

Asia Minor: The Birthlands of Philosophy, Science, Medicine and Anatomy

Küçük Asya: Felsefe, Bilim, Tıp ve Anatominin Doğduğu Topraklar

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ABSTRACT In 7th century BC, the crowning periods of Egyptian and Mesopotamian civilizations had ended. The pioneering in science came farther west, to Aegean coasts of Anatolia. First free thinking systems which were purified from primitive beliefs and religious dogmas had been grown in there. The well-known Milesian school of philosophy had searched for logical explanations about natural events. In following centuries, worlds well-known philosophers like; Pythagoras of Samos, Heraclitus of Ephesos, Anaxagoras of Clazomenae and Democritus of Abdera who were educated in these coasts as well, had improved outreligious theories about the genesis and evolution of cosmos and nature. Aristotle who gave lectures in Assos had honoured these objective erudites' succession. In this occasion, the diagnosis and treatment of illnesses were became as rational sciences by departing from prophecy and witchery. Hippocrates of Cos who became known as the "Father of Medicine" had found a medical school on these coasts in 5th century BC. Herophilus of Chalcedon and Erasistratus of Keos had followed him and gave a start to dissections in Alexandria where became as the new science center. Herophilus had made history as "founder of anatomy" and Erasistratus as "founder of physiology". Medicine and anatomy had continued to grow in these lands known as the "Asia" state of Roman Empire, in 1st century BC. Galen of Pergamon, crystallized all the best work of the classic age as a physician and anatomist, was also born in Asia Minor after Rufus of Ephesos and Soranus of Ephesos. But in 5th century AC, scholastic idea had dominated with the propagation of Christianity and medicine had incurred in to the sagnation period.

Key Words: History of medicine; anatomy; asia, western; history, ancient

ÖZET M.Ö. 7. yüzyılda Mısır ve Mezopotamya uygarlıklarının parlak dönemleri sona ermiştir. Bilimde öncülük daha batıya, Anadolu'nun Ege kıyılarına geçmiştir. İlk inanışlardan ve dinsel inaklardan arınmış ilk özgür düşünme sistemleri burada doğmuştur. Ünlü Milet Felsefe Okulu doğal olaylar hakkında mantıklı açıklamalar ortaya koymuştur. Sonraki yüzyıllarda Sisam'lı Pisagor, Efes'li Heraklit, Kilizman'lı Anaksagoras, Abdera'lı Demokritus gibi bu kıyılarda eğitim görmüş ünlü filozoflar da doğa ve evrenin başlangıcı ve evrimi hakkında dinselikten uzak kuramlar geliştirmişlerdir. Behramkale'de ders veren Aristo nesnel düşünen bu âlimlerin başarılarını onurlandırmıştır. Böylece, hastalıkların tanı ve tedavisinde kehanet ve büyücülükten arınmış mantıklı bilim kullanılmıştır. Tıbbın babası olarak bilinen İstanköy'lü Hipokrat M.Ö. 5. yüzyılda bu kıyılarda bir okul kurmuştur. Kadıköy'lü Herofilus ve Keos'lu Erasistratus da onun takipçileri olmuşlar ve yeni bilim merkezi haline gelen İskenderiye'de diseksiyonlara başlamışlardır. Herofilus anatominin, Erasistratus ise fizyolojinin kurucuları olarak tarihe geçmişlerdir.

1. yüzyılda Roma İmparatorluğu'nun Asya eyaleti olarak bilinen bu topraklarda, tıp ve anatomi gelişmeye devam etmiştir. Küçük Asya'da Efes'li Rufus ve Soranus'tan sonra doğan Bergama'lı Galen bir hekim ve anatomist olarak klasik çağın en başarılı eserlerine imza atmıştır. Ancak M.S. 5. yüzyılda Hıristiyanlık propagandasıyla birlikte ortaçağ düşüncesinin hâkim olması sonucu tıp duraklama dönemine girmiştir.

Anahtar Kelimeler: Tıp tarihi; anatomi; batı asya; tarih; antik

Ancient Egyptian medicine, like other aspects of ancient Egyptian civilization, was a product of the intimate relationship between the heavens and earth. Medicine in ancient Egypt was but one aspect of an advanced civilization. It was not practiced by witch doctors as in primitive tribes, with mixture of magic, herbal remedy, and superstitious beliefs. This was acknowledged by Homer in the *Odyssey*: “*In Egypt, the men are more skilled in medicine than any of human kind*”. Despite such limitation in their knowledge of the causes of diseases, their study of anatomy and physiology was so advanced. No doubt, this was due to their embalming of the dead, when other nations at that time used to burn them.¹⁻⁶

As Mesopotamian civilization emerged, Egyptian civilization rose in the Nile valley. The most important of these was a religious outlook that resembled the Mesopotamian in its comprehensiveness. Egyptians also contributed to mathematics, astronomy, and medicine, often outstripping the Mesopotamians but, like them, never theorizing their observations.^{7,8}

In 7th century BC, the crowning periods of Egyptian and Mesopotamian civilizations had ended. The pioneering in science came farther west, to Aegean coasts of Anatolia (Asia Minor).

AEGEAN COASTS OF ASIA MINOR

After the collapse of the Hittite Empire and the Trojan War, because of the dynamic developments, an increase of prosperity depending on maritime and trade had been on Aegean coasts of Asia Minor. Instead of central powerful monarchies, lots of harbour cities were developed here. The elections for city government, councils that bring to book and written norms of law assured the manufacturers and merchants. Comparatively democratic ambient triggered the free thinking systems which were purified from primitive beliefs and religious dogmas had been grown in there.

The earliest scientific developments began with the Ionian Confederation (Ionian Dodecapo-

lis) consisting of 12 harbour cities. On Anatolian coasts: Miletus, Ephesos, Myus, Priene, Kolophon, Lebedos, Teos, Klazomenai, Erythrai, Phokaia; and two islands opposite, Samos and Khios. The center of this confederation; the place that “Panionian Games” were held is now near Kuşadası, Turkey (Figure 1).⁹

First, philosophy was developed and initiated the other positive sciences. The systematic ideas predicating the constitution of the nature and cosmos to outreligious factors are first told by Milesian erudites in 6th century BC. Miletus; the most developed and richest harbour city of Ionia was 30 km south of Kuşadası now. Miletus produces three philosophers: Thales, Anaximander and Anaximenes. These philosophers seek the one, unchanging material principle of all things. *Thales* (624 BC–546 BC) (Figure 2) seems to be the first known Milesian philosopher, scientist and mathematician. He learned astronomy and geometry from Egyptian monks and borrowed this knowledge to Aegean coasts. According to him all things are “water”. Water is the principle, source and support of the nature and cosmos. Thales was a figure of enormous prestige because he predicted an eclipse of the sun in 585 BC. He is believed to have been the teacher of



FIGURE 1: Aegean coasts of Asia Minor.

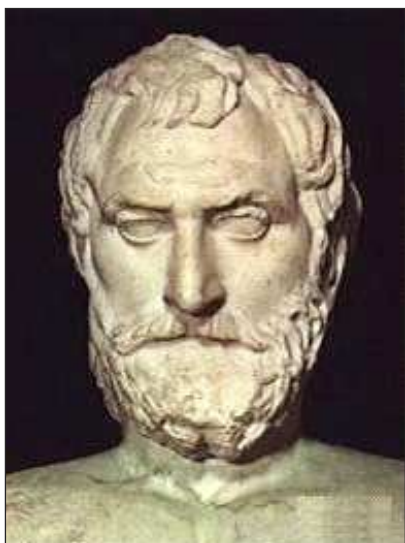


FIGURE 2: Thales of Miletus.

Anaximander and he was the first natural philosopher in the Milesian School.⁹⁻¹³

Anaximander (611 BC–545 BC) worked on the fields of what we now call astronomy, geography and biology. He suggested that cosmos is “boundless” (apeiron) and there are oppositions in it (heat-cold, dryness-wetness, birth-death). These ideas of him are the forerunner of the dialectic. According to him man traces his origin from fishes. Because of this, he has come to be considered the pioneer of “evolution” theory.^{9,11-13}

Anaximenes (585 BC–528 BC) is the last of the Milesian school founded by Thales. With Thales he held that a single element lay behind the diversity of nature, and with Anaximander he sought a principle to account for diversity. He believed that single element to be “air” (pneuma).^{9,11,13}

The erudites from other Ionia cities (Samos, Kolophon, Clazomenae, Ephesos) had improved the ideas of of the Milesian School step by step. *Pythagoras of Samos* (560 BC - 497 BC) was an Ionian mathematician and philosopher, known best for formulating the Pythagorean theorem. Known as “the father of numbers”. Pythagoras was born on the island of Samos, off the coast of Kuşadası. Pythagoras and his students believed that everything was related to mathematics, and felt that everything could be predicted and measured in

rhythmic cycles. He opened his school in Croton (South Italy) to men and women students alike. Pythagoras was the first to use the word “cosmos”. The universe is a cosmos, not a chaos.^{11,14,15}

Xenophanes of Kolophon (540–440 BC) went to South Italy because of the Persian invasion and founded the famous “Eleatic School”. He was the first erudite to examine the fish rumps and sea fossils.¹⁶

Anaxagoras of Clazomenae (500–428 BC) moved to Athens from the Ionian coasts and brought the spirit of scientific research to the “School of Athens” which was established there. He is said to have dissected animals and studied brain anatomy. After he was accused of atheistic and sentenced to execution, he fled to Lampsakos (now Lapseki, Turkey) at the North of the Dardanelles Strait, where he died.^{9,11,12,17}

Heraclitus (535 BC–475 BC) (Figure 3) was born in Ephesos, the second great Ionian city, now Selcuk, Turkey. Unlike the Milesian philosophers whose subject was the material beginning of the world, Heraclitus believed “fire” to be the underlying substance of the universe and all other elements transformations of it. He taught that all things carried with them their opposites, that death was potential in life, that being and not-being were part of every whole: therefore, the only possible

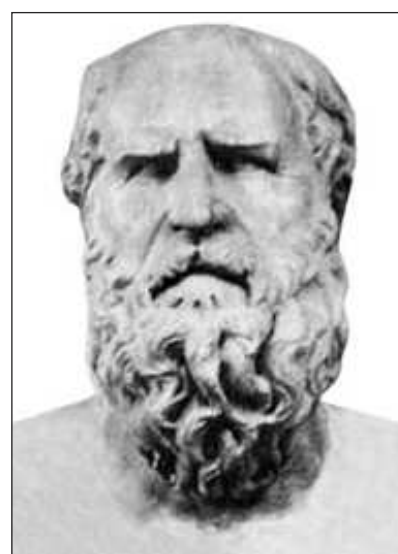


FIGURE 3: Heraclitus of Ephesos.

real state was the transitional one of becoming. He examined the old Mesopotamian and Persian beliefs and quoted to western world. For Heraclitus everything is “in flux”, as exemplified in his famous aphorism “Panta Rhei”. He is known as the “father of dialectic method”.^{11,13,18}

AEGEAN COASTS OF ASIA MINOR

The scientists reached a more suitable environment on north Aegean coasts (Macedonia, Thracia) after the Ionian Rebellion was stifled by Persians (494 BC). Abdera School of Philosophy was founded first. *Protagoras of Abdera* (485 BC–410 BC) went to Athens but had been fled when he was accused of atheistic as well. He is the author of the saying: “Man is the measure of all things” and father of the relativism and negativism in philosophy.^{17,19}

Democritus of Abdera (460 BC–370 BC) (Figure 4) is considered the father of atomic theory. According to his definition, atoms are unborn, indestructible, incorruptible and indivisible, complete and perfect, compact, uniform and simple, infinite in number, variety and form, and in constant motion in a vacuum. He wrote books and dissected animals.^{11,12,17}

Aristoteles of Stagira (384 BC–322 BC) (Figure 5) is the son of a court physician to the king of Macedonia. He educated in “The School of Athens”.

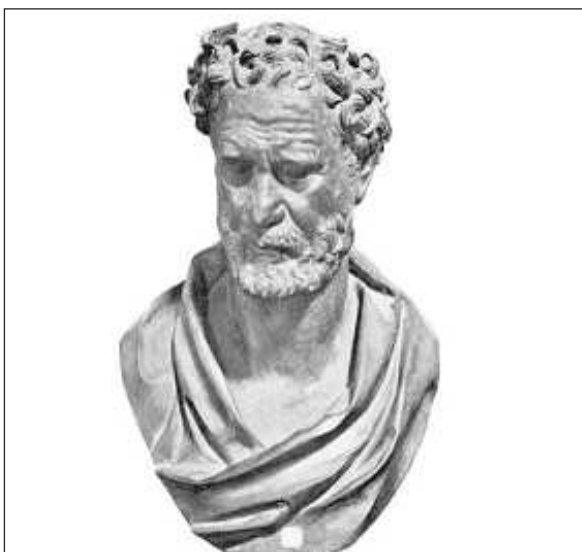


FIGURE 4: Democritus of Abdera.

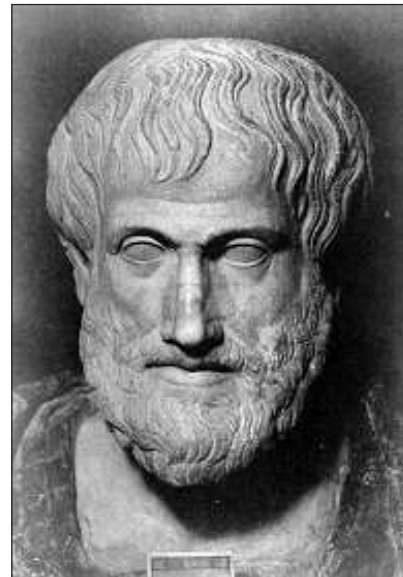


FIGURE 5: Aristoteles of Stagira.

After Plato’s death, he moved to Assos (now Behramkale, Turkey) on the northern Aegean coast of Asia Minor and founded his own school of philosophy. At the invitation of Philip of Macedonia, he tutored his 13 years old son Alexander, later to be known as the famed Alexander the Conqueror. When Alexander became king, Aristotle returned to Athens and established his own school, the Lyceum. He wrote his most important works here. Upon the death of Alexander, he left Athens again and died in Khalkis.^{11,12}

While in Assos, Aristotle became the leader of a group of philosophers and scientists who observed and discussed the anatomy, structure and classification of various plants, animals and insects. His observations on the anatomy of invertebrates are remarkably accurate, and could only have been made from first-hand dissections. He is the first to use the terms “aorta, placenta, arteria and meninges”. He is also known as the founder of comparative anatomy. Aristotle was a great thinker of all times. He used his powers of observation and analysis to document concepts in many fields of science, as well as to develop a lasting philosophy concerning life.^{11,12,20-22}

THE BIRTH OF MEDICAL SCIENCE

Free thinking and natural philosophy developing between 6th and 4th centuries, has shone on applied sciences in the following centuries. In this occasion, the diagnosis and treatment of illnesses were became as rational sciences by departing from prophecy and witchery. The first school of medicine was established in Cos island (opposite of Bodrum, Turkey), at the southernmost point of the Aegean coasts and gained a reputation all over the world. *Hippocrates* (460 BC–377 BC) (Figure 6) is perhaps history's most famous physician. He was a physician from the so called medical school of Cos. By rejecting superstition in favor of scientific observation, by classifying diseases, and by creating a set of moral and professional standards for physicians, he earned the title of “Father of Medicine”. He also gave the world the Hippocratic Oath, a code of ethics for physicians. The anatomy of heart, bones, joints and veins were described correctly in “*Corpus Hippocraticum*” treatises which is attributed to him but could be compiled after many years.^{4,11,12,20,23}

The conquests of Alexander the Great has united the East and West, marked an epoch on science. The harbour city Alexandria that he ordered to be founded in Egypt was developed quickly under the command of his successors (The Ptolemaic



FIGURE 6: Hippocrates of Cos.



FIGURE 7: Portrait of Herophilus by Josef Doeve of The Netherlands in the collection of the Houston Academy of Medicine-Texas Medical Library.

Dynasty) and became the best science center of the world. The Egyptian traditions were enabling the dissections of corpses. The equipped scientists coming from Asia Minor practised upon this opportunity and made the first anatomical dissections in “The School of Alexandria”.^{9,22}

Herophilus (330 BC–250 BC) (Figure 7) made history as the “founder of anatomy”. He was born in Chalcedon (now Asiatic part of Istanbul), became a student of Praxagoras of Cos and developed his teacher's theories at Alexandria. His anatomical studies identified the duodenum, the straight venous sinus within the cranium, and the calamus scriptorius on the floor of the fourth ventricle. Among his many accomplishments, Herophilus of Chalcedon is remembered for naming many anatomical parts like “duodenum, prostata, hyoid” and for describing three parallel systems of vessels: the arteries, the veins, and the nerves. Herophilus traced the connections between the nerves, the spinal cord and the brain. He distinguished sensory and motor nerves, and distinguished the dura

mater and pia mater membranes surrounding the brain.^{11,12,20,22,24-28}

Erasistratus (304 BC–250 BC) was born in Aegean island Keos and studied medicine in Athens. He continued his studies at Cnidos (now near Datça, Turkey) and finally settled in Alexandria. Erasistratus described the brain more accurately than Herophilus. He distinguished the cerebrum from the cerebellum, and he determined that the brain was the originating point for all nerves. His works survive in many medical terms of parts of the circulatory system which he first introduced. He had made history as “the founder of physiology”.^{11,12,20,22,25,28}

In the 1st century BC, the lands of Asia Minor were became a part of more bigger empire – Roman Empire. This region was firstly named “Asia” state formally and Ephesos was declared to be the capital city. These lands continued to bring up the most scholar physicians of the empire for a period of 400 years of peace and prosperity.⁹

Rufus (98–117 AC) studied and practiced medicine in Ephesos, and lived a long time in Alexandria. 96 genuine works are known, some survive, some written in verse. Rufus of Ephesos, a surgeon and anatomist, who first described the optic chiasma and oviduct of sheep, was Soranus’s contemporary. Little known about him.²⁸

Soranus (98–135 AC) was from Ephesos in Asia Minor and he practised in Alexandria before coming to Rome under the emperors Trajan (98–117 AC) and Hadrian (117–138 AC). He was therefore a slightly earlier contemporary of Galen. He wrote about 20 works on medicine and biology including the famous “On Gynaecology” (two books surviving) which covered midwives, female anatomy, conception and childbirth, diet, surgery, and drugs.^{3,28-31}

Galen (130 AC–200 AC) (Figure 8) hailed from Pergamon (now Bergama, 80 km north of Izmir, Turkey), an ancient center of civilization containing among other cultural institutions, a library second in importance only to Alexandria itself. Galen crystallised all the best work of the Greek medical schools which had preceded his own time. In his



FIGURE 8: Galen of Pergamon.

tenure as surgeon to the gladiators in Pergamon, he undoubtedly gained much experience and practical knowledge in anatomy from the combat wounds he was compelled to treat. After four years he immigrated to Rome where he attained a brilliant reputation as a practitioner and a public demonstrator of anatomy. As a practicing anatomist, Galen was possibly the first exponent of scientific method applied to the vivisection and post-mortem dissection of animals. To study the function of the kidneys in producing urine, he tied the ureters and observed the swelling of the kidneys. To study the function of the nerves he cut them, and thereby showed paralysis of the shoulder muscles after division of nerves in the neck and loss of voice after interruption of the recurrent laryngeal nerve.^{9,11,12,20,23,26,28,32,33}

CONCLUSION

“The Aegean coasts of contemporary Turkey” had been a science center worldwide about a thousand years duration from 6th century BC till 4th century AC. The most famous philosophers, scientists, physicians and especially the anatomists were born, educated or studied on these lands. Because of its active commercial relations and strategical location between east and west, these lands could collect

and evaluate all the knowledge of the prehistoric civilizations. Through the merits of free thinking and democratic governance, outreligious and rational concepts were improved about cosmos, nature, human and the real science was born. Aristotle, Hippocrates and Galen had influenced on both Christian and Islamic philosophy and medi-

cine over the centuries. But as a consequence of Christianity to be the only official religion of the Roman Empire in 4th century AC and the quick spread of Islamism in 7th century AC, the human body was proclaimed blessed and the dissections were prohibited. All the Mediterranean had fallen into darkness of the Dark Age.

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