and the famous Surgeons Leōnidas, Hēliodōros and Antyllos (who successfully performed and described Aneurysmectomies), belonged to this School. In their treatises we find descriptions of ligatures of arteries and veins, of improvements in Herniorhaphy and urinary tract Lithotomy. They describe Tracheotomy, intubation of the larynx, resections of the lower jawbone, amputation of the breast (for breast cancer), plastic operations of the breast, excision of the ribs and transplantation of rib cartilage for plastic reconstruction of the nose and the ears, as well as many more.

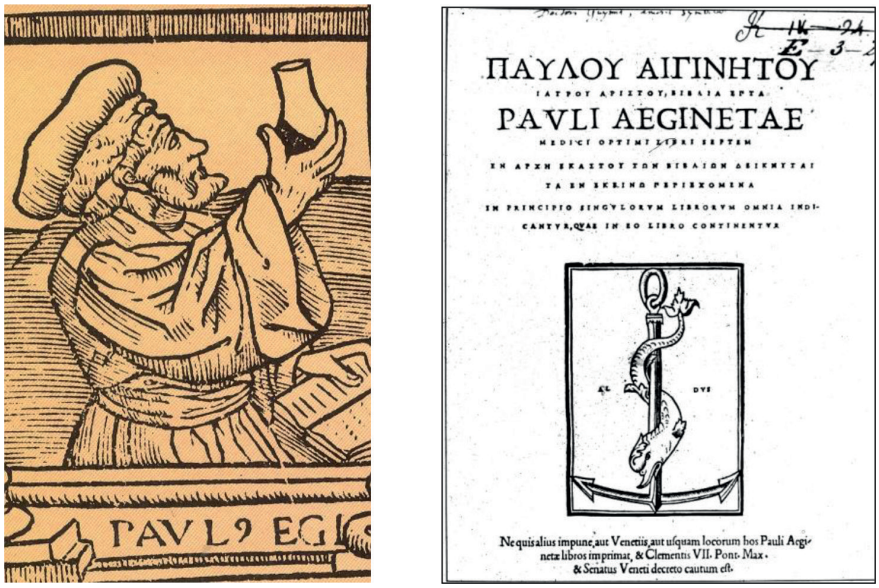


Figure 19: [L] Representation of Paulos Aighinitēs, to whom Avicenna refers too, from Galēnos' work *Methodus Medendi vel de Morbis Curandis Libri Quatordecium* (Paris 1530): detail of the book's cover. **[R]** Frontspage of the 1st edition of the *Seven Books of Paulos* by the famous printer Aldus Manutius (Venice 1528), dedicated to Pope Clemens VII.

The Eclectic School: It was more or less a further development of the Pneumatic School, though with certain elements of the Empirical and the Methodic Schools. Some people call it the *Second Methodic School*. It started during the Helleno–Roman Period, after the Fall of Alexandria in the hands of the Romans. This School tried to collect all positive elements of the other Schools and to develop a new one more reconcilable. It is to be noted that again the members of the Eclectic School were also very active in Surgery. But, let us now pass briefly to Arabic/Islamic Medicine.

7. Arabic/Islamic Medicine and Ophthalmology.

This Section of the present paper will be shorter, since our study is already very extensive with its main topics being ancient Egyptian and Alexandrian Medicine. As there is no parthenogenesis in general and in Sciences in particular, Arabic/Islamic Medicine was firmly grounded on the achievements of the former generations of Medical Doctors (on Arabic Medicine, see Campbell, 1926; Khan, 1964, pp. 64-74). Since the empirical and magical methods of ancient Egyptian Medicine and the sublime scientific approach of Alexandrian and Hellenic/Hippocratic Medicine, the way was paved for more developments and achievements for the Arabic/Islamic Medicine. The fact that the Scholars and Medical Doctors of the East not only respected and translated earlier medical works **[Fig. 20]**, but also evolved them, enriching them with fresh knowledge and experience **[Fig. 24]**, was crucial for the further development of that discipline, whose purpose was also to save human lives and relieve human pain.

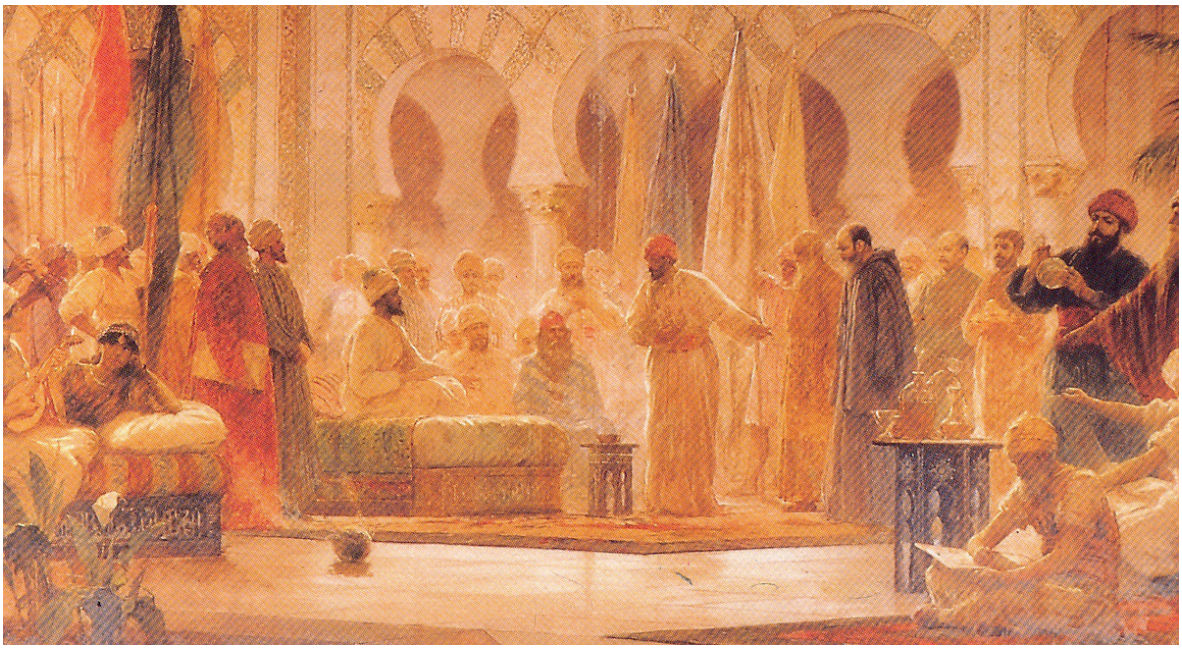


Figure 20: Painting of Dionisio Baixeras, depicting the arrival of the Monk Nikolaos from Kōnstantinoupolis, dispatched by the Emperor Kōnstantinos VII Porphyrogennētos in Cordoba, to translate Dioskoridēs in Arabic.
Aula, University of Barcelona.

Paulos' of Aighina 6th Book **[Fig. 19]**, dealing entirely with surgery, was taken almost word for word by Albucasis of Cordoba (936-1013 AD). Thus, nearly the entire body of Hellenic and Roman surgical knowledge was transmitted to the Islamic culture through Paulos' writings. Later, as Rutkow points out, when the writings of Albucasis **[Fig. 23]** were translated from the Arabic into Latin, during Middle Ages and the Renaissance, large sections of Paulos' works were incorporated into the writings of medieval surgeons such as Guy de Chauliac, forming part of the basis of early European Surgery. Albucasis stands very high on the pedestal of the History of Medicine. This 10th Century Innovator, from Andalusia, in modern Spain, produced a 30–Volume Compendium, including a 300 pages Treatise on Surgery. In it he described such advanced procedures as: the use of catgut for internal stitching, the removal of bladder stones using an instrument inserted through the urinary passage, Thyroidectomy and the removal of Cataracts.

The advances of Arabic/Islamic Ophthalmology were also remarkable **[Fig. 21(L), 22, 23, 24, 25]**. Medieval Islamic/Arabic and Persian Scientists (unlike their classical predecessors) considered it normal to combine theory and practice, including the crafting of precise instruments **[Fig. 23, 25]**, and therefore found it natural to combine the study of the eye with the practical application of that knowledge. An excellent collection of perfect replicas of such instruments is one of the spiritual jewels of the Museum for the History of Sciences in Islam, founded by the late and unforgettable Prof. Dr Fuat Sezgin, which together with the homonymous Foundation (I.B.T.A.V.) constitute a light–beacon of Research and an Educational Institute adorning modern Istanbul.

Figure 21: [L] An Arabic Manuscript titled *Anatomy of the Eye*, authored by ʾAl-Mutadibih (*c.* 1170-1199 AD). This manuscript, dated from *c.* 1200 AD, is kept in the Cairo National Library, Egypt**.**
[R] Muhammad Ibn Qassoum Ibn Aslam ʾal-Ghafīqi, (Spain, + 1165 AD): bust offered by the Municipality of Cordoba.

Ibn ʾal-Haytham, an Arab Scientist, wrote extensively on Optics and the Anatomy of the Eye in his *Book of Optics* (1021 AD). Ibn ʾal-Nafis, an Arab native of Damascus, wrote a large textbook (*The Polished Book on Experimental Ophthalmology*, divided into two parts: *On the Theory of Ophthalmology* and *Simple and Compounded Ophthalmic Drugs*). Prof. Dr J. Hirschberg, highlighting the achievements of Arabic/Islamic Ophthalmology said the following to an enthralled audience at the American Medical Association: «From 800-1300 AD the World of Islam produced not less than 60 renowned Eye Specialists or Oculists, Authors of Textbooks and producers of Monographs in Ophthalmology. Meanwhile in Europe prior to the 12th Century an Oculist was unheard of». Indeed, it was not until the 18th Century that the method of removal of cataract by a hollow needle was employed in Europe! Such were also the views of the late Prof. Dr Fuat Sezgin, whose monumental 5–Volumes' work on Sciences in Islam deals not only with Medicine, but with Astronomy, Mathematics, Geometry, Chemistry, Optics, Geology and Mineralogy, Geography and Cartography, as well as Warcraft (see Sezgin, 2003: with Introduction, Catalogue of the Collection of Instruments, Sciences, & c.; in five Volumes). With his work, this Scholar managed to re–enact the motto of J.–W. von Goethe that adorns his Sciences' Museum in Istanbul, denoting the unity between East and West, which is also used as one of the mottos of the Hellenic Institute of Egyptology, the symbol of which is the double lion of the horizon of the ancient Egyptians, combining West and East (death, yesterday, Osiris and darkness with resurrection, tomorrow, Rēᵉ and light): «Wer sich selbst und andere kennt, wird auch hier erkennen: Orient und Okzident sind nicht mehr zu trennen!» (von Goethe, J.–W.: *West–östlicher Divan*).

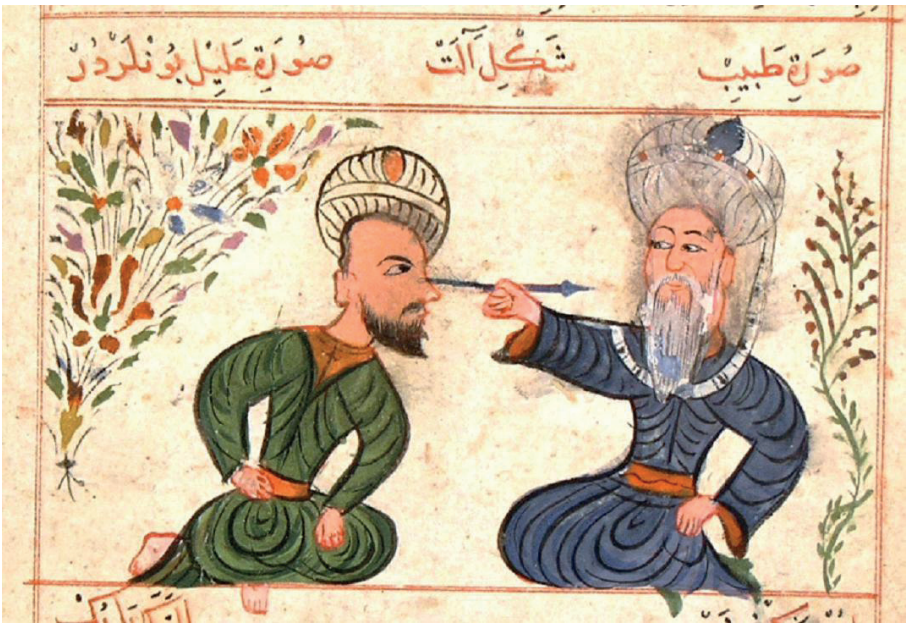


Figure 22: A Muslim Physician (Ophthalmologist) during an eye–treatment. Serefeddin Sabunçuoğlu, *Cerrahat 'al-Haniyye*, Millet Library, ᶜAli Emiri Tip: p. 79.

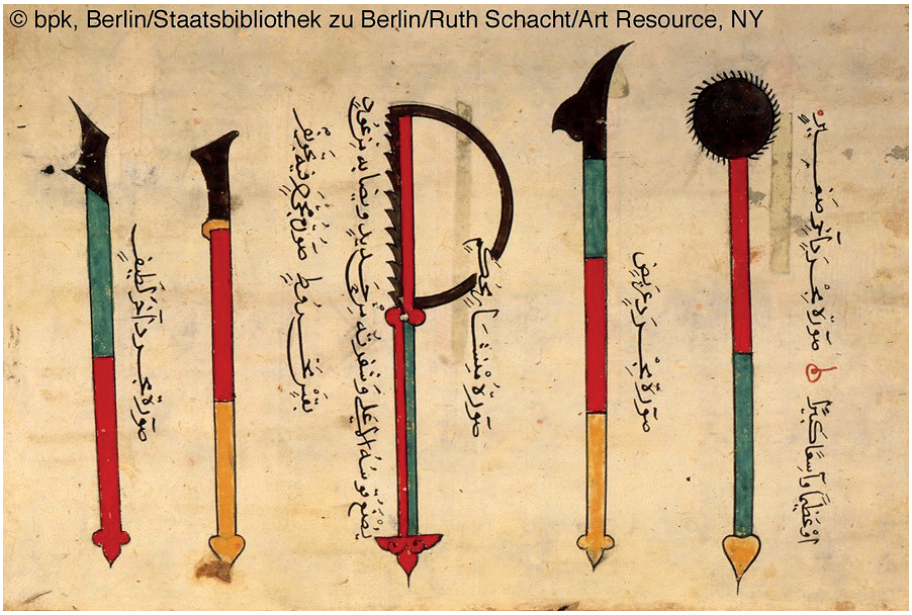


Figure 23: Arabic manuscript illustrating Albucasis' surgical instruments.

Furthermore, Muhammad Ibn Qassoum Ibn Aslam 'al-Ghafīqi, (Spain, + 1165 AD), wrote a book, during the 12th Century, called *'Al-Murshid fī 'l-Kuhl* (*The Right Guide in Ophthalmology*). It is not just confined to the Eye but provides details of the head and diseases of the brain **[Fig. 21(R)]**. Additionally, one of the outstanding classical works (*Memorial of Ophthalmology*) written by ᶜAli Ibn Isa (1000 AD) was compiled from Hellenic Sources, mainly the *Ten Treatises of the Eye* of Galēnos, where he added new knowledge. The earliest known medical description of the eye in the Islamic World comes from a 9th Century work by Hunayn Ibn Ishaq **[Fig. 21(L), 24]**.

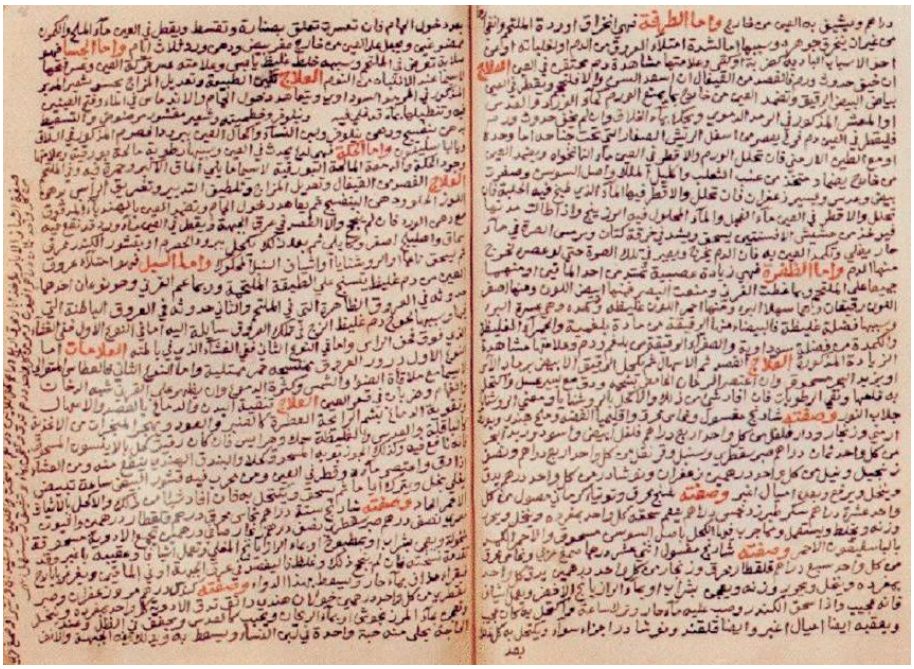


Figure 24: *The Result of Thinking about the Cure of Eye Diseases (Natijat 'al-Fikar fi 'Ilaj Amrad 'al-Basar),* written in Cairo by Fath 'al-Din 'al-Qaysi (+ 1259 AD / 657 H). Copy finished by an unnamed scribe on 16th November 1501 AD (5 Jumada I, 907 H): MS A48, fols 7b-8a.

Finally, Ibn 'al-Haytham (* 965 AD) was the first to explain that all vision was made possible because of the refraction of light rays. The work of Ibn 'al-Haytham was repeated and expanded upon by the Persian Mathematician Kamal 'al-Din 'al-Farisi (+ 1320 AD), who observed the path of light rays in the interior of a glass sphere, in order to examine the refraction of sunlight in rain drops. This led him to an explanation of the origin and of the mechanisms of the primary and the secondary rainbow.

Figure 25: Two pages from the original Manuscript of *'Al-Tasrif*, depicting Surgical Instruments.

Conclusion

«Magical» Medicine in ancient Egypt constituted a theoretical and experimental practical craft, or Proto–Science, which managed to advance ancient Medicine considerably, never attaining however the Domain of Pure Science, as Alexandrian Medicine did. No matter how great the ancient Egyptian culture was, it would be exaggerated and absurd to consider that there were enormous reserves of «hidden/secret knowledge», latent behind apparently naïve symbols, in the ancient Egyptian Medicine and Proto–Science. However, this imaginary view that begun to manifest already from the early centuries AD [i.e.: as soon as the ancient Egyptian language and its carrier–scripts (Hieroglyphic, Hieratic and Demotic) fell into oblivion] passed rather corrupt and transformed (through Hermetism and Horapollōn's *Hieroglyphica*), during the Middle Ages, into various Arabic and Hebrew *grimoires* that were translated into Latin; it also continued during the Renaissance and even later, reaching our modern world, where it revives among the circles of occultists, esoterists, freemasons, and suchlike. This fact is a characteristic paradigm of the tendency of many humans to mystify, to exaggerate, to deify and to imagine without any circumspection various unreal and unproven circumstances, being also an outcome of the (weak?) human nature that seeks aid for the daily issues — be they everyday–life–related or existential — from the heavens. Was there in Egypt any conflict between more magic/religion–oriented priests and the empirical practice–oriented Physicians? As noted, many of the text–sequences appear not magical at all, but indeed methodical. Was there, perhaps, in ancient Egypt a field of tension between magic and experience–based healing? All these questions need a more trans–temporal and inter–disciplinary approach, from the triple perspective of Historians of Medicine, Egyptologists and Islamologists/Arabologists too.

Alexandrian Surgery has reached — due to the freshly accumulated knowledge in both Anatomy and Physiology — a very high standard. Surgery was separated from the rest of Medicine. For the first time in the History of Medicine the term *Surgeon* has been used for a Physician (Ptolemaios) and the Antique writings provide evidence that several subspecialties existed indeed. There were «General» Surgeons, but also *Lithotomoi* (Urologists), *Mēchanikoi* and *Orghanikoi* (Orthopaedists), *Ophthalmikoi* (Ophthalmologists), as well as Gynaecologists and Obstetricians. Teachers in Surgery and authors of Surgical Books were also mentioned or praised. Operations like Aneurysmectomies, Tracheotomies, Strumectomies, the Seton Technique for anal fistulas and many other operations were refined or ameliorated. Orthopaedic extension beds or benches and other devices were created, and surgical instruments invented, ameliorated or refined. Surgical medicaments were collected from the newly conquered or other surrounding countries and greatly added to the Hellenic knowledge of that time. It looks as if the apex of Surgery was reached during this Hellenistic–Alexandrian Period, tremendously influencing Helleno–Roman, Galenic, Byzantine, Arabic, Hebrew and also Western Medicine. Interestingly, the Alexandrian Medicine looks as if it was surpassed only after the invention of Anaesthesia! Unfortunately, most of the writings of this glorious Period of recent Antiquity have been lost, to be able to prove with certainty this last statement.

The Mediterranean Basin has been a melting pot for ancient Egyptian, Hellenic, Hellenistic, Latin, Byzantine and Arabic Surgery, cross–fertilised through these different cultures. Through the writings of the Alexandrian and Byzantine authors and especially of Paulos of Aighina **[Fig. 19]**, the surgical knowledge of the ancient Hellenes from Antiquity to the early Byzantine era has been conserved, perfected and transferred to the surrounding cultures. Ancient Egyptian, Alexandrian and Byzantine surgical sources have initiated the Syriac, Persian, Arabic, Ottoman, Hebrew, Italian, and finally the Central European Renaissance of Surgery, considerably influencing even the surgical practice of the recent centuries. Surgical writings belong to the major fields that Alexandrian/Mediterranean Surgeons and Medical Doctors have conserved, perfected and transferred to the West.

The same is true with the significant contribution of innumerable famous Arabic/Islamic Medical Doctors, Scientists and Scholars. It is indeed time to start acknowledging the fact that medical and ophthalmological knowledge cannot remain secret over a long period. All Mediterranean cultures have implanted their own part in this very cross–fertilisation of surgical knowledge, whose most ancient foundations can be detected in the ancient Egyptian Medical Proto–Science

and whose scientific integrity was firstly met in the transcendence that Alexandrian Medicine has managed. As in other Sciences — in Medicine and Ophthalmology too — Islamic Culture has safeguarded ancient Egyptian and Hellenic Science, during a period of relative decline in Medieval Europe. What the Hellenes firstly presented, released from superstitious and magico–religious beliefs, and scientifically evolved, the Arabs and other Islamic–World Nations managed to safeguard and further develop, during a period of relative spiritual darkness falling upon the Medieval Europe. Ibn ʾal-Haytham, ᶜAli Ibn Isa, Ammar Ibn ᶜAli ʾAl-Mosuli, Zarrindast, Avicenna, and several others, were beacons for the Science and social function of Medicine in the Islamic World.

References

ᶜAbd ʾel-Maksoud, G. & ʾEl-Amin, ᶜA. ʾel-R. (2011). A Review on the Materials used during the Mummification Processes in Ancient Egypt. *Mediterranean Archaeology and Archaeometry*, 11, 129–150.

Adams, B. ([2]1998 [[1]1984]). *Egyptian Mummies*. Aylesbury.

Adams, F. (1846). *The Seven Books of Paulus Aegineta*. London: Sydenham Society.

Ἀέτιος Ἀμιδηνός (1534). *Τετράβιβλος*, Βενετία: Τυπογραφεῖον Ἄλδου Μανουτίου.

Aldred, C. (1987). *The Egyptians*, London: Thames & Hudson.

Allen, J.P. (2005). *The Art of Medicine in Ancient Egypt.* New York, New Haven & London: The Metropolitan Museum of Art & Yale University Press.

Aufrère, S. (1991). *L'univers minéral dans la pensée égyptienne: I: L'influence du désert et des minéraux sur la mentalité des anciens Égyptiens; II: L'intégration des minéraux, des métaux et des «Trésors» dans la marche de l'univers et dans la vie divine*. Le Caire: IFAO / *BiÉtud*, 105.

Avalon, J. (1927). *Imhotep, l'Esculape des Égyptiens*. Paris: Aesculape.

Bardis, P. (1967). Circumcision in Ancient Egypt. *Indian Journal for the History of Medicine*, 121, 22–23.

Baas, J.H. (1889). *Outline of the History of Medicine* (transl. by Henderson, H.E.). New York.

Bliquez, L.J. (1984). Two Lists of Greek Surgical Instruments and the State of Surgery in Byzantine Times. *Symposium on Byzantine Medicine* (Scarborough, J., ed.), *Dumbarton Oaks Papers,* 38, 187–204.

Blomstedt, P. (2014). Orthopedic Surgery in Ancient Egypt. *Acta Orthopaedica*, 856, 670–676.

BMD = Shaw, I. & Nicholson, P. (eds) (1996). *British Museum Dictionary of Ancient Egypt*. Cairo: AUC Press.

Borghouts, J.–F. (1973). The Evil Eye of Apophis. *JEA*, 59, 114–150.

Βοσκός, Α. (ed. & transl.) (2007). Ἀπολλώνιος Κιτιεύς: Περὶ Ἄρθρων Πραγματεία. *Ἀρχαία Κυπριακὴ Γραμματεία*. Λευκωσία: Ἵδρυμα Λεβέντη, 96-293 & 344-565.

Bouwer, D.S. (2012). *Ancient Egyptian Health related to Women: Obstetrics and Gynaecology* (MA Thesis). Pretoria: University of South Africa.

Breasted, J.H. (1980 [1930]). *The Edwin Smith Surgical Papyrus* I-II. Chicago: University of Chicago Press.

Bryan, C.P. (1930). *The Papyrus Ebers*. London.

Budge, E.A.W. (1971). Egyptian Magic. New York: Dover.

Campbell, D. (1926). *Arabian Medicine and its Influence on the Middle Ages*. London.

Cave, A.J.E. (1950). Ancient Egypt and the Origin of Anatomical Science. *Proc. Roy. Soc. Med*., 43, 568–571.

Chhem, R.K. & Brothwell, D.R. (2007). *Paleoradiology: Imaging Mummies and Fossils*. New York–Berlin: Springer Verlag.

Cocburn, A. & Cocburn, E. (1980). *Mummies, Disease and Ancient Cultures*. Cambridge: University Press.

Dawson, W.R. (1933). Studies in the Egyptian Medical Texts – II. *JEA*, 19, 133–137.

Dawson, W.R. (1934a). Studies in the Egyptian Medical Texts – III. *JEA*, 20, 41–46.

Dawson, W.R. (1934b). Studies in the Egyptian Medical Texts – IV. *JEA*, 20, 185–188.

Διοσκορίδης (1914). *Περὶ Ὕλης Ἰατρικῆς / De Materia Medica* (Wellmann, M., ed.). Berlin: Weidman.

Διοσκορίδης (1998). *Περὶ Ὕλης Ἰατρικῆς – Der Wiener Dioskurides: Cod. Med. Gr. 1* (Mazal, O., ed.) I-II. Wien: Nationalbibliothek.

Ebbell, B. (1937). *The Papyrus Ebers*. Oxford: Oxford University Press.

Ebers, G. (1875). *Papyros Ebers* I-II, Leipzig.

Ebeid, N.I. (1990). Médecine égyptienne au temps des pharaons. *Le Monde Copte*, 20, 7–14.

Ebeid, N.I. (1999). *Egyptian Medicine in the Days of the Pharaohs*. Cairo.

EG = Gardiner, A.H. (1988). Egyptian Grammar: *Being an Introduction to the Study of Hieroglyphs*. Oxford: Griffith Institute, Ashmolean Museum.

ʿEl-Daly, O. (2005). *Egyptology: The Missing Millennium. Ancient Egypt in Medieval Arabic Writings*, London: UCL Press.

Εὐτυχιάδης, Α.Χ. (2001). *Ἀρχὲς Φιλοσοφίας καὶ Ἱστορίας τῆς Ἰατρικῆς*. Ἀθήνα: Βῆτα.

Filer, J. (1996). *Disease*. Austin, TX: University of Texas Press.

Finch, J.–L., Heath, G.H., David, A.–R., & Kulkarni, J. (2012). Biomechanical Assessment of Two Artificial Big Toe Restorations from Ancient Egypt and their Significance to the History of Prosthetics. *Journal of Prosthetics & Orthotics*, 244, 181–191.

Forshaw, R. (2013). Hesyre the First recorded Physician and Dental Surgeon in History. In R. David (Ed.), *Ancient Medical and Healing Systems: Their Legacy to Western Medicine*. Manchester: Manchester University Press / Bulletin of the John Rylands University Library of Manchester, 181–202.

Fournier, R.L.P. (1933). *La médecine égyptienne: des origines à l'école d'Alexandrie*. Delmas.

French, R. (2003). *Medicine before Science: The Business of Medicine from the Middle Ages to the Enlightenment*. Cambridge: Cambridge University Press.

Fuchs, R. (1902). *Médecine grecque* [*Handbuch der Geschichte der Medizin* (Neuburger, M. & Pagel, J., eds), II], Jena: Fischer.

Γαληνός (1884-1893). *Scripta Minora* (Marquardt, J. *et al*., eds.). Leipzig: Teubner.

Gardiner, A.H. (1935). *Hieratic Papyri in the British Museum: 3rd Series* I-II. London.

Gardiner, A.H. (1938). The House of Life and the Master of the King's Largess. *JEA*, 24, 83–91.

Gardiner, A.H. (1955). *The Ramesseum Papyri*. Oxford: Oxford University Press.

Gardiner, A.H. (1964). *Egypt of the Pharaohs*. London: Oxford University Press.

Germer, R. (1979). *Untersuchung über Arzneimittelpflanzen im alten Ägypten* (PhD Dissertation). Hamburg: Universität von Hamburg.

Germer, R. (1991). *Mumien: Zeugen des Pharaonenreiches*. Zürich–München: Artemis und Winkler.

Germer, R. (2000). La momification. In R. Schulz & M. Seidel (Eds.), *L'Égypte: Sur les traces de la civilisation pharaonique*. Köln: Könemann, 458–469.

Geroulanos, S. (2007). Surgery in Byzantium. *Proceedings of the International Conference on "Material Culture and Well Being in Byzantium"*. Wien: Österreichische Akademie der Wissenschaften / *Veröffentlichungen zur Byzanzforschung*, Bd. XI), 129–134.

Γερουλάνος, Σ. (2012). Ἡ Χειρουργικὴ στὸ Βυζάντιο καὶ ἡ Μεταφορὰ τῶν Γνώσεων τῆς Χειρουργικῆς στὴν Δύση. *Δέλτος*, 42, 32–46.

Geroulanos, S. (2016). An Introduction to Alexandrian Medicine and Surgery. In N. Guilhou (Ed.), *Liber Amicorum – Speculum Siderum: Nūt Astrophoros*. Papers Presented to Alicia Maravelia. Oxford: Archaeopress / *Egyptology*, 17, 321–328.

Geroulanos, S. & Bridler, R. (1994). *Wund–Entstehung und Wund–Pflege im antiken Griechenland*. Mainz: P. von Zabern.

Geroulanos, S. & Maravelia, A.–A. (2012-2014). Alexandrian Medicine and Surgery: An Introduction. In A. Maravelia (Ed.), *Ancient Egyptian Science & Meta–Physics: Quintessence of Religious Allegories, Roots of Scientific Thought: Proceedings of the 1st Egyptological Conference of the Patriarchate of Alexandria: 6th May 2011 = Journal of the Hellenic Institute of Egyptology*, 2, 233–248. Athens: Hellenic Institute of Egyptology.

Ghalioungui, P. (1963). *Medicine and Magic in Ancient Egypt*. London.

Ghalioungui, P. (1965). *Health and Healing in Ancient Egypt*. Cairo.

Ghalioungui, P. (1987). *The Ebers Papyrus*. Cairo: Academy of Scientific Research & Technology.

Ghalioungui, P. (1993). *The Physicians of Pharaonic Egypt*. Mainz.

Ghalioungui, P., Khalil, S. & Ammar, A.R. (1963). On an Ancient Egyptian Method of diagnosing Pregnancy and determining Foetal Sex. *Med. Hist.*, 73, 241–246 & fig. 1-2.

Gillings, R.J. (1982). *Mathematics in the Time of the Pharaohs*. New York: Dover.

Γκιάλας, Α.Ι. (1978). Νεώτερα Στοιχεῖα ἀπὸ τὴν Ἰατρικὴν τῶν Ἀρχαίων Αἰγυπτίων. *Ἑλληνικὴ Ὀγκολογία*, 143, 124–131.

Gödicke, H. (1984). The Canaanite Illness. *SAK*, 11, 91–105.

Godley, A.D. (1981). *Herodotus History II*. Cambridge MA: Harvard University Press, *Loeb Classical Library*, 117.

Gordon, A.H. & Schwabe, C.W. (2004). *The Quick and the Dead: Biomedical Theory in Ancient Egypt*. Leiden: Brill–Styx.

Grapow, H. (1935). *Untersuchungen über die altägyptischen medizinischen Papyri*. Leipzig.

Grapow, H. (1954-1962). *Grundriß der Medizin der alter Ägypter*. Berlin: Akademie Verlag.

Griffith, F.L. (1898). *Hieratic Papyri from Kahūn and Gurōb*. London: B. Quaritch.

Griffith, F.L. & Thompson, H. (1904-1909). *The Demotic Magical Papyrus of London and Leiden* I-III. London: H. Grevel & Co. [2nd Edition (1974). *The Leyden Papyrus: An Egyptian Magical Book*, New York: Dover].

Hand, W. (1986). *Magical Medicine*. Berkeley: University of California Press.

Hannig, R. (2009). *Großes Handwörterbuch Ägyptisch–Deutsch* (2800-950 v. Chr.), Mainz: P. von Zabern.

Harer, J.B. (1985). Pharmacological and Biological Properties of the Egyptian Lotus. *JARCE*, 22, 49–54.

Harris, J.R. (1961). *Lexicographical Studies in Ancient Egyptian Minerals*. Berlin: Akademie–Verlag, Deutsch. Akad. Wiss. Berlin / *Veröffentlichungen*, 54.

Harris, J.R. & Wente, E.F. (1980). *An X–Ray Atlas of the Royal Mum*mies. Chicago: University of Chicago Press.

Hermann, B. & Hummel, S. (Eds.) (1994). *Ancient DNA*. Berlin: Springer.

Iversen, E. (1939). *Papyrus Carlsberg, № VIII*. Copenhagen: Munksgaard.

Jacq, C. (1985). *Egyptian Magic* (translated by Davis, J.M.). Warminster: Aris & Phillips.

Jelínkova–Raymond, E. (1956). *Les inscriptions de la statue guérisseuse de Djed–her–le–Sauver*. Le Caire.

Jonckheere, F. (1958). Les médecins de l'Égypte pharaonique: Essai de prosopographie. *La Médecine égyptienne*, *3*. Bruxelles: Fondation Égyptologique Reine Élizabeth.

Jones, M. (2001). *The Molecule Hunt: Archaeology and the Search for Ancient DNA*. New York: Arcade.

Kamal, H. (1964). *Ancient Egyptian Medicine* 1-4. Cairo [in Arabic].

Kamal, H. (1967). *A Dictionary of Pharaonic Medicine*. Cairo: The National Publication House.

Khan, A.B. (1964). Surgery in the Medieval Muslim World. *Indian J. Hist. Science*, 19, 64–74.

Kitchen, K.A. (1997). *Pharaoh Triumphant: The Life and Times of Ramesses II*. Cairo: AUC Press.

König, Y. (1987). La Nubie dans les textes magiques: l'inquiétante étrangère. *Revue d'Égypte*, 38, 105–110.

Κούζης, Α. (1929). *Ἱστορία τῆς Ἰατρικῆς*. Ἀθῆναι: Πυρσός.

LÄ = Helck, W. & Otto, E. (Hrsg.) (1975-1989). *Lexikon der Ägyptologie* I-VII. Wiesbaden: O. Harrassowitz.

Lacau, P. (1921-1922). Les statues "guérisseuses" dans l'ancienne Égypte. *Monuments Piot*. Paris (*Académie des Inscriptions et Belles Lettres*, 25), 189–209.

Lambert, J.B. & Grupe, G. (Eds.) (1993). *Prehistoric Human Bone: Archaeology at the Molecular Level*. Berlin: Springer.

Lauer, J.–P. (1948). *Le Problème des Pyramides d'Égypte*. Paris: Payot.

Lauer, J.–P. (1974). *Le Mystère des Pyramides*. Paris: Presses de la Cité.

Leca, A.P. (1983). *La médecine égyptienne au temps des pharaons*. Paris.

Leek, F. (1972). *The Human Remains from the Tomb of Tutcankhamūn* (Harris, J.R., ed.). Oxford: University Press.

Lefebvre, G. (1956). *Essai sur la Médecine égyptienne de l'époque pharaonique*. Paris.

Lucas, A. (1989). *Ancient Egyptian Materials and Industries* (Harris, J.R., rev. ed.). London.

Lyons, A.S. & Petrucelli, R.J. (1987). *Medicine: An Illustrated History*. New York: Abradale & Adams.

MacQueen, J.G. (1986). *The Hittites and their Contemporaries in Asia Minor*. London.

Majno, G. (1975). *The Healing Hand: Man and Wound in the Ancient World*. Cambridge MA: Harvard University Press.

Manniche, L. (1987). *Sexual Life in Ancient Egypt*. London: KPI.

Manniche, L. (1989). *An Ancient Egyptian Herbal*. London: BMP.

Manniche, L. (1999). *Egyptian Luxuries: Fragrance, Aromatherapy and Cosmetics in Pharaonic Times*. Cairo: AUC Press.

Μανιάτης, Π. (2002). *Ἱστορία τῆς Ἰατρικῆς*. Ἀθήνα: Ἐντός.

Μαραβέλια, Α.–Α. (2003). *Ἡ Μαγεία στὴν Ἀρχαία Αἴγυπτο: Μεταφυσικὴ Πεμπτουσία τῆς Χώρας τῶν Θεῶν*. Ἀθήνα: Ἰάμβλιχος.

Μαραβέλια, Α.–Α. (2014). Τὰ Μαθηματικά, ἡ Γεωμετρία, ἡ Μηχανικὴ καὶ ἡ Ἀρχιτεκτονικὴ στὴν ἀρχαία Αἴγυπτο. *Χρονικὰ Αἰσθητικῆς*, 47, 107–168.

Μαραβέλια, Α. (2020). Οἱ Ἰατροὶ καὶ ἡ Ἰατρικὴ στὴν Ἀρχαία Αἴγυπτο. In A. Tselikas (Ed.), *Stephanos: Festschrift in Honorem Prof. Dr Stephanos Geroulanos*. Athens, *in press*.

Μαρασλής, Α. (1983). *Ἡ Χειρουργικὴ στὸ Βυζάντιο*. Ἀθήνα: Ἐκδόσεις Παρισιάνου.

Maravelia, A.–A. (2006). *Les astres dans les textes religieux en Égypte antique et dans les Hymnes Orphiques*. Oxford: Archaeopress / *BAR International Series*, 1527.

Maravelia, A.–A. (2010). Asklēpios and Ophiuchus: Katasterismoi, Constellations, Transformations and … Heresies. *Deltos*, 39, 79–92.

Maravelia, A.–A. (2012). Paula Alexandra da Silva Veiga: Health and Medicine in Ancient Egypt: Magic and Science, 2009. *AntOr*, 10, 163–170 [Book Review].

Maravelia, A., Bontozoglou, N., Kalogerakou, K., Couvaris, C.M. & Geroulanos, S. (2019). Application of Smart Informatics in Egyptology: The Athens Mummy Project as an Example of Effective Interdisciplinarity. *The Oriental Studies / Сходознавство*, 84, 127–162.

Maravelia, A. & Filianos, M. (2020). The Kyphi/Kῦφι/*Kȝpt*–Incense of the Ancient Egyptians. In A. Maravelia & N. Guilhou (eds). *Environment and Religion in Ancient and Coptic Egypt: Sensing the Cosmos through the Eyes of the Divine. Proceedings of the 1st Egyptological Conference, Organized by the Hellenic Institute of Egyptology and the Writing & Scripts Centre of the Bibliotheca Alexandrina at the People's University of Athens (Athens 1-3 February 2017)*. Oxford: Archaeopress / *Egyptology*, 30, 257-303.

Margotta, R. (1996). *Ἱστορία τῆς Ἰατρικῆς* (μτφρ.: Ἀντωνακόπουλος, Γ.Ν.). Ἀθήνα: Παρισιάνος.

Merck (2006). *The Merck Index – Fourteenth Edition* (O'Neil, M.J., Heckelman, P.E. *et al*., eds). Whitehouse Station NJ: Merck Research Laboratories / Merck & Co, Inc.

Milne, J.S. (1970). *Surgical Instruments in Greek and Roman Times*. New York.

Molinier, A. (Ed.) (1851-1876). *Oeuvres d'Oribase: Texte grec traduit par les docteurs Bussemaker et Daremberg* I-VI. Paris: Imprimerie Nationale.

Nerlich, A.G., Zink, A., Szeimies, U. & Hagedorn, H.G. (2000). Ancient Egyptian Prosthesis of the Big Toe. *Lancet*, 356, 2176–2179.

Nunn, J.F. (1996). *Ancient Egyptian Medicine*. London: BMP.

Ody, P. (1993). *The Herb Society's Complete Medicinal Herbal*. London: Dorling Kindersley, Ltd.
Parkinson, R.B. & Quirke, S. (1995). *Papyrus*. London: BMP.
Partridge, R. (1994). *Faces of Pharaohs: Royal Mummies and Coffins from Ancient Thebes*. London: BMP.
Παντερμαλής, Δ. (1999). *Δῖον: Ἡ Ἀνακάλυψη*. Ἀθήνα: Ἐκδόσεις Ἀδάμ.
Πεντόγαλος, Γ.Η. (1983). *Εἰσαγωγὴ στὴν Ἱστορία τῆς Ἰατρικῆς*. Θεσσαλονίκη: Παρατηρητής.
Pinch, G. (1994). *Magic in Ancient Egypt*. London: BMP.
Pollard, A.M. & Heron, C. (1996). *Archaeological Chemistry*. London: Royal Society of Chemistry.
Posener, G. (1958). Les empreintes magiques de Gizeh et les morts dangereux. *MDAIK*, 16, 252–270.
Posener, G. (1981). Les ʿafārīt dans l'ancienne Égypte. *MDAIK*, 37, 393–401.
Posener, G. *et al*. (Eds.) (1992). *Dictionnaire de la civilisation Égyptienne*. Paris: Hazan.
Reeves, N. (1990). *The Complete Tutankhamun*. London: Thames & Hudson.
Reisner, G.A. (1905). *The Hearst Medical Papyrus*. Leipzig: Hinrichs.
Riad, N. (1979). Hygiène et médecine cosmétique au temps des pharaons. *Le Monde Copte*, 8, 44–49.
Ritner, R.K. (2001). s.v. Magic. *The Oxford Encyclopedia of Ancient Egypt* II, Oxford, 321–336.
Roaf, M. (1990). *Cultural Atlas of the Ancient Mesopotamia and the Ancient Near East*. Oxford: Oxford University Press.
Roth, A.M. (1992). The *Psš-Kf* and the Opening of the Mouth Ceremony: A Ritual of Birth and Rebirth. *JEA*, 78, 113–147.
Roth, A.M. (1993). Fingers, Stars and the Opening of the Mouth: The Nature and Function of the *Nṯrwi*–Blades. *JEA*, 79, 57–79.
Rutkow, I.M. (Ed.) (1993). *Surgery: An Illustrated History*. St Louis: Mosby.
Sandison, A.T. (1963). The Use of Natron in Mummification in Ancient Egypt. *JNES*, 22, 259–267.
Sauneron, S. (2000). *The Priests of Ancient Egypt*. Ithaca–London: Cornell University Press.
Scarborough, J. (2010). Teaching Surgery in Late Byzantine Alexandria. *Stud. Anc. Med.*, 35, 235–260.
Schöne, H. (1903). Zwei Listen chirurgischer Instrumente. *Hermes*, 38, 280–284.
Sezgin, F. (ed.) (2003). *Wissenschaft und Technik im Islam* I-V. Frankfurt am Main: Institut für Geschichte der Arabisch–Islamischen Wissenschaften an der Johann Wolfgang Goethe–Universität.
SGI (2004). *News Release*. California & London.
Simmance, E.B. (2014). *Amenhotep Son of Hapu: Self–Presentation through Statues and their Texts in Pursuit of Semi–Divine Intermediary Status* (Master Thesis). Birmingham: University of Birmingham, Institute of Archaeology & Antiquity.
Σκαμπαρδώνης, Γ.Ι., Σίψας, Ν. & Γερουλάνος, Σ. (2012). Ὁ Ξενὼν τῆς Μονῆς Παντοκράτορος: Ἕνα Πρότυπο Βυζαντινὸ Νοσοκομεῖο τοῦ 12ου Αἰώνα. *Δέλτος*, 42, 47–60.
Smith, G.E. (1908). The Most Ancient Splints. *Br. Med. J.*, 1 (2465), 732–736.
Spencer, A.J. (1986). *Death in Ancient Egypt*. UK: Penguin Books.
Spencer, W.G. (Ed. & Transl.) (1935-1938). *A. Cornelius Celsus: De Medicina* I-III. London: Loeb Classical Library.
Steven, J.M. (1975). Gynaecology from Ancient Egypt: The Papyrus Kahūn. A Translation of the Oldest Treatise in Gynaecology that has survived the Ancient World. *Medical Journal of Australia*, 21, 949–952.
Strouhal, E., Vachala, B. & Vymazalová, H. (2014). *The Medicine of the Ancient Egyptians: 1. Surgery, Gynaecology, Obstetrics & Pediatrics*. Cairo: AUC Press.
Taylor, J.H. (1996). *Unwrapping a Mummy*. Austin TX: University of Texas Press.
Taylor, J.H. & Antoine, D. (2014). *Ancient Lives – New Discoveries: Eight Mummies, Eight Stories*. London: British Museum.
Ternon, Y. & Helmans, S. (1979). *Histoire de la Médecine*. Paris: Aujourd'hui.
Till, W.C. (1951). *Die Arzneikunde der Kopten*. Berlin: Akademie–Verlag.
Veiga, P.–A. da Silva (2009). *Health and Medicine in Ancient Egypt: Magic and Science*. Oxford: Archaeopress / *BAR International Series*, 1967.
von Känel, F. (1984a). *Les prêtres–ouâb de Sekhmet et les conjurateurs de Serket*. Paris: *Bibliothèque de l'École des Hautes Études, Section des Sciences Religieuses*, 87.
von Känel, F. (1984b). *La nèpe et le scorpion: une monographie sur la déesse Serket*. Paris.
Wagle, W.A. (1994). Toe Prosthesis in an Egyptian Human Mummy. *American Journal of Radiology*, 1624, 999–1000.
Walton, A. (1979). *Asklēpios: The Cult of the Greek God of Medicine*. Chicago: Arēs Publishers [translated into modern Hellenic by Maravelia, A.–A. (2007). *Ἀσκληπιός: Ἡ Λατρεία τοῦ Ἕλληνα θεοῦ τῆς Ἰατρικῆς*, Athens: Kardamitsa].
Westendorf, W. (1966). *Papyrus Edwin Smith*. Bern–Stuttgart: Verlag Hans Huber.
Wildung, D. (1977a). *Imhotep und Amenhotep: Gottwerdung im alten Ägypten*. Berlin: Deutscher Kunstverlag.
Wildung, D. (1977b). *Egyptian Saints: Deification in Pharaonic Egypt*. New York: University Press.
Wilkinson, C. (2004). *Forensic Facial Reconstruction*. Cambridge: Cambridge University Press.

Wiltse, L.L. & Pait, T.G. (1998). Herophilus of Alexandria (325-255 BC): The Father of Anatomy. *Spine*, 2317, 1904–1914.

Worth Estès, J. (1993). *The Medical Skills of Ancient Egypt*. USA: Canton.

Wreszinski, W. (1909). *Der große medizinische Papyrus des Berliner Museums*. Leipzig: Hinrichs.

Wreszinski, W. (1912). *Der Londoner medizinische Papyrus (BM 1005) und der Papyrus Hearst in Transkription, Übersetzung und Kommentar*. Leipzig: Hinrichs.

Wreszinski, W. (1913). *Der Papyrus Ebers*. Leipzig: Hinrichs.

Ζηρογιάννης, Π.Ν. & Προβατοπούλου, Σ. (2009). Ἀπὸ τὴν Δράση τοῦ Ἱπποκράτη στὴν Αἴγυπτο. In Σ. Προβατοπούλου, Π.Ν. Ζηρογιάννης *et al.* (Eds.), *Ταξιδεύοντας μὲ τὸν Ἱπποκράτη: Ἀνάλυση τοῦ Πολιτικοῦ καὶ Πολιτισμικοῦ Γίγνεσθαι τῆς Ἐποχῆς του* 4. Κῶς: ΔΙΙΚΩ, pp. 14–44.

Yannakopoulos–Salili, A.B.M. (2011). *Die antiken und byzantinischen Chirurgen nach Hippokrates* (Inaug. Dissertation). Zürich: Medizinische Fakultät, Universität von Zürich.

Zumla, A. & Lulat, A. (1989). Honey, a Remedy rediscovered. *Journal Roy. Soc. Med*., 82, 384–385.