European Journal of Science and Theology, December 2013, Vol.9, No.6, 5-16

ON HIPPOCRATES FOOTSTEPS

Danil Adam*

'Carol Davila' Medicine and Pharmacy University, 37 Dionisie Lupu, Ro-70183, Bucharest, Romania

(Received 31 October 2012, revised 30 June 2013)

Abstract

Freedom of movement in the modern age offers possibility to know many wonderful places with an exciting history and personalities that contributed to the development of Science. Without this depth knowledge, the tourist sees only ruins but without another significance. Kos Island is a tourist attraction for many people. We propose a brief geographical and historical presentation of island and, in the footsteps of Hippocrates - the father of Medicine, an overview of medical practice based on scientific reasoning in *Asclepieions*. We present: methods of treatment in healing houses based on the interpretation of dreams and invoking the gods, the supposed origin of the Medicine symbol, as well as Hippocrates' contributions to the development of Medicine, his medical concepts presented in *Corpus Hippocraticum*. Part of his legacy is still valid in current Medicine.

Keywords: Kos Island, Hippocrates, Asclepieion site

Life is short, science is long, occasionally elusive, experience misleading, judgment difficult.
(Hippocrates)

1. Short history of Kos Island

The Island of Hippocrates, Kos, is one of the most beautiful islands of the Dodecanese (Figure 1) [http://en.wikipedia.org/wiki/Kos]. This archipelago has 17, not 12 habitated island and around 200 small unhabitated islands.

The daughter of one of the first kings of Kos was called Kos (Coas), from whom the island was named after. In their history the inhabitants of the island had participated at the Trojan War (1184 BC), Persians wars (6th century BC) and Peloponnesian war (431-404 BC).

The Apostle Paul was the first Christian to preach the words of the Lord in Kos. The idolatry was changed by Christianity.

The Crusaders, after the great schism (1054) of Christianity conquered Kos and in 1204 the island passed under the Catholic rule of Baldwin of Flanders. The Turkish occupation lasted 390 years beginning with 1523.

*E-mail: ffrunzi@yahoo.com

Only after the Second World War the Greek flag flew over Kos on March 7th, 1948.

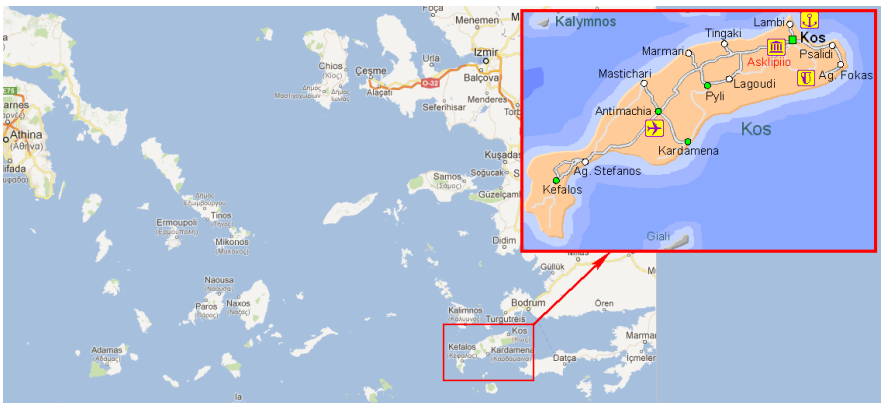


Figure 1. Kos Island [http://maps.google.com/].

2. Who was Asclepius

The birth of the ancient world was depicted by Greek mythology.

Apollo, among his other attributes, was the god of healing. Asclepius was the illegitimate son of Apollo and the Thessalian nymph Koronis. His mother was killed by goddess of hunting Artemis for being unfaithful to Apollo, but the unborn child was rescued from her womb. The name of Asclepius means 'to cut open'. Apollo was the doctor of Gods of Olympus. He raised his son and taught him the secrets of Medicine. The centaur Chiron also instructed him in the art of Medicine. Asclepius became a well known doctor for the ordinary human beings for his skills in healing all ailments and for relieving the patients suffering by pain. He succeeded in bringing one of his patients back from the dead. His fame attracted the envy of Zeus. Zeus killed Asclepius because he raised Hippolytus from the dead and accepted gold for it. Zeus felt that the immortality of the Gods was threatened. His body was placed by Zeus among the stars in the constellation Ophiuchus but, to prevent any father feuds with Apollo, he later resurrected Asclepius.

The secrets of Medicine were passed by Asclepius to his children (6 daughters and 3 sons) (Figure 2). Hygeia was the personification goddess of health and sanitation, and Aceso was the goddess of healing process. Panacea was the goddess of universal remedy, Aglaea goddess of glory and adornment, and Meditrina the serpent-bearer. The snake coiled around a stick remained the symbol of Medicine even today. The names of his daughters reflect a certain subset of 'good health'. From the three sons (Machaon, Podaleirios and Telesphoros), Podaleirios was the creator of the medical school.

Machaon and Podaleirios were surgeons and have participated at the Trojan War.

The worshipping of Asclepius spread throughout Greece, with main site at the island Kos. Homer describes Asclepius as "the great healer" (Iliad, Book XI, line 518). He was deified by the time of Hippocrates.

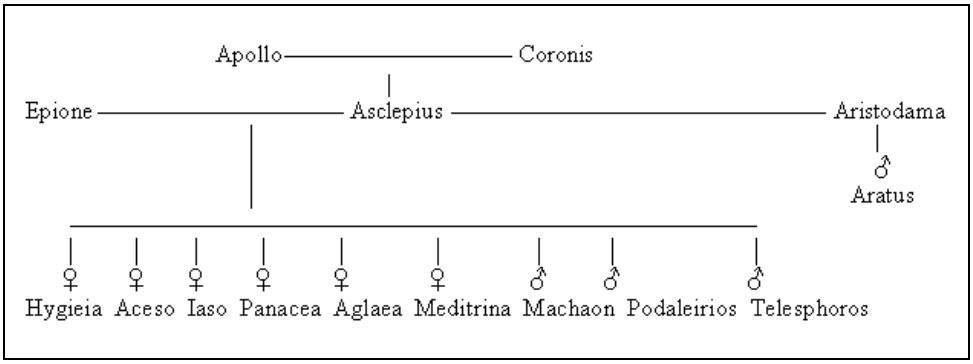


Figure 2. Asclepius's children.

3. Who was Hippocrates

The island of Kos is linked to the hero and semi-god Hercules, the illegitimate son of Zeus. He landed on Kos when he returned from Troy. From the union of Hercules with Chalkiopi, Heraclides Thessalos was born.

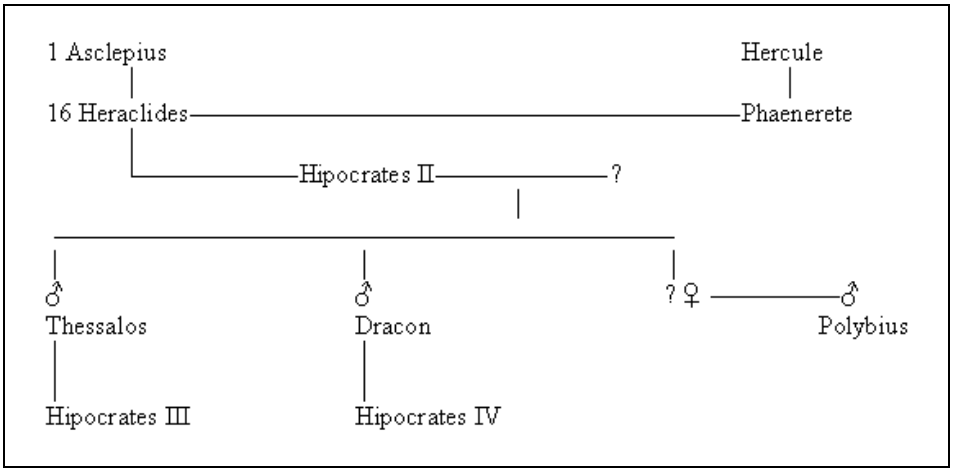


Figure 3. Genealogic tree of Hippocrates.

According to tradition, Hippocrates was born in the ancient capital of the island, Astypalea. Eratosthenes (255 BC) from Alexandria fixed the date for the birth of Hippocrates as 460 BC, from a genealogy study of Asclepiads of Kos. He lived in the classical period of Greece, during the Age of Pericles. He was a descendent of the Asclepiads from his father Heraclites and of Hercules from his mother Phaenarete.

Hippocrates II (the great) was a 17th generation of physicians (Figures 3 and 4). The grandsons of Hippocrates II represent the 19th generation of physicians.

Hippocrates started to study Medicine since his childhood. His education began on Kos and continued in Asclepion of Knidos. At approximately 24 years of age, in response to a dream, he began to travel in Thessaly, in island of Thasos, in Thrace, and in Asia Minor. Wherever he travelled, Hippocrates treated patients and noted the case histories.

Figure 4. Statuary group in Kos town with Hippocrates receiving patients.

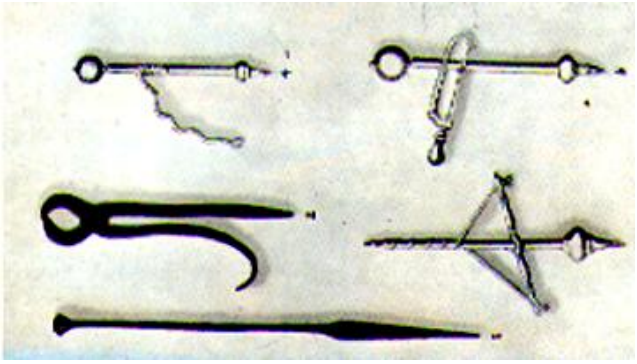


Figure 5. Trepanning instruments of Hippocrates.

Around 420 BC Hippocrates returned to Kos where he founded a Medical School. Later he founded another one in Tessalia. After 40 years of a highly successful career, Hippocrates retired to Larissa, where he lived until the age of 85 years (375 BC).

In his Medical School, Hippocrates initiated the therapy based on clinical symptoms but also invoked the gods for healing [1].The Hippocratic School attached importance to observation, inspection and documentation of symptoms, pulse, pains, and excretions.

Disease has not a divine origin; it came from the external environment. In Homer's time, epilepsy was regarded as a miasma cast upon the soul by the goddess Hecate. Hippocrates refuted this belief. In his text 'The Sacred Disease' he wrote about epilepsy (Morbus Sacer) which "men regard its nature and cause as divine from ignorance" [2]. Hippocrates consider erroneously that brain do not receive sufficient air transported by veins. He correctly sees that the brain is the place of origin of this condition. He sustained that wounds must be cleaned with wine. Herbs were used for analgesia as well as for coagulation and scar formation.

In the case of a depressed cranial vault fractures he invented an instrument, the trepan, and performed trepanations (Figure 5). *Trepanon* in Greek means borer.

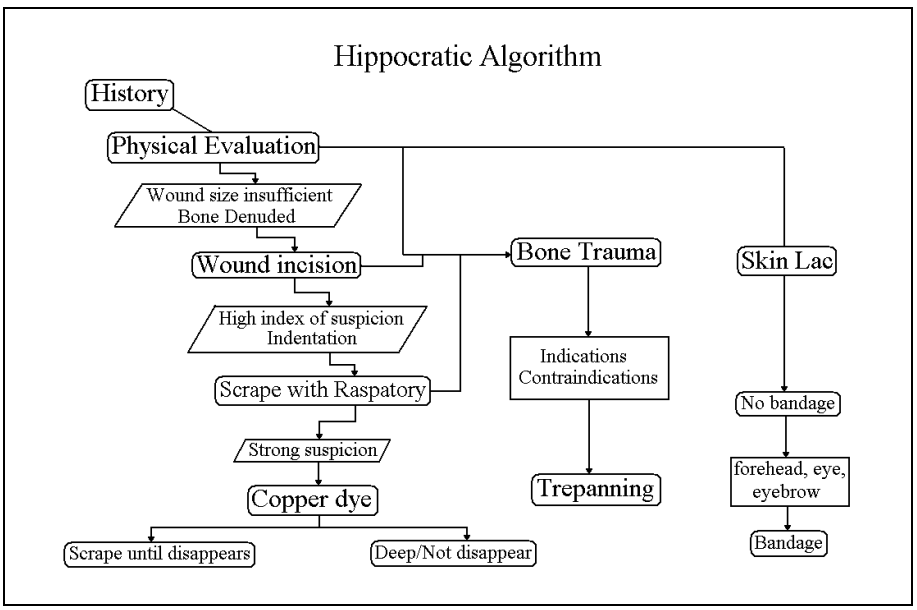


Figure 6. Hippocratic algorithm applied in cranial vault fractures.

He classified these fractures in five categories: 1. fissured fractures, 2. contusion without fracture, 3. depressed fractures, 4. hedra or dinted fractures and 5. contre-coup fractures [3]. He standardized the treatment of cranial vault fractures in an algorithm (Figure 6) with more than 2000 years before modern medicine [4].

He is the first which described a deformity of 'the fingers and the fingernails', the clubbing named 'Hippocrates fingers', an important diagnostic sign in cyanotic heart disease and chronic suppurative lung disease. Hippocratic succusion is still learned by medical students to diagnose hydropneumothorax or

pyopneumothorax. Hemorrhoids were treated by ligation and drying them with a hot iron, and excision.

Broken bones required traction to relieve pressure on the injured area. The Hippocratic bench and Hippocratic ladder were used to do extension and reduction of the vertebral fractures. His method to reduce the shoulder dislocations are still learned by medical students today (Figure 7).

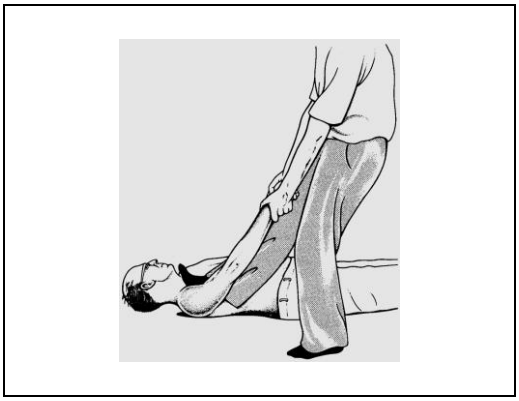


Figure 7. Hippocratic method used to reduce shoulder dislocation [http://ps.cnis.ca/wiki/index.php/71._Shoulder-Upparm].

In Corpus Hippocraticum, a collection of around 70 medical works, is described a medical device, the rectal speculum. This constitutes the earliest recorded reference to endoscopy.

He established medicine as a profession and separated from religion and Philosophy. The disease was not a punishment inflicted by the gods but a product of died, environmental factors and living habits. The therapeutic approach was based on 'the power of nature'. The body contains in itself the power to heal itself. His statements about health and illness are remarkable:

- "Your nutriments to be your remedies".
- "Health depends on the balance between nourishment and physical activity."
- "Exhaustion predicts illness".
- "Fat people are more predisposed to sudden death than thin people".

To investigate Medicine properly, one must consider seasons, climate, location and waters for they are not the same in all places.

The most famous document of the Hippocratic Corpus is the Hippocratic Oath, a document on the ethics of medical practice, still in use today. In his famous 'Hippocratic Oath' he laid the foundation of the code of ethics [5].

His contributions revolutionized the practice of Medicine. Hippocrates was considered to be the 'Father of Medicine'. Platon describes Hippocrates as 'Hippocrates of Kos, the Asclepiad'. Aristotle referred to Hippocrates as 'Hippocrates the great', though he was of short height.

For Galen (129-200 AD), Hippocrates was the source of all he knew and practiced himself. Galen said that Hippocrates was *the greatest of philosophers*

and doctors of his time. In the Middle Ages, the Islamic world adopted Hippocrates methods, translated his writings and transmitted them to Western Europe medicine. In modern days, in the biography of Hippocrates the Great, Hans Much wrote: "*to speak of Hippocrates is to speak of the very essence of medicine"* [6].

Hippocrates was a model for doctors of his time and for the next generations of doctors.

4. What was Asclepieion

An Asclepieion was a sanctuary dedicated to Asclepius (god of healing) son of the god Apollo (Figure 8a). In the ancient Greece there were over three hundred asklepieions. The most famous temple was at Epidaurus in Peloponese. Another healing temple were located on the island of Kos, in Pergamum in Asia Minor, Gortys in Arcadia. Many pilgrims from all over came in these healing temples to be cured of their illness. These pilgrims firstly made sacrifices to the god and participated in purification ceremonies of atonement.

Both priests and physicians attended patients during the day, administering medicaments and ointments, watching over their diet and prescribing exercises and massages. Patients received a dream-inducing narcotic at night and the priests visited them dressed as deities and accompanied by a sacred snake. It was during the dream that they offered medical advice to their patients that would aid their healing.

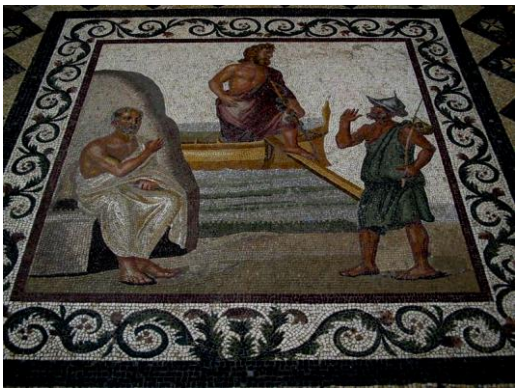
In healing rituals a non-venomous snake was used. The snake was introduced in the rooms where the sick or injured persons spend the night in the holiest part of the sanctuary. The physicians of the Asclepieion had the snake as a symbol, thanks to his ability to discover therapeutic herbs (Figure 8b).

The Asclepieion from Kos was founded in the 4th century BC, and later, was enlarged and transformed during the 2nd century AD. The renowned treatment centre near town Kos is built concentrically on a vegetation-filled hill. Here, the 'father of Medicine', Hippocrates, may have begun his career.

This Asclepieion was a clinic where medicine was practiced by Hippocrates taught. He remains for nearly 900 years after the death of Hippocrates, until 554 AD. The earthquakes played a significant role in its decline. The domination of Christianity had also contributed to the decline of the pagan sanctuary.

It has three terraces that are linked together with imposing stone staircases. The structures on the first terrace housed the medical school. On the second terrace there are the ruins of a large altar dedicated to Apollo, two smaller temples and Temple of Apollo, erected in the 2nd century BC, now in ruin. On the highest terrace is the Doric temple of Asclepieion (2nd century BC).

The ruins of Asclepieion were brought to light in 1902 through archaeological excavation. Since then many tourists came here, on the footsteps of Hippocrates (Figure 9).



(a)

(b)

Figure 8. (a) The mosaic depicting the arrival of Asclepius on Kos, with Hippocrates to the left, and an inhabitant of Kos to the right (Mosaic of Roman villa in Kos – Kos museum); (b) Symbol of ancient medicine.

Figure 9. The archaeological site of Asclepieion (Kos).

5. Discussion

5.1. Symbol of Medicine

Several myths describe how Asclepius chose his symbol [7].

a) In perhaps the most popular tale, Asclepius is examining a man, Glaukos, whom Zeus had recently struck dead with a thunderbolt. During the examination, a snake gliding into the room surprised Asclepius, and he responded by killing it with a blow from his staff. Asclepius was subsequently intrigued by the arrival of a second serpent, which placed certain herbs in the mouth of the dead serpent and thereby restored it to life. Asclepius quickly perceived the lesson, revived Glaukos by recourse to the same herbs, and, as a mark of respect, adopted the serpent coiling about his staff as his emblem [7].

In antiquity the staff was a walking stick associated with itinerant physicians [8].

b) In Asclepion at Bergama (Pergamum) the origin of the snake emblem is explained as follows: a vessel with milk was left in front of a building as an offer to gods. In the morning, a venomous snake was found drinking the milk. When the milk was given to a deceased person, he quickly recovered.

From that time snake was used as a symbol of healing.

In the classical Greece was a sentence: 'the spear which kills, heals too'.

c) In ancient times parasite worms as the 'Guinea worm' (Dracunculus medinenses) were common. They were extracted from beneath the skin by incising the skin and winding them around a stick. Physicians practicing this procedure may have advertised it by posting a sign depicting a worm on a stick

d) There is a similarity between the physician's activity and the ambivalent character of the serpent, which in shedding its skin, is a symbol of rebirth and fertility.

The physician's activity places accent on preventing and treating illness. The physician advises people to learn how to prevent the appearance of disease, and he treats the ill. The treatment may be successful, leading to healthiness, or unsuccessful, leading to death. Similar, the venom of the snake may lead to the quick death of the person or, on contrary, today, not in antiquity, the venom may be used to prepare the vaccine and so to the cure of some affections.

e) There are various explanations of the significance of serpent.

The snake is found also in another story related in the Bible. The Jews lived in Egypt for four centuries. During the reign of Ramses the second, around the year 1300 BC. Moses was born, saved from the river by a princess, one of the pharaoh's daughters. At the age of 80, Moses saw a bush in flames and heard a voice coming from that spot which promised him to free the Jewish people from the Egyptian slavery and, to prove his strength, it turned his cane into a snake.

After departing from Egypt, arrived at the mountain Hor, passing to the Red Sea, the Jewish people, unhappy with the privations of the journey through the desert, spoke against Moses and God. Then the Lord sent venomous snakes among them; they bit the people and many persons died. The people realized that they sinned and asked Moses to pray that the Lord take the snakes away. The Lord said to Moses "make a snake and put it up on a pole; anyone who is bitten can look at it and live" (Numbers, 21.4-9).

5.2. Dreams

Modern Neurophysiology sees the dream as a psychological phenomena that takes place during sleep, and it is formed of a serial of more or less coherent images. The word comes from an old term, esver (to roam) that comes from the Latin word vagus.

The images during dreaming are triggered by external sensorial excitation, internal sensations, or the dreamer's daily concerns. Dreams take place during

the 'paradoxal phase' of sleep, lasting about 10 minutes and repeated 3 to 6 times per night.

Freud had studied dreams, their content and meanings. Analysis of a dream allows, according to Freud, to reveal the manifest content: absurd, and confuse, and of another latent content of the dream. A dream is elaborated through a process of transformation of the gathered yet unaccomplished thoughts during the day in a dream where these thoughts become harmless. Interpretation of dreams has a particular place in psychoanalysis sessions. In the human history there are many well-known dreams and visions. We give two examples.

From *The Old Testament* we found that after the conquer of Jerusalem by the Babylonians, in Babylon were taken, among others, Daniel to whom the head of the administration gave the name Beltşaţar, and who possessed the ability to give answers to hard questions, interpretation of dreams, and unravel the tangled things. He had been put to rule over wizards, fortune tellers and star readers.

In the night before Babylon was conquered by the Persians, at Belşaţar's feast (the son of the king Nabucodonosor) a hand wrote on the wall the words '*mene, techel, ufarsin*'. Only Daniel was able to translate these words by 'counted, weighted, divided', meaning: "God counted the days of your kingdom, and ended it. He weighted it and found it light. Your kingdom will be divided and given to the Persians and Medes". That night, the emperor was murdered and the empire was conquered by Darius, the Med (Daniel 5.25-28).

In the year 313 AD, in the eve of the battle between the Emperor Constantine and Maxentius, Constantine dreamed that on the skies appeared the sign of the cross and the words '*In hoc signo vinces*'. The battle was won and Constantine became the first Christian emperor, and the Christian religion had been accepted in the Roman Empire. Since 390 AD the pagan cults had been outlawed, Christianity remaining the only official religion. Constantine has been a pagan most of his life. Before his death he became a Christian. The Christian Church has sanctified him for his spiritual becoming.

5.3. The Hippocratic smile – risus sardonicus

In the Greek antiquity the wound caring was considered to be a frequent problem in the physician's activity. Even though this is considered to be a simple problem, in the past these wounds got infected and the patient could have died. One of the causes of death could have been infection with tetanus. One of the first signs of tetanus is the spasm of the facial muscle, giving the impression of a smiling face but of bad omen for the patient's evolution: 'risus sardonicus'. This sign was first described by Hippocrates, as a careful following of the patients he cared for.

Risus sardonicus, a spasm of the face muscles, is termed Hippocratic smile. Sardinia is an island in the Adriatic sea. Pausanias described in his Guide to Greece that "the whole island is free of lethal drugs except for one weed; the deadly herb looks like celery but… if you eat it you die of laughing. The herb grows mostly around spring but without its poison infecting the water." [9] The

plant is a ranunculus, described by Homer in Odyssey. Homer coined the term 'sardonic grim'. In Sardinia, Phoenician colonists gave to elderly people who could no longer care for themselves and to criminals an intoxicating potion. They were then dropped from a high rock. Persons that ingested the potion have had a smile on their face. Today the scientists identified the herb responsible: hemlock water dropwort (aenanthe crocata), which is common on Sardinia.

5.4. Comparison between Kos and Knidos medical schools

In the long history of Medicine, two ancient schools appeared at the same time and in the same geographic region: island of Kos and peninsula of Knidos. Between them there was a competition.

The main difference between the two medical schools lies in the fact that the school of Knidos was interested in 'local character of disease' and the school of Kos was more interested in 'general character of disease'. In fact the difference consists between medical specialities for the former and general medicine for the latter.

Knidian medicine concentrated on the 'disease' rather than on the patient. Hippocratic medicine of Kos put emphasis on the patient and his illness and not the illness itself. Even today it says that doctors don't treat the disease but the patient. Every sick person has the characteristic features of his disease.

5.5 The Medicine after Hippocrates' death

In Corpus Hippocraticum there is no clear evidence of human dissection. For the first time in human history dissection and vivisection of the human body were performed by Herophilus and Erasistratus in Alexandria, during a period of 40 years. After this period, for approximately 1800 years, human dissections were no more performed.

Herophilus (335-280 BC) was born in Chalcedon, near Constantinople. As a teenager, he moved to the island of Kos to study Medicine. Hippocrates has already been dead for 65 years when Herophilus arrived in Kos. After the medical education received in Kos, Herophilus moved in Athens for a short period and after that in Alexandria in 300 BC. Here he practiced his profession.

The successors of Alexander the Great, Ptolemy I and Ptolemy II established in Alexandria a library and a museum. In Alexandria, Herophilus had the opportunity to dissect human bodies. Ptolemy I and Ptolemy II gave royal support to scientists and even permission to take prisoners out of jail for use in vivisections.

In Alexandria Herophilus dissected 600 persons [10].

The original manuscripts written by Herophilus were lost. His contributions to the foundation of Anatomy are described in the works of Galen of Pergamon, Rufus of Ephesus, Loranus of Ephesus, Celsus. A part of his discoveries are listed here: sensory and motor nerves; difference between arteries and veins; arachnoid of brain; dural venous sinuses: torcular herophili;

cranial nerves: optic, oculomotor, trigeminal, facial, auditory, hypoglossal; ventricles of the brain; cornea, retina, choroid and iris.

He also described liver's lobes, pancreas, uterus, prostate, duodenum, lymphatic circulation. For the first time Herophilus reported that ovaries produce the '*human egg*' and ***that the brain is the seat of the intellect and of the soul***. This is located in the ventricles of the brain. Herophilus was in contradistinction to the Aristotelian view of the heart as being the cardiocentric control of higher functions. Together with Hippocrates, Herophilus remains one of the great figures in the history of the neurosciences.

6. Conclusions

During the long history of Medicine, from the Hippocratic era to modern medicine where diagnosis is based on imagistic investigations, there is a huge step forward. Up to Hippocrates, the disease was considered to be of divine origin and healing was achieved by invoking the gods in the sanctuaries of Asclepius. Hippocrates rejected this belief and, through careful observation and inspection, he notices certain features in the evolution of diseases in the context of different dietary habits and environmental factors. Generally speaking, he focuses his attention on the patient, not on the disease.

With contributions of great importance for his time in various medical specialties, from Neurosurgery to Orthopedics, Pulmonology and Proctology, he was a model not only for the doctors during his time but for the doctors of future generations as well. His medical knowledge contained in Corpus Hippocraticum roamed historical eras, reaching today to be appreciated as well.

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