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Epilepsy in ancient Greek medicine—the vital step

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EPILEPSY IN ANCIENT GREEK MEDICINE: THE VITAL STEP

In the opening paragraph of his book, *The Falling Sickness: A History of Epilepsy from the Greeks to the Beginnings of Modern Neurology*¹, Temkin writes as follows:

Diseases can be considered as acts or invasions by the gods, demons, or evil spirits, and treated by the invocation of supposedly supernatural powers. Or they were considered the effects of natural causes and are consequently treated by natural means. In the struggle between the magic and the scientific conception the latter has gradually emerged victorious in the western world. The fight has been long and eventful, and in it epilepsy held one of the key positions. Showing both physical and psychic symptoms, epilepsy more than any other disease was open to interpretation both as a physiological process and as the effect of spiritual influences. . .

In this paper I propose to concentrate upon the struggle mentioned here by Temkin and shall endeavour to describe the social and intellectual influences that brought about the vital step-forward that led some medical authors in fifth century Greece to regard epilepsy, notwithstanding its striking and alarming symptoms, as a disease due to purely natural causes.

Although our evidence of early medicine in ancient Egypt and Mesopotamia is in an incomplete and fragmentary state, it is nevertheless possible to draw some general conclusions from it. It is clear that the physician in these societies considered diseases to be signs of divine displeasure and caused by the intrusion of a demon. The primary purpose of the physician was to appease the god or drive out the demon which had

‘possessed’ the sick man’s body. To do so he employed prayers, supplications, spells and incantations. Surviving Egyptian medical papyri, like the Hearst and Ebers Papyrus, consist largely of prescriptions of drugs interspersed with magical spells which were believed to impart efficacy to the prescriptions they follow. Many of the remedies prescribed contain noxious or offensive ingredients to make them as unpalatable as possible to the possessing spirit and so give it no inducement to linger in the patient’s body.

The ancient Babylonians, too, lived in a world haunted by evil spirits. Whenever they fell ill they believed that they had been seized by one of these spirits. Those afflicted sought for aid to bring about a return to their previous condition. The healer’s function was to help them achieve this end by removing the cause of their illness. Patients were required to atone for their sins and the angry god has to be placated. The treatment involved the employment of ritual involving sacrifice and incantations.

A recently translated cuneiform text preserves invaluable evidence of Babylonian views regarding the nature of epilepsy. Here we are presented with an accurate and comprehensive description of many familiar features of an epileptic seizure²:

12. [If at the time] of his fit [the patient] loses consciousness and foam comes from his mouth, it is miqtu [diurnal epilepsy].

13. [If at the time] of his fit he loses consciousness and his arms and legs bend round to the same side as his neck, it is miqtu.

14. If at the time of his fit. . . takes hold of him and foam comes from his mouth, an [unfulfilled] vow made by his father has seized him. He [the child] will die.

15. If at the time of his fit after it has

taken hold of him foam comes from his mouth,—hand of Lîlü.

16. If at the end of his fit when his limbs become relaxed again his bowels are sometimes seized and he has a motion, it is ‘hand of ghost’ [nocturnal epilepsy].

17–18. If at the end of his fit his limbs become paralysed, he is dazed [or dizzy], his abdomen is ‘wasted’ [sc. as of one in need of food] and he returns everything which is put into his mouth. . . - hand of a ghost who has died in a mass killing. He will die.

19–22. If at the end of his fit his limbs become paralysed, [the demon] ‘pouring out’ upon him so much that he loses control [of his functions]; if when he thus ‘pours out’ upon him his eyes are red and his face expressionless; if his ser’anu-vessels pulsate at a quickened rate and he cries although the tips of his fingers and toes remain cold; if when the exorcist asks the sick person to repeat [a prayer] he repeats what he says to him, but after [the demon] has let him go he does not know what he said, - hand of Lîlü-la’bi.

23. If before his fit a half of his body is ‘heavy’ for him and pricks him, and afterwards he has a fit with loss of consciousness and he loses control [of his functions], it is miqtu. At midday it will be most serious for him.

24–25. If before his fit he suffers from frontal headaches and is emotionally upset, and afterwards he. . . [.] his hands and feet, [and] rolls from side to side [on the ground] without deviation [of the eyes] or foam[ing at the mouth], it is a fall due to emotional shock, or ‘hand of Ishtar’. He will recover.

26. If when he has his fit [the fallen person] is looking sideways or the whites of his eyes deviate to the side, and blood flows from his mouth, for female [patients] it is Lîlü, and for male, Lîlîtu.

Sakikku 12–26.

Our unknown Babylonian, however, unequivocally maintains elsewhere: ‘if epilepsy falls once upon a person [or falls many times], [it is (as a result of) possession] by a demon or a departed spirit.’

Our earliest literary sources for the history of Greek medicine are the epic works of Homer and Hesiod which clearly reveal that the views of the Greeks of

the Heroic Age regarding disease and the operation of remedies employed to effect a cure, were, like those of their ancient Egyptian and Mesopotamian counterparts, permeated with belief in magic and the supernatural. As the Roman encyclopaedist Cornelius Celsus later declared, ‘*morbos. . . ad iram deorum immortalium relatos esse*’. (*On medicine*, Proem, 4), diseases were attributed to the wrath of the gods—although here the gods, for the most part, act directly and not through the intermediary of demons or evil spirits. In the first book of the *Iliad*, for example, the plague which attacks the Greek army besieging Troy is sent by Apollo in punishment for Agamemnon’s arrogant treatment of his priest Chryses, who had come to the Greek camp to try to ransom his captured daughter:

The arrows rattled on the shoulders of the angry god when he moved and his coming was like the night. Then he sat down apart from the ships and let fly a shaft. Terrible was the twang of the silver bow. He attacked the mules first and the swift dogs, but then he loosed his piercing shafts upon the men themselves and shot them down and continually the pyres of the dead thickly burned. For nine days the missiles of the god ranged throughout the host. . .³

The same superstitious attitude towards epilepsy is also to be found in Classical Greece. Our best evidence of this is afforded by the Hippocratic treatise, *On the Sacred Disease*, whose author mounts a vigorous attack upon witch-doctors, faith-healers, charlatans and quacks who claim that epilepsy has a sacred character and who regard manifestations of mental disease generally as due to supernatural causation⁴:

In my opinion those who first attributed a sacred character to this disease were the sort of people we nowadays call witch-doctors, faith-healers, charlatans and quacks. These people also pretend to be very pious and to have superior knowledge. Shielding themselves by citing the divine as an excuse for their own perplexity in not knowing what beneficial treatment to apply, they held this condition to be sacred so that their ignorance might not be manifest. By choosing suitable terms they established a mode of treatment that safeguarded their own positions. They prescribed purifications and incantations. . .

Our author also attacks as charlatans those who diagnose manifestations of mental disease as due to supernatural causation⁵:

Men in need of a livelihood contrive and embroider many fictions of all sorts with regard to this disease and many other matters, putting the blame for each kind of complaint upon a particular god. If the patient acts like a goat, if he roars, or has convulsions on his right side, they say that the Mother of the Gods is responsible. If he utters a higher-pitched and louder cry, they say he is like a horse and blame Poseidon. If he should pass some faeces, as often happens under stress of the attack, Enodia is the name applied. If the stools are more frequent and thin like those of bird, it is Apollo Nomius. If he should foam at the mouth and kick, Ares is to blame. In the case of those who are beset during the night by attacks of fear and panic and madness and jump out of bed and rush out of doors, they speak of attacks by Hecate and assaults by the Heroes.

He then attacks the superstitious awe with which epilepsy is regarded⁶:

I do not believe that the so-called 'Sacred Disease' is any more divine or sacred than any other disease. It has its own specific nature and cause; but because it is completely different from other diseases men through their inexperience and wonder at its peculiar symptoms have believed it to be of divine origin. This theory of divine origin is kept alive by the difficulty of understanding the malady, but is really destroyed by the facile method of healing which they adopt, consisting as it does of purifications and incantations. But if it is to be considered divine on account of its remarkable nature, there will be many sacred diseases, not one.

And claims that epilepsy has a similar nature and cause to that of other diseases⁷:

I believe that this disease is not more divine than any other disease; it has the same nature as other diseases and a similar cause. It is also no less curable than other diseases unless by long lapse of time it is so ingrained that it is more powerful than the drugs that are applied. Like other diseases it is hereditary. . . [3]. The brain is the cause of this condition as it is of other most serious diseases.

He holds that, like other diseases, epilepsy is susceptible to treatment⁸:

This so-called 'Sacred Disease' is due to the same causes as other diseases, to the things that come to and go from the body, to cold and sun and changing restless winds. These things are divine so that there is no need to put the disease in a special class and to consider it more divine than the others; they are all divine and all human. Each has its own nature and character; none is irremediable or unsusceptible to treatment.

It is at first sight surprising to find in the above passage that, although supernatural explanation is firmly ruled out, the notion of the divine is not entirely excluded. According to our author the whole of nature is divine, but this belief does not allow any exception to his rule that natural effects are the result of natural causes. Here, if I may anticipate, can be seen the continuing influence of Ionian natural philosophy. The Milesians philosophers, as I shall proceed to show, in rejecting supernatural causation, did not reject the notion of divinity altogether, but regarded their own first principles as divine. According to our medical author, diseases, too, share in this divinity in the sense that, as parts of the cosmos, they also possess their own individual *physeis* (natures), which display in the regular pattern of their origin, development and operation the same intelligible laws inherent in the world about them.

Another Hippocratic treatise, possibly by the same author as *Sacred Disease*, namely, *Airs, Waters, Places* attempts to account for certain diseases, including epilepsy, as due to the effect of particular climatic and topographical factors. It is maintained that all these diseases are endemic in cities 'exposed to hot winds and sheltered from the north'⁹:

The women are unhealthy and prone to fluxes. Again, many of them are barren through disease and not naturally so, and frequently miscarry. The children are liable to convulsions and attacks of asthma and to what is thought to cause the disease of childhood and to be a sacred disease <i.e. epilepsy>. The men suffer from dysentery, diarrhoea, ague, chronic fevers in winter, pustules and haemorrhoids.

Here, then, towards the end of the fifth century BC is revealed a strikingly different and novel attitude towards the causation of disease. Medicine is now freed from magical and religious elements and based upon natural causes. Even a disease like epilepsy with its

at times dramatic and terrifying onset is no longer regarded as the result of supernatural causation. The importance of this revolutionary innovation for the history of medicine can hardly be over-stressed. Here for the first time is displayed an entirely different outlook towards disease, whose causes and symptoms are now accounted for in purely natural terms. This revolutionary attitude, however, did not spring forth fully developed like Athena from the head of her father Zeus. Let us now endeavour to trace the factors which brought about this *vital* step.

This emancipation of medicine from superstition, paving the way for its subsequent development as a science, was the outcome of precisely the same attitude of mind which the Milesian Natural Philosophers, Thales, Anaximander and Anaximenes, were the first to apply to the world about them in the sixth century BC. The latter's attempts to explain the world in terms of its physical constituents, without having recourse to supernatural agency brought about the transition from mythological conjecture to rational explanation. Rain, for example, which was previously attributed to the activity of Zeus¹⁰ is now held to be squeezed out from the clouds by compression¹¹. Moreover, just as the natural philosophers had sought to explain in purely natural terms such frightening phenomena as earthquakes, thunder and lightning and eclipses^(12a–g), which had previously been regarded as the manifestations of supernatural powers^(13a–c) so the same outlook was applied by medical authors of Hippocratic treatises to explain in terms of natural causation such frightening diseases as epilepsy (the 'Sacred Disease'), apoplexy, delusions, and even impotence, which had all previously been attributed to divine action. Evidence of this relationship between philosophy and medicine may be seen in the fact that the medical literature of the fifth and early fourth centuries BC is written in the Ionic dialect. Although both Cos and Cnidus, whence the bulk of the treatises in the Hippocratic *Corpus* seem to have emanated, were both Dorian settlements, the *Corpus* itself is written throughout in Ionic, which became at this time the standard literary medium not only for philosophy but for medicine and science generally. In ancient Greece, then, philosophers and medical men shared a common intellectual background. They subscribed largely to the same general assumptions, and, to a considerable extent, adopted the same concepts, categories and modes of reasoning.

A variety of factors seems to have coalesced to initiate this intellectual revolution in the sixth century BC. Its place of origin, the Ionian Greek city of Miletus on the west coast of Asia Minor, was possessed of enormous energy. A colony herself, she had founded on her own account no less than 90 new colonies. Through these offshoots she came into contact with older neigh-

bouring cultures. As a result of her trade in materials and manufactured goods brought to the coast from inner Anatolia and by the export of her own manufactures she became extremely wealthy. Shipping, trade and industry, then, brought Miletus great prosperity and a wide range of contacts with other lands and cultures. The standard of living of her citizens was too obviously the product of human energy and initiative for there to be any need to acknowledge an indebtedness to the gods, such as we find in ancient agrarian economies. This secular spirit, which relegated the gods to the background, was doubtless fostered by the fact that the Milesians were not inhibited by any demands of a theocratic form of society. There was at Miletus no professional priesthood jealous to preserve a dogmatic religious orthodoxy. There was no one true religion expounded from a common sacred book by universally recognized spokesmen and supported by an organized religious authority. Unlike their Oriental neighbours, the Milesians were not constrained to adhere to any inviolable dogmatic code and they shared with their counterparts in other Greek city-states a common experience of regular participation in political debate and a characteristically irreverent attitude towards traditional authority, coupled with the tolerant belief that any citizen was entitled to voice his opinion on any subject. Moreover, the affluent environment of commercial Miletus provided both the leisure and the stimulus for disinterested intellectual enquiry.

No Greek medical literature prior to the Hippocratic *Corpus* has survived. Alcmaeon of Croton, a Greek colony in south Italy is the only pre-Hippocratic Greek medical writer whose views have come down to us even in fragmentary form. That they survived at all may have been pure accident. His interests seem to have been primarily medical and physiological¹⁴, but, like so many of his Greek contemporaries, they were wide. Some of the problems that engaged his curiosity subsequently aroused the interest of the natural philosophers. Aristotle, therefore, took note of his opinions and he was later dutifully included by Theophrastus in his *Physical opinions*, the first History of Philosophy. Although we possess only fragmentary information regarding Alcmaeon's medical beliefs, it is nevertheless sufficient to reveal that he displays the same outlook which characterizes the Milesian Natural Philosophers before him and the Presocratic Philosophers after him. Just as Anaximander had viewed the cosmos in terms of a balance or even a legal contract between equal opposed forces¹⁵ so, in the human body, health is held by Alcmaeon to be due to the equilibrium (*isonomia*) of the powers composing it, while the supremacy (*monarchia*) of any one of them causes diseases.¹⁶ Here is revealed a totally different conception of disease from that encountered previously in Greek epic. In Homer the more dramatic

diseases, at any rate, are represented as being outside nature and subject to the whim of the gods. Alcmaeon rejects this conception of disease and holds it to be due to disturbances of the body's natural equilibrium and, in consequence, subject to the same rules that operate in the world at large. This medical theory became very influential and was adopted within the Hippocratic *Corpus*¹⁷. It was also linked, in combination with Empedocles's Four Element Theory, with the humoral theory¹⁸. Its subsequent influence can be traced through Philistion of Locri¹⁹ in the fourth century to Plato²⁰, and beyond.

Alcmaeon's physiological interests are also recorded by Theophrastus and his researches into the nature of the sense organs²¹ also seem to have had an important influence upon later philosophical thought. After him psycho-physiological investigations became almost standard topics of inquiry among later Presocratic philosophers. As a result of his researches Alcmaeon came to the conclusion that all the senses were connected to the brain. Here we may see the first step taken in the great debate as to whether the heart or the brain was the seat of the intellect—a debate which rumbled on down through the centuries and is echoed, for example, in Bassanio's query in the *Merchant of Venice*: 'Tell me where is fancie bred, or in the heart or in the head?'

Interrelations between philosophy and medicine subsequent to Alcmaeon became highly intricate. We have just seen how the initial influence of philosophy was instrumental in bringing about the development of rational medicine in ancient Greece. Now, as a result of a widening interest in medicine itself in the fifth century, the impulse to turn from macrocosm to microcosm was quickened considerably. The philosophers, themselves, began increasingly to apply their views about the world at large to man himself and base their medical and physiological theories upon their unifying philosophical hypotheses. The most influential philosophers in this respect are Empedocles of Acragas and Diogenes of Apollonia. Both of these philosophers had medical interests and may even have actually been doctors themselves. Empedocles is keenly interested in the human body and seeks in his didactic hexameter poem, *On nature*, to explain its composition, its organs and their functions upon the basis of his highly influential four-element theory, which dominated philosophy and science for over two millennia. We may note here that, although influenced by Alcmaeon's researches in physiological psychology, Empedocles, firmly maintains that the heart (or rather the blood around the heart), not the brain, is the seat of the intellect.

Although a less important thinker than Empedocles, Diogenes, too, exercised a strong influence in the subsequent histories of both philosophy and medicine and

is a figure of seminal importance in any study of the early history of epilepsy. Like Empedocles to whom he is indebted for many of his biological theories, Diogenes may also have been a physician and may even have written a medical treatise. He revived in the fifth century the monistic hypothesis of Anaximenes that air was the first principle, that all existent things were different modifications of air. Significantly he now sought to support his belief in air as his basic substance on biological and physiological grounds, pointing out that human beings and all other animals live by breathing air; that air is their soul and intelligence, since when it is taken away, their intelligence fails and they die; that the semen is aeriform (revealed in its foamy appearance) and since it produces new life, its aerated nature is an important indication that air is the vital substance. Upon this monistic hypothesis that all things are composed of air, Diogenes not only attempted to account for health and disease, but also to account for the different levels of intelligence encountered within the animal world. He discriminated in the first place between the animate and the inanimate by claiming that living creatures differ in that they contain air that is warmer than that outside but much cooler than that near the sun. He then stressed that this warm air was capable of many differentiations, both among different species of living creatures and among the individuals which make up any given species. Theophrastus has preserved several instances of the manner in which Diogenes differentiated between levels of intelligence possessed by various living creatures. Although all creatures derive their intelligence from this same air, variations may be caused by such factors as moisture or even physical structure. As thinking depends upon pure dry air and moisture hampers intellect, thought is consequently at a low ebb when one is either asleep, drunk or in a state of surfeit. Notwithstanding his biological debts to Empedocles, Diogenes follows Alcmaeon, rather than the latter, in regarding the brain as the central organ of sensation and thought.

Philosophy, as we have seen, came to exercise a powerful influence upon the development of medicine. From this connection medicine derived certain important benefits. It now became incorporated within self-consistent and tightly integrated systems. Rational modes of explanation, based upon formal, deductive reasoning and sustained by logical argument, were now adopted to account for health and sickness. Man himself was considered to be part and parcel of an ordered world whose laws were discoverable, a product of his environment, made of the same substances and subject to the same laws of cause and effect that operate within the cosmos at large. Furthermore, the diseases to which he is prone were themselves defined strictly in accordance with the same natural processes

and ran their course within a set period of time totally independent of any arbitrary, supernatural interference. However, the disadvantageous effect of this influence was almost equally great, for along with the above benefits, medicine adopted, too, an undue tendency to deduce explanations from a preconceived position, which resulted in a propensity to accommodate observed facts to pre-established convictions. This had an adverse effect upon the development of a more empirical method more appropriate to the subsequent development of medicine, as the Hippocratic author of *Ancient medicine* is at pains to point out in a bitter polemic inveighing against the intrusion of ‘new-fangled’ philosophical postulates into medicine. Nor should it be assumed that the advent of Ionian Rationalism totally eradicated superstitious beliefs in the causation of disease. Then, as indeed now, superstition remained firmly entrenched—as the ‘cures’ (*iamata*) inscribed on the pillars at the temple of Asclepius at Epidaurus reveal. Interestingly one of these records the case of an epileptic from Argos. This man, we learn, during his sleep in the Abaton saw a vision: he dreamt that the god approached him and pressed his ring. . . upon his mouth, nostrils and ears and he recovered.

It is time now to return to our seminal text *On the Sacred Disease*. We have already seen that its author, influenced generally by the spirit of Ionian Rationalism, had denied that epilepsy was due to supernatural causation and had put forward a theory to explain psychic affliction which was not only rational and natural but based upon somatic factors. However, a more immediate and particular philosophical influence can be described since our author elaborates a comprehensive explanation of the disease upon the basis of two theories, held, as we have just seen, by Diogenes—the belief that the brain is the seat of the intelligence and that air is the source and principle of intelligence within the living organism. The first of these beliefs is clearly in evidence in Chapter 14 where we find the author maintaining:

Men ought to know that the source of our pleasures, merriment, laughter and amusements as well as our grief, pains, anxiety and tears is none other than the brain. It is by this organ especially that we think, see, hear and distinguish between the ugly and the beautiful, the bad and good, the pleasant and unpleasant. Somethings we differentiate by convention, others by our perception of expediency. By this same organ, too, we become mad or delirious, and are assailed by fears and panics, sometimes by night, sometimes even in the daytime, by insomnia, sleepwalking, thoughts that do not

come, ignorance of established usage and actions out of character. These things we suffer all come from the brain whenever it is unhealthy. . .²²

And the second of these beliefs—that air is the source and principle of intelligence—is found in Chapter 17:

For these reasons I consider the brain to be the most potent organ in the body. So long as it is healthy, this is our interpreter of the phenomena caused by air. It is the air that supplies intelligence. Eyes, ears, tongue, hands and feet carry out the actions determined by the brain. For the whole body participates in intelligence in proportion to its participation in air. The brain serves as messenger to comprehension. For when a man draws in breath, the air first reaches the brain, and so is dispersed into the rest of the body, having left in the brain its essence and whatever of intelligence it possesses²³.

According to our author, then, epilepsy is no more divine than any other disease. It has the same nature as other diseases. It has the same cause that gives rise to other individual diseases. It is also curable no less than other diseases, unless by long lapse of time it has become so ingrained that it is more powerful than the remedies that are applied. Its origin, like that of other diseases lies in heredity, since in the production of semen diseased parts of the parents’ bodies give off diseased seed. The disease, however, afflicts only the phlegmatics, never the choleric. (Here the author adopts the theory of the four humours.) To make the pathogenesis of the disease comprehensible to his reader our author then presents a brief sketch of his anatomical and physiological beliefs. He holds that the human brain is double—divided in the middle by a delicate membrane. For this reason pain is not always felt in the same part of the head, but sometimes on one side, sometimes on the other, and occasionally all over. Many fine vessels lead up to it from all over the body. Two thick vessels also connect it to the liver and the spleen. The vessel to the liver stretches downwards on the right side, close by the kidney and the muscles of the loins, to the inner part of the thigh and reaches down to the foot. It is called the ‘hollow vein’. The other part of it stretches upwards through the right side of the diaphragm and the right lung; branches split off to the heart and to the right arm while the remainder passes up behind the clavicle on the right side of the neck and there lies subcutaneously so as to be visible. It disappears close to the ear and then divides; the thickest, largest and most capacious part finishes in

the brain, while the smaller branches go separately to the right ear, the right eye and to the nostril. From the spleen, too, a vessel extends downwards and upwards to the left. It is similar to the one from the liver, but thinner and weaker. (We may note here that this notion of two vessels, one connecting the liver with the right arm, the other the spleen with the left is also, significantly, attributed by Aristotle to Diogenes of Apollonia.) Our author goes on to explain that it is by these vessels that we take in the greater part of our breath which they then spread over the body through the minor vessels. If the breath is held up anywhere, that part of the body where it is stopped becomes paralysed. He goes on to describe a variety of other conditions that may arise when the air is obstructed by discharges, especially by phlegm, and then applies this general theory to epilepsy: should the routes for the passage of phlegm be blocked, the discharge enters the vessels described; this causes loss of voice, choking, foaming at the mouth, grinding of the teeth and convulsive movements of the hands; the eyes roll, the patient becomes unconscious, and, in some cases, he passes excrement.

Although our author gives here a reasonably accurate description of an epileptic attack and his assertion that the young are more prone to the disease than those who are older is valid, most of his pathological, anatomical and physiological theories are highly speculative and over schematic. (These deficiencies should not surprise us at a time when deeply seated religious beliefs in Ancient Greece had given rise to what amounted to a taboo interdicting the dissection of the human corpse.) Again, although in the opening chapter of *Sacred Disease* our author criticizes his opponents for 'pretending to have superior knowledge about what causes and what cures disease', he is himself susceptible to this same charge, since the particular treatment recommended by him, dietetic control of temperature and humidity, in fact afforded no greater possibility of cure. While his establishment of a naturalistic basis for the understanding of madness and his rejection of any reference to the divine or demonic marks a release from one sort of mystification, he achieves this at the cost of the substitution of another. His manifest confidence that salutary effects are to be derived from the antibilious or antiphlegmatic diet he recommends is itself clearly a matter of faith. Our author is patently over-confident in his assessment of the procedures he advocates. Although they are, in principle, capable of being subjected to further tests with a view to their verification, in practice, they remain speculative and untested.

While it is true, then, that many of his theories and explanations are quite fanciful, we must be careful not to throw out the baby with the bathwater. For amid all this foam and froth there is a large and lusty baby, indeed. These explanations of the causes of madness,

epilepsy and other mental disturbances, by purely natural causes stand in marked contrast to the belief in the supernatural causation of these afflictions found in contemporary works of Greek tragedy as well as the diagnoses of those charlatans, who, as we saw earlier are attacked by the author of *Sacred Disease*. His attempt to explain a frightening disease long invested with superstition without recourse to supernatural explanation but rather by natural causes; his attempt to put forward a corporeal cause for a mental affliction, is a *vital* step forward.

To illustrate the progress of this baby and show how it was fostered by later philosophers and physicians, permit me in conclusion briefly to review its progress throughout the subsequent history of Greco-Roman medicine. At times our evidence exists in only fragmentary form. Yet, nevertheless, it is sufficient, I believe, to show that even when thinkers differed in their particular views of the causation of epilepsy and differed, too, in their belief as to the location of the seat of the intellect, they were unanimous in their conviction that this disease, so often shrouded in superstition, was due to purely natural causes. Plato agrees with the author of *Sacred Disease* that epilepsy is an affliction of the brain and caused by phlegm (with, in this case, an admixture of black bile). It may be noted here that, although he retains the use of the term 'Sacred Disease', he justifies it upon a non-supernatural basis, claiming that epilepsy is justifiably called the 'Sacred Disease' because it is an affliction of the sacred substance i.e. of the brain marrow²⁴.

Unlike Plato, both Diocles of Carystus, the second Hippocrates, and Praxagoras of Cos, the last really important Hippocratic doctor, hold that the heart, not the brain is the seat of the intellect. Their explanation of the cause of epilepsy, however, is not dissimilar. Both of them hold that it is caused by the blocking of the psychic *pneuma*²⁵.

In the third century BC Greek rational medicine was transplanted into Egypt and at Ptolemaic Alexandria it achieved its greatest success. Expatriate Greek doctors, attracted there by better opportunities for research under the Ptolemies, displayed on the one hand, the same rational attitudes towards medicine that we have previously encountered at Cos, Athens and elsewhere in Classical Greece; but being uprooted from their native environments and thus no longer constrained by traditional customs and attitudes still in force in Mainland Greece, they also reflected in their pioneering approach to medicine the new freedoms they encountered in this new and cosmopolitan city. Levels of sophistication in the knowledge of human anatomy were attained at Alexandria that remained unsurpassed until the Renaissance. The immediate cause of these great scientific advances is not difficult to discern. For here certain medical researchers first began systemati-

cally to dissect the human body which had previously been protected from violation by powerful taboos. At Alexandria, however, an authoritarian state had come into being, whose founders, the first Ptolemies, sought to enhance their regime's prestige by fostering not only the arts but also the sciences. To further anatomical research, it is alleged, they even supplied criminals for dissection from out of the royal gaols.

Among the doctors attracted to work at Alexandria two were outstanding, Herophilus of Chalcedon and Erasistratus of Ceos. Herophilus, the elder of the two, moved to Alexandria after initial training under Praxagoras. His greatest contributions to medical research were largely in anatomy and he conducted important investigations, based at times on human dissection, into the brain, the nervous and vascular systems. His most impressive contribution to anatomy, however, is his discovery of the nervous systems. Having discovered the nerves and demonstrated that they originated from the brain, settling once and for all—one might have been tempted incorrectly to assume—the long-standing debate regarding the seat of the intellect, he then distinguished between the sensory and motor nerves and traced the optic nerves from brain to eye.

Like Herophilus, Erasistratus made important contributions to the development of anatomy. Although Herophilus was the actual discoverer of both sensory and motor nerves, Erasistratus carried the inquiry into the brain and nervous system considerably further. His discoveries here put the work of his predecessor in the shade. His description of the structure of the brain, as can be seen from a verbatim account preserved by Galen²⁶ reveals greater accuracy than that attained by Herophilus. Like Herophilus, Erasistratus distinguished the *cerebrum* (*enkephalos*) from the *cerebellum* (which he called *epenkranis* not *parenkephalis*, as the former had done). He also described in some detail the cerebral ventricles or cavities within the brain. It seems likely that he agreed with Herophilus that the fourth ventricle of the *cerebellum* was the seat of intellectual activity since his observations that the *cerebellum* of the human brain has more convolutions than that of other animals had led him to the conclusion that the number of convolutions varied according to the degree of intellectual development. He was also in agreement with Herophilus that the brain was the starting point of all the nerves and, like him, differentiated between the sensory and motor nerves.

Unfortunately little has survived concerning the Alexandrians' views on epilepsy, it is not even known whether Herophilus put forward any theories on epilepsy at all. Some information preserved in Galen, however, reveals that Erasistratus did discuss epilepsy. Here we learn that, like other diseases generally, it was caused by *plethora*—the flooding of the veins by a superfluity of blood engendered by an excessive intake

of nourishment. Unfortunately, in this case the organ affected is not specified and it is, thus, impossible to determine whether his views on epilepsy were in any way connected with his researches into the nervous system.

As time is pressing, we must now jump four centuries or so and turn finally to the 'Prince of physicians'. Galen was committed to the integration of philosophy and medicine and believed that to be a good doctor one had to be a philosopher; that medicine presupposed all parts of philosophy. The good doctor had to master the natural sciences in order to understand human physiology, anatomy and pathology. He had to know logic in order to give proper definitions, to make the right conceptual distinctions, to analyse proofs and to avoid fallacies. He needed training in ethics so that he could exercise sound moral judgement. In philosophy Galen was influenced primarily by Plato, Aristotle and the Stoics; in medicine by the writings of Hippocrates (or what he conceived to be such) and by the anatomical and physiological researches of Herophilus and Erasistratus.

Integrating these influences, Galen put forward a conception of nervous disorders that was based at once on anatomical knowledge and upon traditional speculation. Galen believed that the soul was domiciled within the brain where reason originated and the memory of sensual perceptions was stored. Sensibility and the voluntary motions of the body were functions of this rational soul, and to carry out these functions, the soul employed the psychic pneuma, located in the ventricles of the brain, as its instrument, which received sensations and transmitted the soul's commands to the muscles via the spinal cord and the nerves. Here one may discern the influence of the anatomical researches of the Alexandrians. All epileptic attacks, Galen held, were due to affections of the brain. The brain could be affected itself primarily and directly, or indirectly from another part of the organism. In the first case, Galen considered that epilepsy was the outcome of an 'idiopathic' ('protopathic') disease of the brain. In the second case, he held that the involvement of the brain was 'sympathetic' i.e. the brain, though healthy in itself, had become involved in a disease-process which had started external to it.

In the former instance of epilepsy as an idiopathic disease of the brain, Galen held that the cause of seizure was an accumulation of a thick humour, which might consist either of phlegm or of black bile, in the cerebral ventricles, blocking the psychic pneuma. Generalized convulsions ensued, produced by the shaking of the origin of the nerves. These convulsions were a biological reaction to the impediment, as the brain sought to rid itself of the irritation. This affliction began in early childhood and most epileptics belonged to this group.

In a limited number of cases, the original lesion was located elsewhere in the body, and the epileptic attacks were the result of a 'sympathetic' affliction of the brain. Galen distinguished two possible causes of such sympathetic involvement. The first of these he attributed to an impairment or to a general weakness of the *cardia* (i.e. the stomach here) which he held to be extremely sensitive because of its abundant supply of nerves. According to the second possibility the primary lesion lay sometimes in the extremities, sometimes elsewhere in the body. In the case of such an attack, patients noticed an upward motion of the *aura* (a Greek term meaning 'breeze'—this term was apparently introduced into medicine by a thirteen year old epileptic patient of Galen). This subjective symptom led to Galen believe that some qualitative change had come about or a 'pneumatic substance' had spread over the body until it finally reached the brain, just as the poison from the bite of a scorpion or spider gradually affects the entire organism.

Galen's tightly integrated and comprehensive system, offering a complete medical philosophy, came to represent the very embodiment of Greek and Roman medical knowledge and dominated medicine throughout the Middle Ages and beyond until the very beginning of the modern era. In the particular case of epilepsy what is of crucial importance is his rational attitude towards the disease. This attitude, as I have sought to show, was a direct legacy of the vital step taken by his Hippocratic predecessor several centuries earlier. Galen follows directly in the latter's footsteps and so, in this respect, do we ourselves.

FOOTNOTES

1. Temkin, O. *The Falling Sickness: A History of Epilepsy from the Greeks to the Beginnings of Modern Neurology*. 2nd Edition, Baltimore, Johns Hopkins, 1971.
2. Wilson, Kinnier J. V. and Reynolds, E. H. Translation and analysis of a cuneiform text forming part of a Babylonian treatise on epilepsy. *Medical History* 1990; **34**: 185–198.
3. Homer, *Iliad*, I, 46–53.
4. [Hippocrates], *Sacred Disease*, Chapter 1 (VI. 354, 12–20L.).
5. [Hippocrates], *Sacred Disease*, Chapter 4 (VI. 360, 9ff.L.).
6. [Hippocrates], *Sacred Disease*, Chapter 1 (VI. 352, 1–9L.).
7. [Hippocrates], *Sacred Disease*, Chapter 2–3 (VI. 364, 9–15, 366, 5–6L.).
8. [Hippocrates], *Sacred Disease*, Chapter 18 (VI. 394, 9–15L.).
9. [Hippocrates], *Airs, Waters, Places*, Chapter 3 (II. 18, 2–6L.).
10. **Zeus rains upon us, and from the sky comes down enormous winter.** Alcaeus, 4.
Aristophanes later exploits the comic potential of this traditional belief in the *Clouds* when the old peasant, Strepsiades, describes his earlier belief that the rain was caused by Zeus urinating through his 'chamber-pot sieve' (*Clouds*, 373)
11. Here, according to our doxographer, Anaximenes implicitly rejects the traditional belief that Zeus sends the rain and deduces instead from his first principle (*aêr*) the natural explanation that it is 'squeezed out' from the clouds.

Anaximenes said that clouds are formed when the air is thickened further; when it is compressed further still, rain is squeezed out; hail occurs when the descending water condenses, and snow, whenever some portion of the air is included within the moisture.

Aëtius, *On the opinions of the philosophers* III. 4.1 (D.K. 13A17).

This mode of explanation is parodied at *Clouds* 367–369: Strep.: *What do you mean 'there is no Zeus?' Who sends the rain? First of all tell me this.*

Soc.: *The Clouds do, of course, I'll prove it to you by strong evidence.*

- 12a **<Thales> said that the Earth is held up by water and rides like a ship and when it is said to 'quake' it is then rocking because of the movement of the water.**

Seneca, *Natural questions*, III. 14 (D.K. 11A15).

Here Thales dispenses with two Olympian gods—Atlas, who supports the earth, and Poseidon, the 'earthshaker'

- 12b **Anaximenes said that when the earth becomes soaked or parched it breaks and is shaken by the high ground that is broken off and falls. It is for this reason, too, that earthquakes occur both in times of drought and during heavy rains; for in droughts, as has been said, the earth becomes dried up and breaks, and when it becomes excessively wet by the rains it falls apart.**

Aristotle, *Meteorologica*, B7. 365b6 (D.K. 13A21).

In the above passage Anaximenes attributes earthquakes to natural causes—not to Poseidon, the 'earth-shaker god'. A similar theory is attributed by Ammianus to Anaximander (XVII, 7, 12 (D.K. 12A28).

- 12c Thunder and lightning are no longer attributed to the agency of Zeus.

With regard to thunder, lightning, thunderbolts, water-spouts and whirlwinds: Anaximander says that all these are caused by wind. When it is enclosed in thick cloud and forces its way out by reason of its fine texture and lightness, then the tearing makes the noise and the rent in contrast to the blackness of the cloud produces the flash. Anaximenes is of the same opinion.

Aëtius, *On the opinions of the philosophers*, III, 1 (D.K. 12A23) & III. 3,2 (D.K. 13A17 = *Dox.* 367–368).

- 12d Zeus is no longer regarded as the cause of eclipses. Here and in the following contexts below a natural cause is put forward. **According to Anaximander, the sun is a circle twenty-eight <<twenty-seven?>> times the size of the earth and resembles a chariot wheel. The fellow is hollow and filled with fire. At a certain point it allows the fire to shine out through an orifice, as though through the nozzle of a pair of bellows.**

Aëtius, *On the opinions of the philosophers* II, 20, 1 (D.K. 12A21).

- 12e The cause of a solar eclipse. **According to Anaximander, the sun is eclipsed when the orifice of the blow-hole of fire is closed.**

Aëtius, *On the opinions of the philosophers* II, 24, 2 (D.K. 12A21).

- 12f A similar explanation is put forward to account for a lunar eclipse. **According to Anaximander, the moon is a circle nineteen <<eighteen?>> times the size of the earth, resembling a chariot wheel with its fellow hollow and full of fire like that of the sun. It lies oblique also like the sun and has one blow-hole like the nozzle of a pair of bellows...**

Aëtius, *On the opinions of the philosophers* II, 25, 1 (D.K. 12A22).

- 12g It, too, is caused by the blockage of its 'blow-hole'.
According to Anaximander, the moon is eclipsed when the orifice in the wheel becomes blocked.

Aëtius, *On the opinions of the philosophers* II, 29, 1 (D.K. 12A22).

- 13a Zeus and Poseidon respectively cause thunder and earthquakes.

The Father of Gods and Men thundered terribly from on high and from below Poseidon caused the boundless earth to quake and shook the lofty mountain peaks.

Homer, *Iliad*, 20. 56–58.

- 13b Zeus is the cause of thunder and lightning.
... even Okeanos fears the lightning of great Zeus and his terrible thunder when it crashes from heaven.

Homer, *Iliad*, 21. 198–199.

- 13c Zeus is also the cause of eclipses.
Zeus, the Father of the Olympians, made night at noon when he concealed the light of the shining sun...

Archilochus, 74. 3.

14. Diogenes Laërtius VIII, 83 (D.K.24A1)
15. The Milesian philosopher, Anaximander, conceives the universe to be a balance maintained between opposing forces. Anaximander said that the first principle <archê> and element of existing things was the apeiron <indefinite/infinite>. He was the first to introduce this name for the archê. He says that it is neither water nor any other of the so-called elements, but some other apeiron nature, from which come into being all the heavens and the worlds in them. Things also pass away into those things out of which they come into existence 'according to necessity; for they pay penalty and retribution to one another for their injustice according to the assessment of Time', as he puts it using somewhat poetical terms.

Simplicius, *Commentary on Aristotle's physics*, 24. 13 (D.K.12B1 vgl. 12A9).

16. This cosmic theory is adopted by Alcmaeon as the basis of his theory of health.

Alcmaeon holds that what preserves health is the equality <isonomia> of the powers—moist and dry, cold and hot, bitter and sweet and the rest—and the supremacy <monarchia> of any one of them causes disease; for the supremacy of either is destructive. The cause of disease is an excess of heat or cold; the occasion of it surfeit or deficiency of nourishment; the location of it blood, marrow or the brain. Disease may come about from external causes, from the quality of water, local environment or toil or torture. Health, on the other hand, is a harmonious blending of the qualities.

Aëtius, *On the opinions of the philosophers*, V, 30, 1 (D.K.24B4).

17. See, for example, [Hippocrates], *Ancient Medicine*, 14 (1.602, 9–14L = CMG 1.1, pp. 45–46 Heiberg)
18. See, for example, [Hippocrates], *Nature of Man*, 4 (VI. 38, 19–40, 9L = CMG I, 13, pp. 172–4 Jou.)
19. *Anonymus Londinensis*, 20.25–37 (Jones, 1947, p. 80)
20. *Timaeus*, 82A
21. Alcmaeon's researches into the nature of the sense organs (preserved here by Theophrastus), together with other physiological enquiries, exercised a strong influence upon later philosophical thought and contributed to the trend manifested by certain of the Presocratic philosophers in the second half of the fifth century to turn from macrocosm to microcosm.

[25.] Among those who explain sensation by what is unlike, Alcmaeon begins by defining the difference between man and the lower animals. Man, he says, differs from other creatures because he alone has understanding, whereas they have sensation, but not understanding; thought and

sensation are different, not, as Empedocles holds, the same. He next speaks of each sense separately. Hearing, he says, takes place through the ears because they contain empty space, which resounds. Sound is produced by the cavity and the air echoes it. Smelling is effected by means of the nostrils when air is drawn up into the brain. Tastes are distinguished by the tongue. Since it is warm and soft it dissolves substances by its heat and, owing to its porous and delicate structure, it receives and transmits the flavour.

[26.] Eyes see through the water surrounding them. That the eye contains fire is evident, for the fire flashes forth when it is struck. Vision is due to the gleaming element and the transparent when it gives back a reflection; the purer this element is, the better the eye sees. All the senses are connected in some way to the brain. Consequently they are incapacitated if it is moved or shifts its position. For it obstructs the passages through which the sensations take place. Concerning touch he tells us neither the manner nor the means whereby it is effected. This, then, is the extent of his explanation.

Theophrastus, *On the senses*, 25 & 26 (D.K. 24A5).

22. [Hippocrates], *Sacred Disease*, Chapter 14 (VI. 386, 15–388, 4L.)
23. [Hippocrates], *Sacred Disease*, Chapter 16 (VI. 390, 10–20L.)
24. When <white phlegm> is mixed with black bile and is diffused over the most divine circuits in the head and throws them into confusion, the visitation, if it comes during sleep, is comparatively mild, but when it attacks those who are awake it is harder to throw off. As an affliction of the sacred substance <i.e. the brain marrow> it is most justly termed the 'Sacred Disease'.

Timaeus, 85 a–b.

25. Praxagoras says that epilepsy occurs in the region round the thick artery <aorta> when phlegmatic humours aggregate within it. These, being formed into bubbles, block the passage of the psychic pneuma from the heart and thus the pneuma makes the body shake and convulse. Again when the bubbles have been settled, the condition ceases. Diocles also believes that there is an obstruction in the same region and concurs in other respects with Praxagoras.

Anonymus Parisinus 3 = *Anecdota medica* 3 (p. 541 Fuchs = *Diokles* Frg. 51 Wellmann = *Praxagoras* 70 Steckerl).

26. His account is as follows: 'I examined also the structure of the brain. It was divided into two parts, like that of other animals, and has ventricles lying there, elongated in shape. These two ventricles were connected by a passage where the two parts are joined. From here the passage led into the so-called epencranis <i.e. the cerebellum>, where there was another small ventricle. Each of the parts was divided off by itself—as was also the cerebrum, which was similar to the jejunum and had many folds. The epencranis was to a still greater extent than the cerebrum furnished with many varied convolutions. So the observer learns from these that, just as in the case of the other animals, the deer, the hare, or any other that far excels the others in running, is well provided with muscles and sinews useful for this function, so in man, too, since he is far superior to other animals in intellect, this organ is large and very convoluted. All the nerves grow out of the brain, and, speaking generally, the brain seems to be the source of bodily activity. For the sensory channels from the nostrils opened onto it as did those from the ears. And from the brain nerves led to the tongue and the eyes.

Galen, *On the doctrines of Hippocrates and Plato*, 7.3 (V.602K. = CMG V 4, 1, 2 p. 440 De Lacy = Frg. 289 Garofalo).

The above description seems to have been based upon human as well as upon animal brains.