

# Pre-Hippocratic Greek medicine and its influence on the Hippocratic Corpus

First submission: January 2006

The origins of the Hippocratic Corpus, traditionally held to herald the birth of empirical medicine, are traced in the works of the “pre-Socratic” philosopher-physicians. Although it retained many of the earlier, factually incorrect hypotheses on human physiology and pathology, and consequently proposed largely ineffectual therapies, the Corpus was a decisive milestone in that it described clinical disease patterns objectively, it prescribed medication on the basis of rational argument (as understood at the time) unadulterated by considerations of religion or superstition, and it was underpinned by an ethical code which has largely withstood the test of time.

## Voor-Hippokratiese Griekse geneeskunde en die invloed daarvan op die Hippokratiese Korpus

Die oorsprong van die Hippokratiese Korpus, wat tradisioneel beskou word as die geboorte van empiriese geneeskunde, word in die werke van die sogenaamde Pre-sokratiese filosoof-geneeshere nagegaan. Alhoewel baie van die voorafgaande feitelik foutiewe hipoteses oor menslike fisiologie en patologie behoue is en daar gevolglik oneffektiewe terapieë voorgeskryf is, het die Korpus wel 'n besliste ontwikkeling getoon: kliniese siektepatrone is objektief beskryf, medikamente was op rasionele argumente gegrond (soos destyds verstaan) sonder die invloed van religie of bygeloof, en dit was gebaseer op 'n etiese kode wat die storms van die tyd oorleef het.

It is commonly accepted that Hippocratic medicine heralded the birth of rational, empirical medicine during the fifth and fourth centuries BC. However, it has also been argued that in reality Hippocratic medicine differed so little from that of the preceding era, which was based mainly on religion and magic, that its claim to be the forerunner of scientific medicine may be questioned (Lloyd 1999: 37-42). This article will review the origin of empirical medicine from the dawn of Greek civilisation in order to assess the true value of the Hippocratic Corpus.

## 1. Medicine up to the Homeric age

We know very little about the medicine of the Minoan civilisation (2000-1375 BC), but it probably combined a strong religious base with practical experience in managing trauma. There were links with Egyptian medicine, and Cretan beans (for instance) were used in Egyptian therapy. Similarly, Egyptian drugs such as diktane, asplenium and dankos were known in Crete, and Cretan recipes for exorcism were popular in Egypt. Archaeologists have furthermore shown that the hygienic infrastructure of the palaces of Cnossus was exceptionally advanced (Cumston 1968: 72, Arnott 2004: 153-73).

The medicine of the Mycenaean era (1400-1100 BC) was strongly grounded in religion, which involved a large number of gods. Medical instruments from this time show that a modicum of surgery was performed. Homer's epics relating to the Trojan War are set in this era, but the medicine described probably reflects the realities of the eighth century BC rather than the thirteenth (Garrison 1968: 81-5, Arnott 2004: 158-63). The Dorian invasions of 1100-1000 BC led *inter alia* to the founding of Greek city states in western Asia Minor, later named Ionia and Aeolia, which subsequently played a significant role in the evolution of medicine. There was probably overland medical contact with Mesopotamia, Egypt and the Far East (Van Rooy 1980: 81-2, Garrison 1968: 87).

The stagnation of Greek culture (1125-800 BC) came to an end in the eighth century BC when poets like Homer and Hesiod renewed Greek literature, using a new Phoenician alphabet, and energetic colonisation led to the founding of city states around the Aegean Sea, in

North Africa (Cyrene) and in western Mediterranean countries like Italy and Sicily (Van Rooy 1980: 102-4, 112).

The Homeric era (800-700 BC) was also the beginning of Greek medical literature. From Homer's epics it is evident that medical practice was heavily based on religious concepts (Longrigg 1998: 15-7). The gods were believed to cause disease, as is shown by the plague visited upon the Greek army by the enraged Apollo (*Iliad* 1.46-53), the goddess Artemis's killing of women (*Iliad* 21.483-4), and the Cyclops's kinsmen's reference to a malady sent by Zeus (*Odyssey* 9.407-11). Hesiod refers to famine and plague sent by Zeus (*Works and days* 238-45); however, he also indicates that some diseases occur spontaneously and are not caused by the gods (*Works and days* 100-104). On the other hand, gods were also believed to cure disease, as is shown by Athena's healing of the bleeding Diomedes (*Iliad* 5.114-22), Leto and Artemis's healing of the injured Aeneas (*Iliad* 5.445-8), and Apollo's healing of Glaucus's arrow wound (*Iliad* 16.527-31). The earliest Greek god of healing was Paeon, physician of the gods, but in time a pantheon of gods and goddesses acquired healing abilities, including Zeus, Apollo, Asclepius, Hera, Artemis and Athena, as well as demigods such as the Centaur Chiron, and Melampus. Asclepius gradually eclipsed all other gods in this context, and eventually developed a popular healing cult (fifth century BC) (Longrigg 1998: 15-7). The treatment of "divine" diseases was based on appeasement of the gods, sacrifices, purifications, incantations, amulets, and so on. However, doctors were seen as craftsmen, and distinct from seers and healing priests (Nutton 2004: 40).

## 2. Pre-Hippocratic philosophers and physicians

### 2.1 The physicians

During the three centuries separating the Homeric era from Hippocrates, the medical profession underwent progressive change. Although a section of the population continued to view medicine as having a religious base, a groundswell of empirical thinking (not based on superstition, magical or religious principles) gradually moved away from the divine towards hypotheses built on natural science. This process was initiated by a series of philosopher-physicians, whose theories progressively influenced the thinking of practicing physicians (Lloyd 1999:

34-9). Physicians were not a homogeneous profession, however (Lloyd 1999: 56). Besides regular physicians trained in apprenticeship with colleagues, there were other allied lay practitioners, called drug sellers and root cutters. At all levels a significant element of healing must always have been based on very practical empirical reasoning, especially in relation to trauma (fractures and war wounds).

The training of apprentices could occur anywhere, but there were certain recognised centres of medical excellence, often referred to as “medical schools” (Lloyd 1979: 98, Udwardia 2000: 83). Probably the oldest of these in the Graeco-Roman world was in Italy, at Croton. Herodotus (3.131) claimed that the best doctors of the sixth century BC were trained there. He recorded the illustrious career of the Crotonian, Democedes, who excelled at the court of Darius, curing the Persian king’s leg injury (where Egyptian physicians had failed) and subsequently the breast tumour (or abscess) of his queen, Atossa (3.129-130, 133-134). At Acragas (Agrigentum), the richest city in Sicily, the philosopher-physician Empedocles (see below) subsequently initiated much medical activity, but some scholars doubt whether this ever amounted to a medical school responsible for the training of many physicians (Longrigg 1998: 79). However, we do have the name of Acron, a physician of Acragas (Pliny, *Natural history* 29.4-5), and that of Sombratidas, a prominent doctor who worked in Sicily during the early sixth century BC (Nutton 2004: 62).

According to Herodotus (3.131), Cyrene in North Africa, colonised in the seventh century BC, was the second-best centre for the training of doctors (after Croton). It was famous for its silphium plant (laserwort), which was said to have remarkable healing powers (Herodotus 4.169; Dioscorides, *Mat Med* III.80), but we know nothing more about the settlement’s medical activities. One of the first medical schools of the era was at Cnidus on the west coast of Asia Minor, originally settled by Dorians (Longrigg 1998: 29, Udwardia 2000: 83). It probably had significant medical ties with Egypt, and we know the names of some famous Cnidian doctors, for instance Ctesias (a physician at the Persian court); Euryphon and Herodicus, who lived in the mid-fifth century BC, and Polycreitus and Eudoxus a little later. The so-called “Cnidian sentences” were among the very first treatises incorporated into the Hippocratic Corpus at Cos (Nutton 2004: 42-3). The medical school at Cos, established later than that at Cnidus and situated on an adjacent island, was

also originally a Dorian settlement (Longrigg 1998: 29) and became famous as the home of Hippocrates. Nutton (2004: 43) suggests that the physicians on Cos and Cnidus probably operated as a very close unit in creating the Hippocratic Corpus. An earlier medical school on Rhodes had virtually disappeared when Cos and Cnidus were at their zenith, but of this institution we know nothing more (Longrigg 1998: 61).

## 2.2 The philosopher-physicians

This group had the common goal of striving to explain daily phenomena on the basis of the laws of nature rather than religion and magic (Longrigg 1998: 34, 39, Lloyd 1999: 32-6, 49-51). This did not mean that they were necessarily atheists — many accepted that nature had an inherently divine character and that miracles could on occasion happen when nature suspended its laws, or acted supernaturally through these laws (referred to as “double determination”) (Lloyd 1979: 30-1). They were not a homogeneous group and their hypotheses differed quite widely. They all wrote in Ionian, but all their medically-related works (except for fragments from Alcmaeon) have been lost and we have to rely on quotations from later sources like Hippocrates, Aristotle, Plato, Diogenes Laërtius, Celsus, Galen and Aëtius. Although all of these may be called pre-Socratic philosophers, they fall into two groups: early philosophers who came from Miletus in Ionia (the Milesian philosophers) and a later group for whom the term “pre-Socratic” is perhaps best reserved. They were general philosophers and contributed across a broad field; in this overview, however, we shall concentrate on those aspects of their theories which pertain specifically to medicine.

### 2.2.1 The Milesian philosophers

These philosophers all lived in the late seventh and early sixth centuries BC. The founder was Thales, perhaps of Semitic stock, who postulated that water was the essence of all matter, as well as that the (flat) earth was not supported by the god Atlas, but drifted on a bed of water. Aristotle considered Thales the founder of physical science (Kahn 1996: 1491, Seneca, *Nat Quaest* 3.13). Anaximander believed that the primary principle out of which everything evolved was not water, but *archê*, an unknown element. The universe, he said, was a balance maintained by opposing forces. He explained solar and lunar eclipses, as well as phe-

nomena such as thunder, lightning, earthquakes and whirlwinds, on the basis of natural laws of nature, not divine intervention (Aëtius, *On the opinions of philosophers* 2.20.1, 2.24.2, 2.25.1, 2.29.1, quoted by Longrigg 1998: 19-20). Anaximenes explained the origin of rain, hail and snow according to laws of natural science (as he understood them) (Aristotle, *Met.* 365<sup>b</sup>6), and believed that air was the basic substance out of which everything evolved (Lloyd 1999: 141).

### 2.2.2 The pre-Socratic philosophers

This commonly accepted term is a misnomer insofar as some of these philosophers were actually contemporaries of Socrates. Many hailed from Greek city states in southern Italy or Sicily, and were sometimes referred to as the “Italian School” or the “Sicilian School”. The two terms were even used interchangeably.

The Italian School centred on Croton, and its founder was probably Pythagoras (c 570-490 BC) (Major 1954: 111-2, Cumston 1968: 78-9, Nutton 2004: 47-8). His followers were united in a secret brotherhood, of which there were also branches outside Croton. Late in life he became involved in political dissent and had to flee to Metapontum, where he died. Besides his significant contributions to the sciences of geometry and mathematics, he insisted on a frugal and honourable lifestyle, dabbled in mysticism and believed in re-incarnation. His contribution to the field of medicine included dietary recommendations (the exclusion of beans and meat), a belief in the influence of numbers on health, and the hypothesis that health is conditioned by a balance between various bodily elements, including humours. Alcmaeon (c 500 BC) (Cumston 1968: 78-9, Nutton 2004: 47-8), also from Croton, was a Pythagorean and probably the pre-Socratic philosopher most involved in clinical medicine. He wrote *On nature* and was the first authentic Greek medical author. He adhered to the Milesian philosophers’ concepts of the basic laws of nature, but rejected the *archê* hypothesis. He gained a fair knowledge of anatomy through the dissection of animals (but almost certainly not of human beings) and identified the brain as the seat of intelligence and sensation. He also believed animals to have sensation, but not intelligence (Theophrastus, *On the senses* cc 25 & 26, quoted by Longrigg 1998: 34). He saw health as the result of harmony between many factors (*isonomia*) and he combined Pythagorean humoral concepts with four bodily

elements initially postulated by the Sicilian School (see below) (Aëtius 5.30.1, quoted by Longrigg 1998: 38). Philolanus of Tarentum was a contemporary who also worked in Croton and further elaborated the humoral theory of health (Udwadia 2000: 83).

Parmenides of Elea (c 450 BC) (a city in southern Italy) was the founder of the Eleatic School of philosophy (Cumston 1968: 78) and the originator of a medical-religious organisation, the *pholeon* (Nutton 2004: 46). He wrote on the importance of body heat, stating that women have more heat than men, and that death is primarily the result of the body losing its heat. His theories on human physiology included the belief that male foetuses occupy the right side of the womb, and female foetuses the left. He claimed that the human senses are unreliable and that nothing changes in the universe (Lloyd 1979: 34). Other members of the Eleatic School included Melissus of Samos, who believed in a unitary origin for all matter (Nutton 2004: 45), and Xenophanes, who warned that there are limits to what the human mind can apprehend and that certain matters need very prolonged study (Longrigg 1998: 33-4).

The Sicilian School originated at Acragas (Agrigentum), and had a significant influence on the development of medical theory. It was prominent in the time of Plato (Cumston 1968: 80). The founder of the school, Empedocles (c 500 BC), was expelled from the Pythagorean brotherhood for breaking its vow of confidentiality (Nutton 2004: 46-7, Longrigg 1998: 62-4). He was a multi-talented person: in addition to his contributions in science, he was an excellent poet and an active statesman. Late in life he fomented rebellion, was expelled from Acragas and died in Megara. He was a popular clinician with a prominent ego and even believed that he had divine powers of healing. Galen called him a member of the “Italian School” of medicine, showing that the terms “Italian” and “Sicilian” were interchangeable (Galen, *On the method of medicine* 1.1 X.5-6 K). Although he was active in the movement to rid medicine of magic and superstition, his treatments included significant religious elements. His medical theories were elaborated in two poems, *On nature and purification*, and had a decisive impact on western Greek medicine (Lloyd 1979: 34-5). He taught that health depended on a balance between four bodily elements (fire, water, air, and earth) (Theophrastus c 10.), that the heart (not the brain) was the seat of intelligence (Porphyry, *On the Styx* 1.49.53, quoted by Longrigg 1998:

62-3), that innate heat underpinned all physiological processes, and that respiration (which he believed occurred through the mouth, the nostrils and the pores) (Longrigg 1998: 63-4) served to cool the innate heat. He believed that blood originated in the liver and acted as the seat of the soul and the agent of nutrition, and that semen arose from the blood as surplus nutriment. Sweat and milk were “concoctions” of the blood. He studied embryology and proposed the existence of evolution. He also refuted Parmenides, claiming that man has more heat than woman. He was reputed to have rid the town of Selina of a pestilence (possibly malaria) by draining a nearby swamp (Nutton 2004: 46-7). Philistion of Locri (417-347 BC) (Longrigg 1998: 66-8) came from southern Italy, but was strongly influenced by Sicilian medicine and so was called “the Sicilian”. He elaborated on Empedocles’ theory of the four elements by allocating each element a specific power (heat, cold, moisture and dryness). He believed disease to result from an imbalance in these factors, particularly from an excess of or decrease in heat or moisture. Like Empedocles, he believed that consciousness resided in the heart, and that respiration, which occurred through the mouth, nostrils and skin, cooled the body’s innate heat. He had a strong influence on Plato and Aristotle.

Ionia produced three philosopher-physicians of note. Anaxagoras of Clazomenae (born 499 BC) (Nutton 2004: 45, Lloyd 1999: 141) was one of the gifted scientists invited to Athens by Pericles. He taught that everything forms a portion of everything else, and that disease arises from a disturbance of yellow and black bile. He annoyed the citizens of Athens by claiming that the sun was not a god but a large stone. Heraclitus of Ephesus (c 500 BC) (Cumston 1968: 77, Nutton 2004: 45) thought that humanity is constantly surrounded by divine reason, which we inhale in order to make us reasonable beings, except when asleep. He considered fire the essence of matter, and taught that ongoing change was both inevitable and essential. Leucippus (435 BC) (Nutton 2004: 45, 50), the teacher of Democritus of Abdera, probably came from Miletus. He taught that everything comes into being according to reason and necessity, and consists of indestructible atoms within a void.

From the Greek mainland and surrounding regions came three further philosophers, including Diogenes of Apollonia (c 500 BC) (Longrigg 1998: 66, Nutton 2004: 48-9). Like Empedocles, he believed in the importance of innate heat, that blood carries nutrition, and that semen



is surplus nutriment. His theory was that blood in spermatic veins is first converted into flesh, with the remaining portion becoming thin, warm, foam-like semen (Aristotle, *History of animals* 512<sup>b1</sup>). He considered air to be the first principle: on inspiration it becomes *pneuma*, a vital spirit essential for the soul and intelligence. He saw the brain as the seat of intelligence. He studied blood vessels and the senses, and taught that colour played an important role in diagnosis (Ps.-Galen, *On the humours* 19.495 K, quoted by Longrigg 1998: 36). Democritus of Abdera (c 450 BC) (Major 1954: 114-5, Nutton 2004: 49-50), like his teacher Leucippus, supported the atomic theory of matter and thought that the quantity of total mass never changes. He believed disease to arise from a disequilibrium of atoms in the body, and considered adequate respiration essential for keeping the soul from dissipating into the atmosphere. He held that semen originates from all the tissues of the body (the pangenesis theory) (Aëtius 5.3.6.), and that foetal differentiation into male or female in the womb is dependent not on heat but on the prevailing seed (Aristotle, *Generation of animals* 764<sup>a6</sup>).

### 3. The Hippocratic Corpus

There is no significant post-Homeric literature on Greek medicine prior to Hippocrates (Longrigg 1998: 32). Over time, the writings of Hippocrates and his colleagues, emanating from Cos and Cnidus, have come to represent the birth of empirical medicine as we know it today. Although both were Dorian settlements, the various works of the Corpus were written in Ionian, which indicates the important influence of pre-Socratic philosophers from Ionia. The Hippocratic Corpus represents a very heterogeneous compilation of approximately 60 treatises of varying content and quality. These range from little more than lists of drugs and therapies to excellent clinical descriptions of disease, debates, and works of history, argument and criticism, aimed at the iatros as well as the lay public. The various authors do not necessarily agree with one another (Jouanna 1999: 56-65, Nutton 2004: 43-5, 69-71). The Corpus covers all aspects of health — both physical and mental illness — and includes the famous Oath, whose precise role at the time of its writing is uncertain. However, it has fascinated the medical profession through the ages as a document which in the professionalism it displays clearly differentiates between the true and the false doctor (Jouanna 1999: 47-8, Nutton

2004: 66-8). In the treatise *On ancient medicine* the author recognises his obligation to the logical reasoning of the philosopher-physicians of previous eras, but is also fiercely critical of those philosophers who attempt to force their “new-fangled” hypotheses into acceptability (Hippocrates, *Ancient medicine* cc 1, 2 and 20). Empedocles in particular was considered guilty of such conduct, but on closer study the basic medical theory of the Hippocratic Corpus appears to have much in common with his theories. However, it is fair to say, like Celsus (*On medicine Proem* c 8), that Hippocrates effected a vital separation between philosophy and rational medicine. The majority of treatises were probably written between 420 and 350 BC (in the lifetime of Hippocrates); some (like *The heart and precepts*) in the third or second century BC, while *Decorum* possibly dates to the first or second century AD. It is likely that the Corpus, in approximately the form in which we know it, was originally consolidated by Alexandrians like Bacchius and Zeuxis in the third or second centuries BC (Jouanna 1999: 64-5, Nutton 2004: 60-1).

The Corpus, as a continuation of pre-Socratic philosophy, is thus based on the assumption that magic and superstition have no place in medical dogma. Religion was not totally excluded, as the cosmos was considered divinely inspired, but religious contentions were unacceptable in opposition to arguments based on natural phenomena. Purification rituals as a treatment for the “sacred disease” (epilepsy), for instance, were condemned (Hippocrates, *The sacred disease* cc 1 and 2). Knowledge of human anatomy was generally poor and based on limited experience with animal dissection. Certain works, like the treatises *On places in man*, *On fleshes*, and *The heart* (Lloyd 1999: 159) and surgical books like *On dislocations*, *On fractures*, and *On head injuries* (Adams 1985: 568-654), form an exception, demonstrating a quite excellent grasp of anatomy. It has even been suggested that the anatomy in these works was based on actual human dissections performed in the fifth or fourth centuries BC (which is not substantiated by history) or that their anatomical data were later corrected by physicians of the Alexandrian period who had had the benefit of human dissection (Jouanna [67] 308-10, Adams 1985: 565). Clinical descriptions of disease were generally excellent (Lloyd 1979: 168-9), where authors reported their observations without necessarily attempting to explain the underlying pathologies. The physiological theories and concepts of the pathogenesis of illness

were very poor, emanating from the hypotheses of the earlier philosopher-physicians, rarely reinforced by experimentation (Lloyd 1979: 168-9). These included a firm belief that illness resulted from an imbalance of body elements and humours, along with nebulous concepts of innate heat, the concoction of blood to form milk and sweat, and the origin of semen from superfluous blood nutriments. The brain was accepted as the centre of the nervous system, but blood circulation, respiration and the digestive system remained largely mysterious, as they had been to the pre-Socratics. There were divergent views on the seat of intelligence. In *The sacred disease* (chapter 19) the brain is called the centre of bodily function, but in *The heart* (chapter 7) the left ventricle of the heart is described as the seat of the soul. In *Diseases* (Bk II), higher bodily functions are ascribed to both the heart and the brain. Treatment was simple and based on three modalities: first regimen (diet and a healthy lifestyle), then medication (used to a limited extent), and finally surgery, usually as a last resort (Nutton 2004: 96-102).

#### 4. Discussion

It may well be asked whether the Hippocratic Corpus did indeed represent as significant an advance in the evolution of rational medicine as has traditionally been thought. Lloyd (1979: 56-7) rightly points out that in spite of very confident propagation of its case, the Hippocratic authors probably had quite serious problems proving its mastery over traditional religious medicine and over the temple-healers of the Asclepian cult in particular. There was also the lesser-known chthonic cult of Amphiarius at Thebes, Athens and Oropus, where gods assisted through incubation sleep (Longrigg 1998: 11). In the first place, the professional physicians were not a homogeneous group fully supportive of Hippocratic medicine. Many were relatively untrained and others probably adhered to a medical practice based on religion rather than on the newer science. It is significant that the Asclepian cult established itself, like Hippocratic medicine, in the late fifth century BC and flourished for close on eight centuries in competition with rational medicine, its demise being brought about mainly by Christian opposition (Retief & Cilliers 2005: 841-4). Secondly, when we look back on the very inexact nature of the Hippocratic doctors' knowledge of physiology, anatomy and pathology, it is eminently clear that their grasp of how the body

functions in health and illness was only marginally better than that of the temple priests. And finally, because of their relative ignorance of the true causes of illness, it is unlikely that their therapeutic procedures would necessarily have been significantly superior to those of the religious healers. In a culture where the relative success rate of temple healers and empirical doctors probably determined their long-term professional survival, the latter group would thus not necessarily have been in a strongly superior position. The Hippocratic Corpus was obviously built on what the gifted doctors of Cos and Cnidus at the end of the fifth century BC saw as most acceptable from a centuries-long heritage of writings by philosophers exploring the realm of natural medical science, devoid of magic and religion. Measured against modern knowledge, their grasp of medicine was of course woefully deficient. And as both Lloyd (1979: 41-6) and Jouanna (1999: 190-1, 193-5) point out, careful reading of the Corpus still shows evidence of divine considerations, for example in *The law* (c 5), *Ancient medicine* (c 14), *Prognosis* (c 1), and *Epidemics* (c 1.5). The whole of *On Regimen IV* deals with the medical significance of dreams, and *The oath* is dedicated to Apollo and Asclepius, the gods of health.

However, the true significance of the Hippocratic Corpus as a milestone in the development of rational medicine should not be judged by an analysis of its scientific content, measured against the wisdom of a later age. The Corpus was a remarkable document not because its authors had a proper grasp of physiology and pathology, but because they made the right basic decision that the evolution of medical science should be based on a search for rational facts devoid of superstition, magic or blind religion. The real dawn of scientific medicine, of course, lay more than two millennia in the future. But their creation of the Corpus was a fitting confirmation of the often tentative and factually deficient contributions of a long succession of Greek colleagues who had been exploring the mysteries of the human body for close on 300 years. And one of the Corpus's greatest contributions to posterity was its deontological heritage — emanating not only from the Oath, but also from its more general recommendations on the ideal relationships between colleagues and between doctors and patients.

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Acta Academica 2007: 39(1)

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