From Iology to Toxicology: A new specialization in Ancient Alexandrian School

Ana Maria Rosso

International Society for the History of Medicine, University of Buenos Aires, Santa Fe 2844, P 18 “E”, Buenos Aires, Argentina

ARTICLE INFO

Handling Editor: Dr. A.M. Tsatsakis

Keywords: Iology, Toxicology, Alexandrian school, Specialties, Prestigious physicians

ABSTRACT

Alexandria was both an important city and a place of inspiration in the history of medicine since the 3rd century BC until 7th century AD. Its fertile intellectual and scientific environment gave rise to a radical and new thinking and understanding of the disease process. King Ptolemy I (323–285 BC) established the Museion and the Great Library of Alexandria fabled in Antiquity for its treasures of wisdom. This complex interaction between Greeks and Egyptians before and under the Ptolemies gave scientists an opportunity to live and work under royal patronage with excellent repercussions. Scholars were attracted to take part in scientific research, especially in medicine and mathematics, developing different known areas and programs. Furthermore scholars in Alexandria also brought back new ideas and activities each with specialized knowledge of the subjects.

As the medical science of ancient Greece plunged into political decadence and setbacks - scientific work was renewed in this city with the arrival of the greatest minds of the day. The ‘Faculty’ of Medicine in Alexandria seems to be an integral part of the Museion. In the 3rd century BC, the Ptolemaic capital caught the different trends and became the seat of divergent and independent schools. The debt of the Alexandrian physicians to the native Egyptian doctors, highly specialized, was very considerable. Coan school in this time had general professionals who recommended therapeutic and nutritional strategies and diets while Alexandria science provided academic specialization.

On the other hand the court physicians, involved in high politics, could be medical specialists meanwhile the teachers of advanced medicine were sometimes left undisturbed in the pursuit of their research. Being able to commit poisoning crimes with drugs by political interests, they were scared of them. Animal and plants toxins became an accepted and divulged study, very fashionable, and Alexandrian school developed scientific research in iology, name given later to this science. Greek sources on toxicology became a special and developed branch in medical literature and from Apollodorus of Tarentum onwards, the father of iology and his book Peri thérion, the interest in Greek treatises spread.

1. Introduction

The intellectual and scientific ferment taking place in Alexandria when King Ptolemy the first (323–280 BC) established the Museion and the Great Library of Alexandria encouraged the development of the arts and sciences increasing the collection of literary written sources. The King mandated to “collect all books in the inhabited world”, he personally sent letters to all sovereigns and governors in earth, “requesting that they furnished works by poets and prose-writers, rhetoricians, and sophists, doctors and soothsayers, historians and all the others too” [1]. Agents were sent to scout the cities of Asia, North-Africa and Europe, and were authorized to spent whatever was necessary [2].

Alexandria (Fig. 1), qualifies as a center of higher learning, soon became world renowned as the greater town of science, attracting the most skilled scholars, especially in medicine. New disciplines in areas of specialized expertise allowed to increase and ensure system-wide improvements in certain branches. Thus, it became the most famous leading medical school and medical research in Antiquity. In this context court physicians dedicated their efforts to understand the toxicity and risks of poisons and search specific antidotes to combat the side effects. A list of prestigious scholars in the field proves the importance and depth of these studies that reached a certain development according to the time parameters. The School started in the 3rd century BC with the father of iology Apollodorus of Tarentum and his book Peri thérion, and later a long list of specialists transmitted the interest on the subject in several subsequent reviews until the Cleopatra reign.

E-mail address: rossoanamaria@gmail.com

https://doi.org/10.1016/j.toxrep.2021.06.002

Received 31 March 2021; Received in revised form 15 May 2021; Accepted 1 June 2021

Available online 9 June 2021

2214-7500/© 2021 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
2. The intellectual and scientific context in Alexandria

In the Museion and Library (Figs. 2 and 3) poets, historians, musicians, mathematicians, astronomers and scientists took advantage to acquire knowledge of the Ptolemaic patronage that made their work possible. The results were grandly impressive. Euclid worked out the elements of geometry, Ptolemy mapped the heavens, Eratosthenes determined the earth circumference, Ctesibius designed a water clock and built the first keyboard instrument (in a way the prototype of our present computer keyboard), Archimedes refined his theory on the weight and displacements of liquids and gases. Callimachus, the famous poet and librarian, catalogued the huge collection of scrolls. Zenodus produced authentic versions of Homer’s epics by collating every known text that he could find. Alexandria, qualifies as a center of higher learning, soon became world renowned as the most famous leading medical school and medical research in Antiquity and the greater center of science. The intellectual and scientific ferment taking place in the city attracted medical talent whose writings have unfortunately been lost so, most of our knowledge of this situation is derived for commentators, especially Celsus and Galen.

Ancient Egypt made significant advances in almost all areas of learning scientific knowledge included particularly astronomy, mathematics and medicine and the Alexandrian achievements has encouraged the rise of Greek science. The most prestigious and progressive Coan doctors arrived in the late 4th century with their experience and academic level in close connection with Alexandrian group and Cnidus’ elements largely disappeared from the field. The renewal of principles and theories in this area had occurred several centuries before through political and economic contacts between the two civilizations when the mercenaries arrived to Egypt at the Saite Period. The study, review and copying of ancient papyri carried out by the 26th dynasty (664–525 BC) brought to light different Egyptian ideas in many fields. Greek scientific development on the Ionian coast, thanks to these relationships, gave birth to the philosophy of nature and, in medicine, the Hippocratic documents were notably influenced by the Egyptian Papyri. Especially about the assumptions on women’s beliefs and diseases and the Egyptian theory of the intestinal toxins, which was later transformed, after successive changes, in the Hippocratic theory of humours [3].

This complex interaction between Greeks and Egyptians before and under the Ptolemies allows Alexandria to become a major intellectual center, home of native Egyptian Priests, Greek scientists, Jewish scholars, Essenes and Hermetics alike. It continued to be influential until Muslim conquest in 642. Thus the impact of Ancient Egypt on Greek philosophy was esoteric [4].

The ‘Faculty’ of Medicine in Alexandria seems to be an integral part of the Mouseion and this institution still felt the royal interference [5].
who have written in Greek (ca. 280 BC) an account of Egyptian history, scholar in the Museum and the Library, except Manetho of Sebennytus chronology and customs, the well known Ptolemy II Philadelphus (Figs. 6 and 7). It seems that Greek community was impulsed. Nevertheless no Egyptians seem to have been active as remained remarkably insulated from the Egyptian population, preser
borders of the country but in the 2nd century an indigenous nationalism reached a level never acquired before.

The Medical School of Alexandria was immediately charged to infuse a new blood into the native art of healing and perpetuated the reputation of excellence of Egyptian doctors [10]. The foreign professional quality at that time has improved through the training in Egyptian soil. The debt of the Alexandrian physicians to the native Egyptian great tradition of ancient Egyptian medicine was preserved for millennia. The debt of the Alexandrian physicians to the native Egyptian doctors was very considerable although it has been much discussed. Doctors were highly specialized and constituted a numerous caste in Egypt and in previous centuries they were well renowned beyond the borders of the country but in the 2nd century an indigenous nationalism was impulsed. Nevertheless no Egyptians seem to have been active as scholar in the Museum and the Library, except Manetho of Sebennytus who have written in Greek (ca. 280 BC) an account of Egyptian history, chronology and customs, the well known Aegyptiaca, addressed to Ptolemy II Philadelphus (Figs. 6 and 7). It seems that Greek community remained remarkably insulated from the Egyptian population, preserving their language and customs. But probably the intercultural contacts

depite its relations with the independent heads of the known schools. Soter (Figs. 4 and 5) was evidently very anxious to follow the Peripatetic organization of learning provided by the philosopher Demetrius of Phalera, Theophrastus’ pupil, particularly with regard to science. “He had been on Alexander’s campaign and not doubt appreciated the importance of the new scientific knowledge won on it” [6]. More than 1000 salaried scholars lived there at a given time and they paid no taxes. They received free meals, free room and board and free servants. They conducted scientific research, published, lectured and collected as much literature as possible from the known world. The Mouseion and Library were rich decorated edifices in a campus of buildings and gardens with animals of all species. The first possessed a peripatos, an exedra and a large oikos where the common table was located [7]. That is to say that it had a roofed walkway or loggia for walking and talking, an arcade of curved seats and a communal dining room where scholars share their ideas. The building was filled with private study rooms, residential quarters, lecture halls, theaters and probably the dissection rooms where Herophilus and Erasistratus practiced anatomy [8], although for Ter
tullan [9] they were public vivisections upon 600 criminals sentenced to death. To this it must be added the place of instruments through which Hipparchus and Ptolemy did their astronomical observations and the field of applied sciences or ‘technology’. Furthermore Alexandria was the virtual creator of new subjects and activities which demanded a specialized and systematic knowledge. In most fields of science the city surpassed the achievements of the Classical Greek world and it has to be remembered that Pharaohs’ Egypt had reached a high standard already during Old Kingdom times, both in some aspects of medical practice and engineering. The scientific work grew out without any taboo or censorship and the intellectual and scientific ferment taking place in the city attracted medical talents. Alexandria became in a few years the main medical center of the ancient world because its medical achievements reached a level never acquired before.

The first Ptolemies showed a deep interest in medical science, especially Soter because of his poor health, regardless of his practical applications. The great Hellenistic doctors were also historians of medicine and they wrote both medical textbooks and also commentaries and critical works on the Hippocratic Corpus. The Alexandrian physi
ians were thus a real bridge between this Corpus and the medical works of the Imperial period, particularly Galen. A copy of the Epidemics belonging to the physician Mnemon of Side, marked with signs (χαρακτήρες), reached Alexandria in the reign of Ptolemy III Evergetes I (Figs. 8 and 9) as an acquisition for the Alexandrian library [13], but the authenticity of certain works was probably questioned. The critical activity centered on the writings of the Hippocratic Corpus consisted both of commentaries and of studies of glossography. It forms one of the most important Alexandrian contributions to scholarship, unfortunately almost all lost. Works about these traditional writings began early in Alexandria connecting grammarians and doctors. The most notable of all
the early commentators was the Herophilean Baccheius of Tanagra. His glossary (Λέξεις) seems to have covered some twenty works. By far the most important medical commentator after Baccheius was the Empiricist Heraclides of Tarantum. He wrote the first fully developed general commentary on the Alexandrian Hippocratic Corpus, also an attack in 3 books on Baccheius’ glossary, and a history of the Empiricist school in eight books [14].

3. The Coan School and the debates among the sects

The medical profession of the Hippocratic period constituted a widespread organization, the Asclepiadae, that had special connections with Cos and Cnidos and this ‘family’ certainly survived in the Hellenistic period. The activity of the Coan School did not cease but was dissipated under the magnetic influence of the new capitals, Alexandria and Antioch-on-Orontes, which offered patronage to doctors and students of medicine. Cos and Alexandria emerged as the two main centers of medicine while Cnidos began to fade. Cos was a reservoir of general practitioners, interested in complete therapy, hygiene and dietetics while Alexandria developed a more purely academic level in the field of specialties. The last Coan doctors as Praxagoras of Cos, the teacher of Herophilus, marked the end of an epoch to make way for the creative activity and the professional rivalry between the doctrines of the different schools. He is a bridge between the old and the new in medicine in the 3rd century BC.

Many practitioners have been formed in the Cos island and Cnidos, others still came from the Alexandrian schools and surgeons from the Hippocratic teachings. In all cases it was a secular and scientific medicine (away from the magic and religious) which, by his deontology, was also claimed to be the major Hellenistic philosophy. Indeed the credit around their representatives met the premier Ptolemies’ rationalistic requirements, fed by Platonism and Aristotelianism. A collision between the different concepts of both cultures occurred, attracting the attention of the brightest medical authorities of the various Greek regions. This would more accurately assess the Greek practitioner’s influence at the Alexandrian court [15].

Indeed, in the 3rd century BC, the Ptolemaic capital city caught the different trends and became the seat of divergent schools that had apprentices who probably paid masters and institutionally might have been independent. The debate among dogmatists or rationalists and empiricists had important clinical implications and also for scientific or
‘theoretical’ medicine. The Dogmatic school, founded by both the Hippocrates’ son and son-in-law and continued by the Herophilus and Erasistratus’ students, who in turn were divided, claimed that reason and anatomy were sufficient for understanding the underlying causes of diseases, while the Alexandrian Empiricist’s theory, rising in popularity and founded by an Herophilic dissident, Philinos of Cos [16], denied the scientific value and clinical relevance of systematic dissection and physiology [17]. Whereas Herophilus’ pulse theory, whose roots were in the Egyptian studies, was firmly rejected by Empiricists as a part of theoretical and speculative medicine, the last embraced pharmacology as an empirical discipline of unquestionable clinical importance. They asserted that only observation and experience is a sufficient foundation for practice and medical knowledge, refused any experimentation and to search into remote causes to explain health and disease. They were limited to record the accessible symptoms to the senses and the effective treatments in everyday practice. However, the Herophilian School and all his followers united by the interest in clinical and scientific investigations, remained always open to changes in emphasis, to doctrinal shifts and to radical revisions in a remarkably long history, from 300 BC to 50 AD. A new phase in its institutional development seems to have been reached by the expansion of the school in Asia Minor in the middle or later 1st century BC, after it had been associated exclusively with Alexandria for at least two hundred years. “Founded by Zeuxis ‘Philalethes’ or ‘Truth-Lover’ (a reverential title traditionally reserved for Hippocrates) at the famous temple of the moon god in the local pantheon. Men Karou’, near the Phrygian city of Laodicea, it was called by Strabo (XVII, 1.8) ‘large place of instruction’ or ‘great school’, a formal institution far away from medical education in Classical and Hellenistic Greece. Associated with a cult centre as in the Alexandrian Museum it had a more institutional character than the school in Alexandria, where “a group of scientists and scholars were joined together as a researchers sharing patronage and meals, but also as members of a cult association presided over by a priest” [18].

Alongside the illustrious dogmatic physicians we can cite among others: Eudemus [19], a famous anatomist in Alexandria, a little younger than Herophilus and Erasistratus, Cleophas [20], who lived under Philadelphus and Evergetes and was Erasistratus’ brother; Memnon of Side [21] an obscure Pamphylian doctor who introduced later interpolations in Hippocratic writings and Antigens [22], both followers of Cleophas; the Erasistrateian Strato [23] and Apollonius of Memphis.

A third medical school arose later in response to this debate, the Methodic school, with Soranus of Ephesus, Greek physician from the 1st century AD who practiced in Alexandria and Rome, known almost solely by his works in gynecology. In contrast to Dogmatics and in agreement with Empirics, they argued that found underlying and hidden causes was a superfluous task. Rather the patient’s immediate symptoms, along with common sense, are sufficient and provided the necessary information to treat the sick. No real uniformity distinguished this sect that represented a minor position but rocketed with the two others and were still living in the 17th and 18th centuries. Soranus sought to capture ‘the communities’ that characterized the health state and to bring the sick body to those few main or key states [24].

The founder of a new Pneumatic medical sect, known probably at the mid 1st century BC, Athenaeus of Attalia, proposed to systematize medicine on a ‘synthetic’ basis. He accepted and supported the Peripatetic tradition about cardiocentric thesis beyond Aristotle, Diodotes, Pneumatics. He wrote in general terms. Many Pneumatics were a kind of eclectic who might have tried to assimilate Herophilic views to their own. The origin of psychic pneuma was the most debated and controversial subject since some time before. Herophilus extended to the nerves the pneumatic mechanism that his teacher Praxagoras has applied to arteries [25]. The psychic pneuma was prepared in the front ventricles of the brain and then travelled to the cerebellum, the body commander center, and then enters in the motor nerves to generate movement. However Erasistratus developed finally an organic and coherent doctrine of pneumatology, later refined by Galen. He distinguished two types of pneuma, vital or physic and psychic. The inspired pneuma becomes ‘vital pneuma’ as it passes from the lungs to the heat by the pulmonary vein. The psychic pneuma derives from the vital which exists from the left cavity of the heart upon heart contraction, runs in the arteries and is distributed to the whole body. Once the vital pneuma reaches the meninges, it passes in the brain ventriciles and eventually enters the nerve cavities, turning into psychic pneuma [26].

4. Court physicians and specializations in Alexandria

A great deal of information survives about the social activity of the physicians and their relations with the Crown. The court physicians, involved in high politics, could be medical specialists meanwhile the teachers of advanced medicine were sometimes left undisturbed in the pursuit of their research. Those doctors played a larger role in politics than in medicine but the danger and turmoil of life close to the sovereign laid exacting demands that overstepped their scientific expertise. They assumed political missions as ambassadors or advisers associated with governmental tasks. Of course, they represented a man of trust and a moral authority attached to the royal persons and, for this reason, the first Ptolemies may have given their preferences to their countrymen. The Chrysermus of Alexandria’s family, perhaps of Thracian origin, was close to the Ptolemaic court from the 3rd century onwards. The members are found in strikingly diverse and influential roles. Chrysermus, son of Heraclitus,kinsman of Ptolemy Evergetes was Superintendent of Physicians and Administrator of the Museum and probably a research physician or a layman in charge of public medical services because he had organized the court hierarchy with the highest title of σοφος. The Herophilian Chrysermus was later an eminent figure of Auletes and Cleopatra’s reigns, but devoting himself to pedagogic, theoretical and clinical objectives rather than to political ties and tasks [27]. He developed a theory of pulse that differed from that of Herophilus and Erasistratus [28]. He probably kept his distance from the vicissitudes which rendered life at the Ptolemaic court insecure for many and was probably the leading physician-scientist of his generation in Alexandria.

From the earliest years of the dynasty doctors are involved in political trends and they remained in this path until Cleopatra VII. Artemidorus, another example, was the house-doctor of Apollonius the dioecetes, who travelled with him and resided with him in Alexandria. The sources make reference of his social situation, his extra-medical activities mixed with political and economic issues rather than his skills and medical functions. He occupied the same position as a Court physician, by way of his immediate master, Philadelphus’ powerful minister. Apollonius had received the δοστήρας of Philadelphia and lived surrounded by a princely pomp, worthy of his rank [29]. Artemidorus took an intermediate role in the place between the Greek crowd and his master so influential [30]. In April 253 BC he and his master escorted the princess Berenice to the Syrian border to marry Antiochus II. He reflects the court physician’s activities, invested with the royal confidence and sometimes associated to politics. A trend of this era in Egypt was to enhance the aulic doctors’ reputation as well as the other Hellenistic monarchies of the Alexander’s Empire did [31].

Furthermore, the new diseases, to which they faced and considered, did promote the specialties, distant from the Hippocratic Corpus. Doctors are therefore engaged in the study of certain subjects, previously excluded or ignored and the Alexandrian medicine has gained fame thanks to the environment in which they worked. Being a human study, it has enjoyed the patronage and royal administrative organization and the professional have received it for their scientific research. At that time, the heyday of Greek medicine and the development of surgery, the prestige of doctors for his Hippocratic ethic, show an affinity with ethical philosophers [32]. The Alexandrian medical school was famous for advances and instruction in anatomy, physiology and pharmacology. Herophilus (335-280 BC), considered the father of anatomy and embarked upon a new study of the human body, was the first who based
his writings on authorized, legitimate human dissections. It has been said that this Greek physician occasionally performed dissections in public and recorded this observations in On Dissections. Anatomy had been Herophilus’ and Erasistratus’ most significant and renowned contribution to scientific medicine and since then it was considered a distinct branch in medicine. Few, if any, activities played a more powerful role in the rise of medical science in Alexandria as its major tool, than the dissection - and possibly vivisection - of humans, completely and suddenly abandoned by his successors. Rivaling the well known Coan, Cnidian and Pergamum medical schools, to foster the scientific anatomy, both physicians performed dissections not only of human corpses, but also of vivisected animals and probably even of criminals sentenced to death. One can forgive his weakness in giving it in to the elemental human need for showmanship, despite the bitter criticism by his attitude of the Roman Tertullian, (De Anima, 10 and 25), a prolific early Christian author, who indignantly denounced Herophilus’ pioneer work: “Herophilus the physician or that butcher who cut up hundred of human beings so that he could study nature”. His contemporary Erasistratus (310-250 BC) meanwhile is considered the father of physiology and is also best known for his work in human cadavers and his knowledge of the human body. Erasistratus’ pioneering discoveries in almost every field of human dissection are regarded as a highest medical achievement until the 17th century.

Both outstanding medical investigators, Herophilus and Erasistratus, were the two leading professors of the ‘new medicine’ that sprouted and flowered in Alexandria. Anatomical dissection of corpses was permitted and was a regular practice, for the first time in history. In contrast to the physical observations and disease description of the Hippocratic School, the Herophilus’ contribution to our direct knowledge of anatomy and precise medical terminology is enormous. Through his anatomical studies on the nervous system, Herophilus proved that the brain and not the heart is the seat of intelligence, a revolutionary breakthrough for that period since it contradicted a prevailing Aristotelian concept which stated that the heart is the seat of intelligence, rational thoughts, emotions and desires. The medical school of Alexandria was at the forefront in the move towards a ‘scientific’ medicine.

5. Alexandrian School and the emergence of toxicology

The historical documents show the social and political role of court physicians and the subordination of scientists at the royal organization like those supported by Pharaohs since long time ago. However they were found sometimes guilty of disloyalty to the sovereign. Thus the establishment of scientists on Egyptian soil required a process of adaptation to political trends or to an unexpected succession of kings, which has not always fulfilled like at the time of Ptolemy VIII. Suspected of betrayal several times, the intellectual classes were ejected from the city by the king. On the other hand, voluntary leak and banishment had spread many scholars throughout the Greek world. In 146-5 BC he expelled some and slew others, which resulted in a diaspora of philologists, philosophers, mathematicians, musicians, painters, gymnasts, doctors and other professions.

In addition, court physicians always aroused suspicions by their knowledge, because they could be able to use drugs and poisons for political purposes. Nevertheless this task became precarious and perilous during a disgrace or a regime change. The first suspect was Chrysippus the Cnidian [33], no doubt the son of Erasistratus’ teacher. He involved in the conspiracy of Arsinoe I against Ptolemy II Philadelphus ca. 280 and he fell with all confederates. The sovereign feared that he make use of poison to attempt against his person although the Hippocratic oath forbade it [34]. But Greek practitioners did not respect this mandate and the king, wary of him, put to death the physician with his fellow-conspirator Amyntas while the queen was exiled to Coptos.

Poisons were used by ancient Greeks as a form of capital punishment by drinking a cup of hemlock, delivered to Socrates, Plutarch and Themistocles, among others. It was also used as a means of political assassination and the search of antidotes became a practical necessity if the king wished to survive in office.

In those days, little value was attached to human life and many people lived in fear of being poisoned. In an earlier time, a similar behaviour was already to be found. Alexander the Great encountered dangerous snakes and poisoned projectiles during his conquest to India (probably dipped in the venom of Russel vipers). He had to appeal to Hindus who prepared a decoction of poison by decomposing snakes. Mythological legends show the expertise of ancient Indian doctors in the science of intoxication, defined as agada tantra in the 7th century BC, akin to the modern term ‘toxicology’. The famous Indian surgeon Sushruta (600 BC) dealt with the diagnosis and treatment of any person bitten by poisonous insects or venomous reptiles and affected by natural, artificial and compound poison [35].

In 333 BC indeed, Alexander received a letter from General Parmenion falsely accusing his doctor, Philip of Acarnania [36], of trying to poison him with a lethal drug, although on the contrary he wanted to cure him from his fever after an ice bath [37]. In the Anabasis (VII, 14, 4) the physician Glaucias was hanged for killing Hephaestion by administering him a drug by mischap. Another later example would be that of Ptolemy V Epiphanes (BC 203-181) who forced his unfortunate adviser Aristomenes, to drink hemlock [38].

It became a very popular topic throughout the Hellenistic period and kings, with scientific concerns and to defend themselves, favored the venoms and poisons study and poisonous plants properties, and Egypt developed some reputation. Alexandria school supported decidedly scientific research in iology, name given later to the science that deals with toxics. The knowledge of potions, poisons and antidotes was so pervasive during that era in Alexandria that philosophers and physicians believed could and should be administered by simple pharmacists and they could focus on the dosage of the drugs and the patient himself. The task will rely on prestigious figures in the field, natives or Greeks. Indeed Greek sources on toxicology were a special and developed part in medical literature and Greek treatises appeared from Apollodorus of Tarentum onwards, the father of iology and his book Peri thérion. Nevertheless many texts and treatises have been disappeared and their loss is the main obstacle to a continuous history of ancient medicine. The essential repository of our knowledge about the existence of all the Alexandrian court practitioners is based in two types of sources: 1) the technical writing authors such as Galen, Celsus, Soranus, Pliny who were not much interested in the carrier and social position of Hellenistic doctors, but only in their works, intellectual trends and training, 2) another historical sources of unequal value, Polybius, Diogenes, Aetius, a Theocritus’scholium, inscriptions, papyri, which requires critical examination [39]. They draw us into the curitly circles but do not speak about scientific aspects.

However the splendor of the School was not constant. After the 3rd century BC began a different period in Ptolemaic Egypt, because of the weakening of the royal power and the Greek emigrant puissance. They had representatives in the Egyptian upper classes of society with a strong solidarity between them. They were seeking their protection and influences on the royal court [40]. In contrast, the last 50 years of Ptolemaic reign, saw a great revival of medical schools, despite the monarch’s adverse politics. Heracleides of Tarantum and Apollonia Myrs, the most remarkable Herophilian pupils of the Alexandrian school, belongs to the early 1st century BC, when Ptolemy XII and his daughter Cleopatra VII governed. Heracleides, specialized in iology, was responsible for putting a brilliant end to the golden age of Ptolemaic medicine which had been opened by another great Alexandrian doctor, Herophilus [41].

6. The most remarkable figures in the 3rd century BC

Among the specialists and writers in the field of iology we must mention Phylarcus, probably born in Naucratis or Athens in the 3rd century BC. He was a Greek worth historian and polygraph quoted by Plutarch and Athenaeus. Following the fashion of the time he wrote a
Nevertheless the most famous figure in toxicology was Apollodorus of Tarentum (ca. 300 BC) [42], very important and active in Alexandria in the Erasistratus’ time, a physician whose works on botany, pharmacology and toxicology were renowned. In this capital “the iological teaching seems to have its most systematic development” [43]. Physician more than a naturalist and physicist, he would be the leader of the all subsequent iologists and the main and direct source of Nicander’s poems. Author of a ταθρικός λόγος (Wild beast treatise), conserved fragmentary, his book of medicines and antidotes to heal the bites of poisonous animals is the best known. His first surprising originality was to divide the text argument into three 3 items: an accurate description of θρίψις, the poisoning symptoms and the therapy.

First of all, he utilizes the zoological and botanical nomenclature to carefully describe different types and symptoms of poisonous aggressors and then the appropriate treatment for scorpions, snakes and even all venomous species or δύσολα. He added also a treatise in prose ἀπεπιφανεμένος λόγος, describing the remedies against such type of poisoning. He held moreover the spontaneous generation of spiders, an Aristotelian influence, and debated in few fragments the Theophrastus’ theory of the power of corruption and contagion by simple contact.

According to Athenaeus [44] and Pliny [45], his first book On the bites and stings of animals or Peri therion (Περὶ τῶν δακτυλίων καὶ βίτρων or Peri θρίψεως), was after supplemented by other called On the deadly poisons (Περὶ θανατίων οὐ δηλητηρίων φρουράσκων), a treatise on ointments (Περὶ μύρων) and another On the crowns of flowers or wreaths (Περὶ στέφανων). Not entirely free from superstition, it have inspired the later related treatises of Dioscorides, Aelian, Sosastros, Heraclides of Tarbites and stings of animals or Peri θρίψεως (as Galen called it) and the versatile uses of this drug compounds became being renowned as a teacher, apprentices paid to him and was also remunerated by the state or by his patients themselves [48]. To general therapeutics Herophilus contributed with a treatise entitled Ways of Healing or Therapeutics in at least two books (Caelsius Aurelianus [49], Tardae or Chronicae passiones II. 13. 186), including the knowledge of the ‘neutrals’ [50].

Herasistratus, with an active use of drugs, called them ‘the hands of the gods’ or ‘munera divina’ [51], while for Aetus they were ‘the Asclepius’ hands’. However they required a human agent in order to be efficacious because drugs are nothing per se. His components suggest an Egyptian context because Egyptian Papyri have mixtures containing thirty-five different ingredients. Among these ‘pharmaca’ [52] he selected all kind of minerals, plants and animals even the Aristotle’s collections and those discovered in India by the Alexander the Great’s ‘scientific crew’, which quickly took the route of Alexandria.

His therapeutic policy was very liberal and he was an expert in simples, although Galen (De compositum medicamentorum secundus locus III, 1) refers to him reverentially for his great contribution to the history of compound drugs. He was a particularly innovative therapist who generally adopted treatments by using contrary remedies, allopathic principle that become a commonplace already by the time of Aristotle, but then forgotten, and elaborated prescriptions which included substances from earth and sea venomous animals. He provided an impetus for the active development of the complex pharmacological tradition and his view on the deleterious effect of opium, his ‘amazing’ emollient (as Galen called it) and the versatile uses of this drug compounds became renowned throughout antiquity. Each disease has a specific remedy (Pliny XXVI, 26) but Celsus [53] criticized his drug abuse. Galen, his direct successor in this polypharmacy, gave likewise an appropriate medicine for each disease.

Erasistratus, younger than Herophilus, was born into a medical family in Cos ca. 310 BC [54] when the island was under Ptolemaic influence, but he lived in Alexandria during the reign of Philadelphus and Evergetes. He studied medicine first in Athens with Metrodorus, Aristotle’s son in law and he became strongly influenced by Peripatetic thought. This explained his credit at Alexandrian court and Erasistratus’ philosophical ties represented an advantage dealing with Ptolemy II and his son [55]. Diogenes Laertius [56] held that he was a Theophrastus’ disciple, tradition confirmed by Galen (IV. 729). This historical fact gave rise to a further doxographical tradition about Erasistratus’ relationship to the Aristotelians, attempting to explain Erasistratus’ mechanism and horror vacui as consequences of Aristotelian philosophy. In physics, horror vacui or plenism, commonly stated as ‘nature abhors a vacuum’, is a postulate attributed to Aristotle, who articulated a belief, later criticized by the atomism of Epicurus and Lucretius, that nature contains no vacuums because the denser surrounding material continuum would immediately fill the rarity of an incipient void. But he never said this really and in his Physica (IV. 8) he goes into detail on why vacuums are impossible in his theory. Following Aristotelian logic, Erasistratus holds that all processes in the body can be causally reduced to the mechanical
principle of *horror vacui*.

About 280 BC he went to Cos and Erasistratus came under the influence of Chrysippus, probably a member of Cnidian school [57], especially in the fields of anatomy and physiology, the father of Ptolemy Philadelphus’ palace doctor who was killed by order of this king; the father [58] for Wellmann was already established in Alexandria. It may have been these personal connections which brought him later to Alexandria. This author [59] also argues that Erasistratus was a court physician and he surely had good relations with the rulers. He had lived for some time, probably in 294 BC, at the court of Seleukos I Nicator, where he acquired great reputation by discovering the cause of the disease of the king’s eldest son, Antiochus (Fig. 12), a silent and exalted love for his stepmother Stratonice [60]. The story shows the prestige of a renowned doctor, capable of upsetting the Seleucid power, a distorted reflection of its credit in the Ptolemaic court.

Nicknamed ‘the Infallible’ for his scientific and moral reputation, none of his toxicological works has survived except some fragments about the viper, the basilisk or lizard and the ammodyte or cenchrias. He performed the autopsy on the victims; however he only referred to therapy and symptoms, proposing woman’s breast milk as antidote. He was a pioneer in the field of pathological anatomy, conducting post-mortem examinations of the men’s bodies who had just died to establish the causes and changes [61]. Without being considered a special treatise, he wrote a general pharmacological study, based in his many notions about plants and uses. With a great authonomy to healing, he founded a new alternative school of treatments with remedies, followed by a big supporter in Rome, Asclepiades, and another in Smyrna, Hikesius, author of a successful book on drugs and diets. He founded his cure in an acute diagnosis, without underestimating the ‘diathesis’ or individual organic predisposition to disease (Galen V, 138). This school was withdrawn from Herophilus in these pharmacological aspects. Wellmann thought that many of Erasistratus’ theories could be attributed to Chrysippus. He preferred prevention to therapy and in a separated treatise stressed the importance of hygiene [62]. In general he was opposed to violent remedies, especially purgatives, to the use of so many drugs and to phlebotomy, choosing in their stead carefully regulated exercise, diet, massage and vapor bath. Extant evidence suggests that Erasistratus directly owed to Chrysippus gentle therapeutic practices in place of violent ones because elsewhere is said to have avoided strong purgatives and preferred light emetics [63]. From the testimonia Chrysippus appears as a transitional medical figure, trained within the old medical families of Cnidus but with innovative therapeutics. The evidence about the physician Chrysippus of Cnidus, son of Aristogoras (RE 16), shows him to have been one of the most influential of the non-sectarian physicians of the late fourth and early third century [64]. Opposed to the Herophilus’ Egyptian medicine, Erasistratus condemned his indiscriminate use of poppy and theriac and criticized the use in pharmacology of Apollodorus’ magical substances. He mocked doctors who mixed in their recipes metals, plants, substances of all venemous animals, making a veiled reference to his colleague Herophilus and added that causes of poisoning seems to escape to all logic [65]. Nevertheless, according to later tradition, an incurable ulcer on his foot caused him to commit suicide by drinking hemlock [66].

**Straton de Lampsacus** [67], Peripatetic and the third head of the Lyceum during 18 years, was an Erasistratus’ disciple and the teacher of Ptolemy Philadelphus in Alexandria, shortly before the Theophrastus’ death. He was a philosopher-scientist and adopted a corporeal theory conceiving his particles as very small, imperceptible, corporeal entities surrounded by a vacuum in a finally divided or discontinous condition. He developed the principle so called *horror vacui* [68] that was related to the Erasistratus’ theory and also seems to have suscribed to the *pneum doctrine*.

He had a naturalistic and even mechanistic tendency, mixing Aristotle’s and Democritus’ theories and founded somatic psychic linked to the soul. He is not strictly *a ὕποψις* but Philumenos knew some of his extracts. He also wrote the oldest records on the shrew, the snake hemorhois, the segs with its corrosive venom, stingrays (Fig. 13) (but nothing about the dipsas (Fig. 14) and he is especially interested in the therapy of poisons and human bites [69]. His *pharmacopeia* follows his master’s principles, composed of ordinary remedies, particularly botanical, on the kind of *euphorista*, as cabboge seedpods (Fig. 15), prominent plant in the Erasistratus’ school.

**Apollonius of Memphis** (ca. 250 BC), Straton’s student and Erasistraten (Galen, XIV, 700) is independently known to have had Egyptian connections and have practised in Alexandria. He is quoted by Galen and Soranus because of his merits and his iological skills and about the acnesis in the Scholia to *Theriaca*. For Galen, he has prepared and effective remedy against all venoms, an important milestone in the great future compositions (*Mithridatium* and *Galena*) and five of his ingredients are included in the panacea that ends in the *Theriaca*. It should not to be confused with Apollonius of Rhodes [70], the Greek poet, but he is identified with one who described the most dramatic signs of

---

**Fig. 12.** Antiochus and Stratonice (with Erasistratus). Jacques Louis David, 1774, Beaux Arts, Paris.
envenomation by Egyptian hemorrhoids (Fig. 16). He wrote a work On the names of body parts and he also gave its nomenclature to the diabetes, a metabolic disease with high blood sugar levels, word that means ‘to pass through’ (dia=through, betes=to go) or ‘siphon’, because it drains more fluid than a person can absorb.

Philinus of Cos (ca. 250 BC) was a surgeon, Herophilus’ pupil as well as Andreas, before following another path. In Alexandria of 3th century, he stood at the head of the Empiricist school and was the first to have severed it from the rationalist school, rejecting the discipline of λόγιοι ου δογματικοί (Rationalists or Dogmatics) in benefit of the experience alone. He privileged pharmacology as all Empiricists and shares the enthusiasm for botanical nomenclature with pharmacologists [71]. Reportedly, he wrote a treatise of general scope and likely a particular book on poisonous intitled Περί θηριακών ου θηριακά (Theriaca). Aelius Promotus appointed him as a θηριακός and he introduced to us a viper flesh prophylactic ointment, similar to that mentioned by Nicander [72].

Bolos of Mendes, an Egyptian sage who flourished in Alexandria around 200 BC., has influenced indirectly his school. Following Neo-Platonic philosophy and under the pseudonym of Democritus, he made a synthesis of all sciences in Physical and mystical Questions and wrote on a wide range of subjects developed in his times: marvels, astronomical phenomena, esoterica, natural history and potent remedies, in which natural history and the lore of marvel are indistinguishable. He was widely read in Antiquity when his reputation rivaled that of Aristotle as an authority in natural history. In Artificial and Natural Drugs, animals, plants and minerals, each associated with its particular astral god in terms of ‘magical loves and hates’, were believed to be invested with miraculous powers. Manipulating their occult forces it was possible to achieve the cure of a disease through sympathetic magic and homeopathy or imitative magic. So the black hellebore was effective against black bile diseases or melancholy. The sympathetic remedies, rejected by Hippocrates as magical cures, were used since the Hellenistic period by Greek medicine on behalf of experience but related to magic [73].

Andreas, from Carystos as Diccles, was the personal physician of Ptolemy IV Philopator (244-205) and closed the list of remarkable physicians in the Ptolemaic court during the 3rd century BC. He was killed at early dawn instead of his master in his tend on the eve of the battle of Raphia (Polybius V, 81, 5-6), victim of an enemy conspiracy in the 4th Syrian War against Antiochus III the Great, confirming the dangerous degree of intimacy of courtly doctors. He was a real θηριακός quoted by Celsus, Dioscorides, Soranus and Galen, and represents a rare combination of court Herophilian physician with a literary and scientific distinction. He extended his interests to drugs, surgery and to gynecological and obstetrical problems in general, studying as Herophilus,

Fig. 13. Cowtail stingray of Marsa Alam, Egypt.

Fig. 14. Dipsas, a snake so small and poisonous that its bite kills before it is felt (Lucain, Pharsalia IX, 867-895). Bestiary of Ann Walsh, Kongelige Bibliotek, Copenhagen, Denmark.

Fig. 15. Cabbage seedpods.
the causes of difficult birth labour. Applying the new mechanic technology of Archimedes and Ctesibius, he created a famous instrument for reducing dislocated limbs in the field of orthopedic surgery [74].

He wrote several medical texts on which nothing remains but the titles and a few extracts preserved by different Ancient authors. In his θηριακές λόγος, named following Theophrastus Περί τῶν δακτυλών, On poisonous animals, he described, according to Archelaus, the antidotes and their composition, completed his teachings with an Περί δηλητηρίων (On murderer poisons). According to Nicander’ scholia, where he also highlights the pharmacological virtues of the scolopendrium officinarum (Fig. 17), used in theriac, the salamander blood (Fig. 18), capable of protecting from the fire, and produced a drug to protect against the phalanx or harvest-spiders, with ingredients included in the Panacea or cure-all. He was the first to write a treatise on rabies and hydrophobia, named κυνόλυσσας and explains also panophobia, fear of all things, perhaps an extreme form of paranoia.

In a polemic writing against the beliefs recorded by the paradoxographers, On False Beliefs (Περί τῶν ψευδῶν καισαυτέων), he attacked the popular zoological paradox, mentioned also by Nicander, that sea eels go ashore to mate with vipers. He leaves his master’s aggressive anatomy because at that time the experiences of lethal drugs on humans were on fashion and replaced dissections and vivisections. He cultivated his master’s legacy in his main work on drugs or cosmetics, Narthex or Casket, and invented several drops. The title is significant, nartex (Ferula nartex) is an umbelliferous plant (like the carrot), very appreciated by the Ancients because it yields a valuable antispasmodic drug, asafetida [75]. He made a monumental contribution studying especially the simple and compound drugs and the toxic effects of certain plants and animals, including the deleterious action of opium and its alterations in trade. ‘It is reported if opium was not adulterated, those who smeared their eyes with it were blinded’, Andreas said [76].

Even Dioscorides (praefatio I) dignified Andreas for his greater accuracy in drugs, medicinal plants and roots. He has invented several drops and he is mentioned and quoted extensively, no less than twenty-five times [77], appreciated as an authority and an inevitable source in pharmacological contexts. The later writers used freely his materials because of his great reputation, such as Heraclides of Tarantus and Serapion, Philinos’ disciple and successor in Alexandria. Later on he was forgotten and treated with indifference.
7. Preeminent personages at the end of the Ptolemaic Dynasty

From the reign of Ptolemy VIII onwards the Alexandrian studies turned negative for two generations, although Herophilian medicine survived without noticeable interruption as a prominent force in Alexandrian life until the later days of the Dynasty. In iological and pharmacological studies, talent again manifested itself around the Ptolemaic court in the late 1st century BC and the achievements in some aspects equaled those of the early Ptolemaic Period. It is the time of Heraclides of Tarentum, Apollonius Mys, Zopyrus, Dioscorides Phacas, Apollonius Kition [78].

Heraclides of Tarentum, one of the most quoted doctors of the Hellenistic world, studied with the Herophilean Mantias, but following the example of Philinus of Cos, became an empiricist in the first half of the 1st century BC during Ptolemy XI Auletes and Cleopatra VII’s reigns. He wrote Against Herophilus’ On pulse in an attempt to justify his conversion from Herophilianism to Empiricism, holding that pulse was not related with the movements of systole and diastole [79]. Trying to exclude from medical science the prominence of aetiology, he introduced sign or symptoms, cause and body into the subdivision of neutrals. After being disciple of Ptolemy of Cyrene, he introduced in therapeutic the distinction between internal and external diseases. Heraclides wrote a book on Empirical sect practices and would be a renovator of this trend, advocating a moderate use of rationalism. He really made the union between the two schools, practicing surgery and anatomy on one side and on the other the experimental methods and therapy. He contributed to the compilation of Hippocratic glossaries and consulted the major Empiricists and other masters, Hippocrates, Diocles, Andreas, the iologist Apollodorus and especially Hycessus, an Erasistratean of Smyrna preferred sometimes to Mantias. However, we know very little of his life and works, focused on pharmacology, therapeutics and nutrition. According to Pliny, he was a prolific writer with more than 40 works among them: On inner treatments (Caelius Aurelianus, I, 4), On simples (Galen, Antidotes I, 1), Preparation and testing of drugs (Galen, Simple medicamentorum VI, in proemium), a military pharmacopeia, Stratiotes, and also a Comment, to claim about the genuine works in the context of the Hippocratic exegesis where he mentioned Andreas [80].

Classmate of the pharmacist Apollonius Mys, he collected a vast repository of materials which will draw doctors and pharmacologists. He still followed the prevalent modes of treatment of Herophilus’ tradition using polypharmacy, opium and bizarre remedies in therapy: camel brain and bile, crocodile dung, turtle blood, etc. including metal drugs. He devoted part of his time studying iology among other disciplines and wrote On the Theriac and On Venoms of animals, according to Apollodorus. The proof of his research would be his own recipe of a general antidote (Galen, Antidotes, 182) against all the spiders and venomous animals, other (Antidotes 186-7) against viper bites and a remedy based in sea holly flowers or plants (Eryngium) (Fig. 19) (Pliny XXII, 8) that he prescribed against all poisons. In an open polemic against other contemporary physicians, especially belonging to the Dogmatic school, who recommended as healthy fish and salty plants, Heraclides provided in 120 BC a list of salt-free food actually beneficial (Athenaeus III, 120), following Diocles’ doctrine. He also wrote a Simposion or The art of cooking (Athenaeus, III, 74; VII, 328) prior to Athenaeus [81].

Apollonius Mys [82] a figure of considerable stature in Alexandria during the 1st century BC, was contemporary of Strato and colleague of Heraclides, both Chryseirus’ pupils. This master became known both for his views on simple drugs, such as asphodel for treating parotid abscesses, droopy and spleen affections, and for his compound drug prescriptions. Famous by his pharmacological knowledge and experience, Apollonius Mys composed one of the Antiquity most famous pharmacological treatises, Euporistus or Readily Accessible Remedies (also known as On common Remedies) from which Galen quotes liberally in his treatise On the composition of drugs according to place. He offered detailed prescriptions for common ailments, headaches, toothaches, oral infections, skin irritations, etc., using as his master asphodel (Fig. 20), highly regarded in Greek mythology as the flowers of Hades and the dead, sacred to Persephone. He adopted one of the guiding Mantias’ taxonomic principles, the nomenclature by place or secundum locos, κόλον το γαρ αυτόκτονος (i.e. headaches, ear-aches, skin conditions, eye ailments, upset stomach, etc.), very useful during centuries to replace the earlier compilation of prescriptions by kind or per gener, κόλον γαρ το σαφήνεια (i.e. purgatives, clysters, emollients, etc.). The practicity of this arrangement and the fact that all the ingredients used by Apollonius were readily accessible, although somewhat esoteric, as the Herophilus’ organotherapy in vogue for a long time, may account of its popularity in the first two centuries. Even though the book is mentioned by several authors, it was frequently criticized by Galen, who cited his antidotes to prevent poison effects, by Oribasius and Philumenus.

Two more works are known, one very comprehensive in 29 books under the title On the school of Herophilus, concerning especially his physiological and pathological theories, and the other, Nartex or On perfumes and ointments, which brings us back to Andreas. His doxographic and apologetic writing, a tradition beginning in the 3rd century BC with Bacchius, probably reflects the growing insecurity to face their Empiricist rivals and also the popularity of the Pneumatic and Methodist’s schools of medicine. The second is quoted in Athenaeus’ Dieipoaphilastae and perhaps resumed the Herophilian interest in cosmetics closely related to pharmacology, both using the same substances with the same qualities and effects as ingredients: saffron, rose, olive and bitter almond oils, vineyard, spikenard, dropwort, galbanum, fenugrec, frankincense and purslane [83].

Fig. 18. North African fire salamander: Salamandra algira.

Fig. 19. Sea holly flowers (Eryngium).
Toxicology Reports 8 (2021) 1310–1323

Zopyrus (ca. 100 or 80 BC.) was a surgeon, probably holder of Alexandrian citizenship and thus tutor of Apollonius of Citium and Posidonius, closely associated with the Ptolemaic court. He composed for one of the Ptolemies [84], (probably Auletes), an antidote called ‘Ambrosia’, the same name used in that of Philip of Macedonia (Celsus, XXIII, 2; Galen, XIV, 150), excellent against deadly poisons, all poisonous species and to cure internal diseases. Zopyrus also sent a letter to Mithridates VI of Pontus with another antidote recipe, begging to be included with his tests in criminals.

One of his pupils, both belonging to the Empirical school, was Apollonius of Kition or Cyprus, Greek physician closely connected with the court of Ptolemy Auletes. He studied medicine in Alexandria under the surgeon Zopyrus, but he lived in Kition (now Larnaca). He was famous in all ancient Greek world and he was the best doctor in Cyprus [85]. His medical opinion was considered true and original, according to Herodian. He worked as a surgeon and medical writer.

He wrote the only doxographical work of the Hellenistic medicine that has survived intact, On Joints, in three books, undertaking this exegetical task in obedience of the king’s commends and the first was dedicated to King Ptolemy of Cyprus. He followed the Hippocratic description, diagnostic methods and simplified reduction techniques used by athletes and nonphysicians in the Greek gymnastics. The book was provided with illustrations to show the restraint methods discussed by Hippocrates.

In addition, the author studied the Hippocrates’ teachings [86] in 18 books [87], a polemical work against Baccheius of Tanagra, questioning the interpretations given by Heraclides of Tarentum, a Hippocrates commentator and also wrote two books on therapeutics.

Dioscorides Phacas — apparently a prominent counsellor and ambassador of Cleopatra [88], of her father and brother, was with Andreas the only Herophilean physician identified with the Ptolemaic court. Nicknamed ‘Phacas’ because of the moles or warts (phakoi) on his face [89], he resided in Alexandria in the 1st century BC. He testified the constant presence of Herophilean school at Alexandria, that remains remarkable amidst the political and social vicissitudes in the history of science and scholarship in the city. In Rome, according to Caesar (De bello civili III, 109. 3–6) in 48 BC, ‘Phacas’ undertook with Serapion, both representatives sent to Achillas in Rome, perhaps a fatal mission on behalf of Ptolemy XIII. But he did survive and he re-emerge in an influential role maybe with Cleopatra at Antony’s time.

As most Herophileans, he composed a polemical work in seven books, engaged in the Hippocratic exegesis and lexicography and also twenty-four renowned medical books from an exegetical context that includes also therapeutic measures and close clinical observation. Rufus of Ephesus, a Greek physician (ca. 80 BC or 150), reports an outbreak of ‘bubonic’ plague in Libya, Egypt and Syria and refers that two Alexandrian contemporary doctors, named Posidonius and Dioscorides, described the symptoms including acute fever, pain, agitation and delirium. However Rufus neither identified Posidonius as the Stoic Philosopher (135-50 BC) nor refers to Dioscorides as ‘Phacas’ or the Herophilean and it is a problematic source. Undoubtedly as physician in Cleopatra court, ‘Phacas’ probably shared her interest on poisons and her tests in criminals.

Sostratus, maybe contemporary of Augustus, possibly practiced in Alexandria around 30 BC as a surgeon (Celsus VII, 262) and for Galen (XIV, 235) he knows iology. The iological fragments found refer to the amphibibena or snake-of-two-heads (Figs. 21 and 22), a horned dragon-like creature with a snake-headed tail, spawned by the blood of Medusa, the vipera prester, the plant of Helen, inula or hellénion (Inula helenium L.) (Fig. 23), etc. Through the Nicander’s scholia we know that he also wrote two books On animals, like those of Theophrastus, mentioning poisonous animals that bite and sting. He also included the history of the eel (Fig. 24) that go ashore to mate with vipers, in the same view of Andreas and Nicander. According to Wellmann, the Aelian’s indication on the asp that killed Cleopatra without leaving any sign probably come from Sostratus, who give his own version of the episode, following the symptoms listed by Nicander. Although Strabo (XVII, 10) is the earliest source for Cleopatra’s suicide and even may have been in Alexandria at the time she died, he proposes two versions: by the bite of an asp or by applying a toxic ointment in her chest wound.

Alexandrian science, though much diminished, continued to exist even as Rome eclipsed it, and among the later physicians of note, we can mention Philomenus of Alexandria, a physician of the Eclectic school, who belongs to the late period under the Roman Empire, probably 180 AD, between half of 2nd or 3rd century. His work on venoms and that of Nicander are the only two that were kept. Great style author-compiler, he marks a point in the medical stream of his time, especially in gynecology and toxicology. Philomenus’ treatise, edited by Wellmann in 1908 [90], De venenatis animalibus or On animal venoms and their remedies, (Περὶ κοινίσων ζώων καὶ θηραπείας), differs by the previous ones for its more coherent structure. Philomenus follows the Archigenes’ model, forming an unitary and coherent topic, unlike previous authors who divided in two different part the work, symptomatology and therapy of the envenomation. Philomenus, instead, made a brief description of each animal, accompanied by the effects of its bites, intoxication and remedies. In 37 chapters, he analyzes the dog rabid bites (§1-2), wasps and bees (§11), flies, fleas (§12), gecko (§13) tarantules (§15), mygales

Fig. 20. Asphodelus Ramosus.

Fig. 21. Amphibisena or snake-of-two-heads in medieval bestiary.
affected by the medical practices of ancient Egypt. Court physicians, playing also a large role in politics, stood out in this branch by their research about potions, poisons and antidotes, studying the snake venoms and poisonous plants properties.

Beyond two giants, Herophilus and Erasistratus, there were many other iologues or eminent physicians in Alexandria whose works on botany, pharmacology and toxicology were renowned. But not all the Alexandrian physicians were Herophilus’ or Erasistratus’ disciples, because there was too an important empiricist school. Even Galen, who studied in Alexandria before practicing in Rome, would incorporate into his work the best of that school’s writings, leading to advance of western scientific branch of toxicology. Alexandria was the bridge to develop this science, very important in the History of Medicine.

After the Ptolemaic dynasty, not to mention Philomenus again, Alexandria became once more a major medical center since the 4th century, but it still retained its prestige in the field of toxicology. Suffice it to mention two names as Soranus and the Byzantine physician Paul of Aegina to give an idea of the importance of the proposed studies and the glory found.

8. Conclusion

Alexandria, was the intellectual capital of the world due to its Mouseion, or temple dedicated to the Muses, part academy and part research center, besides to the great ancient Library that epitomized the zenith of learning for over six centuries and continued to inspire scientists and scholars everywhere.

The Faculty of Medicine, recognized as an independent field of science, promoted the specializations in a number of ways, this ancient Egyptian diversified knowledge being superior to the later Greek knowledge.

A famous medical school of toxicology was established for the first time in old Alexandria during the 3rd century BC. Although mainly Greek in essence, following the Hippocratic teachings, it was heavily

References

[1] R. Hajar, Medical illustration, Art in Medical Education, Heart views, 12, 2011, pp. 83–91, p. 83.
[2] R. Hajar, Past Glories. The great Library of Alexandria, Heart Views, 1, 2000, pp. 278–282.
[3] A.M. Rosso, Un ejemplo de las influencias y las transferencias de la medicina egipcia a la griega: la teoría de los wxdw, in: C. Viescas, J.-P. Tritoc (Eds.), Analegta Historico Médica V, Ato V, Méjico, 2007, pp. 159–174.
[4] G. James, Stolen Legacy: Greek Philosophy is Stolen Egyptian Philosophy, 1993.
[5] Fraser P., Ptolemaic Alexandria, 1972: 317. See Rostovtzeff M., The Social and Economic History of the Hellenistic World, T, 3, 1941:1660, n. 48; Paulus-Wissowa, Realencyclopädie der classischen Altertumswissenschaft, 1933: XVI, cols. 797-821 and 811-813.
[6] Fraser, 1972, p. 315.
[7] Strabo, Geography, 1917: XVII,1.8.
[8] A. Benard, Alexandria la Grande, 1998, pp. 131–133.
[9] Tertullian, De anima, 1853: X. 4.
[10] F. Jonckheere, Médecins de Cour et Médecine Palatine sous le Pharaons, Chronique d’Egypte 27 (1952), pp. 51–87, p. 69.
[11] H. von Staden, Herophilus. The Art of Medicine in Early Alexandria, 1989, pp. 25–26.
[12] Jonckheere, 1952: p. 73.
[13] Claudi Galeni, Opera Omnia, C.G. Kühn (Ed.), 20 vol. 1821-1833: XVII, 1, 606. In § 603 he discuss the origin of this sign: probably Mnemon would have added these χαρακτήρες in the copy of the Alexandrian library because forgery flourished when the books were copied. Mnemon 3, Paulus-Wissowa 1932: XV, 2, col. 2261.
[14] Fraser, 1972, pp. 364-367.
[15] C. Goreman, Médecins de Cour dans l’Egypte de l’Ille siècle av. J.-C, Chronique d’Egypte 32 (1957), pp. 313–336, p. 336.
[16] Diller H., Philinos 9., Paulus-Wissowa, 1938: col. 2193–2194. See also about all these physicians, collected sources by Susumbl Fr., Geschichte der Griechischen Litteratur in der Alexanderzeit, 1891-1892, pp. 777-818.
[17] Kadlien F., Anatomie, Paulus-Wissowa, 1968: 44-46; Deichgräber K., Die griechische Empirikerschule, 1965: fr. 66-70, n. 13 infra; von Staden, 1989, p. 446.
The father gave up the woman for the bride to his son and also resigned to his son

M. Wellmann, Beitrage zur Geschichte der Medizin in Alterthum, Hermes 65 (1930)

M. Wellmann, Chrysippus 16, an anatomist, Pauly-Wissowa, 1899. III, col 2510;

Diogenes Laertius, Lives of Eminent Philosophers, 1925.

Pliny (XXIX, 5) made a rude contamination between Antiochus and the king

Celsus, On Medicine, 1989: V, 10; XII, 53.

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

von Staden, 1989, pp. 272-274.

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

[54] Misopogon, 1912: 60-64; Galen XVIII, 2, 18.

Appianus, Syriaca, 1912: 59; Lucian of Samosata, The Syria Dea, 1939:17; Julian,

322

P. Demont, Les découvertes de la Médecine Grecque, 1991, p. 8.

T. Manzoni, The Cerebral Ventricles. The animal spirits and the dawn of brain localization function, Archives Italiennes de Biologie 136 (2) (1998), pp. 153-152.

E. Grivelato, D. Rivanti, Soul, Mind and brain, Greek Philosophy and the Birth of Neuroscience, Brain Res. Bull. 71 (2006), pp. 327-336, p. 334.

von Staden, 1989, pp. 523-527.

J. Sergedini, Ancient Alexandria and the dawn of medical science, Glob. Cardiol. Sci. Pract. 4 (4) (2013), pp. 395-404.

Gortemann, 1957, p. 332.

Gortemann, 1957, pp. 333-335.

Rostovtzeff, 1941, p. 1090.

Adie Flower, I Lidi della Conoscenza. La storia dell’antica Biblioteca di Alessandria, 2002, p. 83.

He was an anatomist, son of Aristagoras, a contemporary of Praxagoras, a pupil of

Rostovtzeff, 1941, p. 1090.

A. Aggrawal, History of Toxicology, 2005, pp. 525.

Pliny the Elder, Natural History, 1938

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

von Staden, 1989, pp. 272-274.

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

[25] T. Manzoni, The Cerebral Ventricles. The animal spirits and the dawn of brain

[67] M. Wellmann, Philumenos, Attributes to Straton of Beirut, 1st century AD,

[66] Longrigg, 1971, p. 386.

Nicandre, 2002, p. XXXVIII.

[89] M. Wellmann, Herodots werk, Hermes 40 (1905), pp. 580

[85] K. Markatos, D. Korres, D. Chytas, et al., Apollonius of Citium (first century BC) and

[75] G. Sarton, Hellenistic Science and Culture in the Last 3rd Century BC, 1993,

[74] von Staden, 1989, pp. 472-475.

G. Sarton, Hellenistic Science and Culture in the Last 3rd Century BC, 1993, pp. 138–139.

Discurcios. Plantas y Remedios Medicinales. De Materia Medica, 1998. I, 74, 6.

Eleftherios, Hellenistic Science and Culture in the Last 3rd Century BC, 1993, pp. 138–139.

Discurcios. Plantas y Remedios Medicinales. De Materia Medica, 1998. I, 74, 6.

E. Phylake,“,’pòd sựσ, 2002 p. XXV .

Alessandria, 2002, p. 83.

A. Aggrawal, History of Toxicology, 2005, pp. 525.

Pliny the Elder, Natural History, 1938

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

von Staden, 1989, pp. 272-274.

A.M. Rosso, Alexandria, an Emporium in the Silk Road, and the Traffic of unusual

[21] C.J. Singer, Greek Biology and Greek Medicine, 1922, p. 84.

von Standen, 1989, pp. 459-460.

Wellman M., Eudemos 17., Pauly-Wissowa, 1909: VI, col. 904.

[40] Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.

Adie Flower, 2002, p. 91.

C. Allboutt, Greek Medicine in Rome: the Fitzpatrick Lectures on the History of

Adie Flower, 2002, p. 91.

Adie Flower, 2002, p. 90.