

# ANCIENT MEDICINE

## SERIES OF ANTIQUITY

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*Series of Antiquity* is a series designed to cover the subject matter of what we call science. The volumes discuss how the ancients saw, interpreted and handled the natural world, from the elements to the most complex of living things. Their discussions on these matters formed a resource for those who later worked on the same topics, including scientists. The intention of this series is to show what it was in the aims, expectations, problems and circumstances of the ancient writers that formed the nature of what they wrote. A consequent purpose is to provide historians with an understanding of the materials out of which later writers, rather than passively receiving and transmitting ancient 'ideas', constructed their own world-view.

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activities of the magician and those of the physician. How far this distinction was followed in practice is unclear, and is less significant than the fact that the magician was used as one of the defining boundaries of what was appropriate behaviour for the physician. 'I am not a mantic diviner', asserted the author of *Prometheic 2*, thereby distinguishing his method of medical forecasting from theirs.<sup>89</sup>

From this perspective both the Hippocratic Corpus and the rise of Asclepius cult are part of the same phenomenon, the defining of orthodoxy over against a magical alternative. In religion magic was credited with the potential to disturb the proper relationship between gods and men. It operated outside the formal religious channels for communicating with the divine; and it thereby posed a threat to civic order.<sup>90</sup> The rise of Asclepius cult was one way in which the divine power to heal could be channelled for the benefit of both city and individual patient. Those who offered religious healing outside these channels, such as the travelling priest and the exorcist, became marginalised, and their religious credentials were called into question. Even when it was accepted that they had the power to interfere with the natural workings of a divinely created world, this was condemned for its individualistic rather than its communal deployment. Skills so powerful, and so privileged an access to the gods, must be constrained within the framework of civic life. Thus Telemachus' mainly private foundation of the shrine of Asclepius at Athens was gradually assimilated into the official religious environment of the city, and may have been subject to some civic control from its inception.

In this process Asclepius came to symbolise not just the power of the gods to heal and save but also the art of medicine itself as contrasted with other healing alternatives. Asclepius possessed the skills, talents and attributes of the good human doctor.<sup>91</sup> For a doctor to reject Asclepius and his healings might also be for him to reject the very things for which medicine was thought to stand. In this way religious and secular healing reinforced rather than opposed each other.<sup>92</sup>

## FROM PLATO TO PRAXAGORAS

The Roman author Celsus praised Hippocrates as the first to separate medicine from the 'studium sapientiae', the study of wisdom, or, as we would say, 'philosophy'.<sup>1</sup> If he intended by this to suggest that after Hippocrates medicine and philosophy went their separate ways, and that neither learned or borrowed from the other, he was considerably mistaken.<sup>2</sup> Even as some of the texts in the Hippocratic Corpus were being composed, the philosopher Plato was making use of medical data for his own philosophical purposes, as well as putting forward an explanation for illness that was to have a long-lasting impact on the intellectual world.

We have already seen that Plato referred on several occasions in his dialogues to Hippocrates as the leading representative of medicine of his day, and in his *Second Letter* he mentioned his own acquaintance with the doctor Philistion of Locri.<sup>3</sup> His letter expressed the hope that Philistion would be allowed by his master, the tyrant Dionysius II of Syracuse, to come to Athens, although whether he ever did so is far from clear.<sup>4</sup> Plato is known to have made three visits to S. Italy and Sicily, in about 387, 367 and 362 BC, and may well have met with Philistion on any of these occasions. However, the authenticity of this letter has been frequently called into question, and a link between the two men could easily have been a later rationalisation of the ways in which some of Plato's theories come very close to those of Philistion as reported in the *Anonymus Londinensis papyrus*.

Philistion believed in three general causes of disease, which he then subdivided. The first (internal) cause was an excess or a deficiency in one of the four 'forms', hot, cold, wet and dry. The second (external) was the presence of wounds or sores, or the result of an excess or deficiency of external heat and cold, of inopportune changes from one to the other, or simply of wrong nutrition. The third and last cause was some impediment to the flow of air into or out of the body.<sup>5</sup> In his *Timaeus*, Plato produced two explanations that are very similar to the first and last of Philistion's: imbalances and irregularities of the body. Where there is no breath, the body begins to rot; where there is too much, the air forces its way through where it should not, and causes painful swellings, sweatings and distortions.<sup>6</sup>

But Plato is not simply repeating Philistion; alongside breath or air he sets the far more traditional pair of bile and phlegm. His second cause goes even further in its apparent independence from what others had said before him. The Platonic body is built up from the four elements, earth, air, fire and water, which form the building blocks from which everything else is created. Flesh and sinews are formed from blood – itself the direct product of 'digested' food – and its constituents, and the 'viscous oily substance that comes from the sinews and flesh' nourishes the outer part of the bones, while a pure substance nourishes the marrow.<sup>7</sup> When this process is working correctly the patient is healthy. But it can go into reverse. The flesh can decompose, the blood become bitter, and bile, serum, phlegm and the like can then destroy the whole body. Instead of nourishing the body and benefiting from one another, they are carried round the body in the veins, spreading destruction and decay in mutual conflict and strife.<sup>8</sup> When the fluid that binds flesh and bone together dries out, the corrupted substance crumbles away and flesh and bone become separated. When the very marrow becomes affected, through some excess or deficiency, even more serious diseases occur. The deeper and more advanced the degeneration, the less the chance of recovery.<sup>9</sup>

Whether this concept of what might be termed diseases of decomposition is Plato's own or draws on an earlier philosopher or doctor is not clear.<sup>10</sup> It creates a powerful image of the body going into reverse, almost spontaneously. Earlier in his argument, Plato had explained growth and decay as the result of the vigour of the triangles that, in his mathematical universe, lay at the very foundation of all matter. When young and fresh, their edges are sharp, capable of prevailing over those that occur in food and drink, and so cutting up that material into its basic constituents, which can then be distributed efficiently around the body in blood as nutriment. The new triangles can attach themselves to the appropriate parts of the body and cause it to grow. Conversely, as we grow old, the triangles become blunter and lose their cutting edge; they themselves become more easily divided, and the body descends into old age. When the bonds of the triangles that make up the marrow can no longer hold together, they come apart, releasing the bonds of the soul, which flies off. This is the normal process of aging and death. To what extent, if at all, the same process is followed in diseases of degeneration is far from obvious, and Plato does not explain what triggers such diseases.<sup>11</sup>

The descriptions of these diseases are all the more striking because they reverse the whole construction of the body so carefully and purposefully organised by Plato's Craftsman (the Demiurge or Creator). From marrow, the most important of all tissues, is formed the brain, and other parts are enclosed in bone to form the spine; after bone is formed flesh, which is carefully distributed around the body according to the design of the Creator. Because solid bone and thick flesh inhibit sensitivity, he reduced the thickness of the bones of the skull surrounding the brain, the seat of the intellect. The consequent loss of protection and the possibility of increased pain is more than

outweighed by the gain in sensitivity.<sup>12</sup> The neck, through which only very tiny channels go upward to the head, further protects the brain from the deleterious polluting effects of the mortal elements of the soul which are located further down in the body.<sup>13</sup>

Plato's description of the human body in the *Timaeus*, which exercised a powerful influence over later thinkers, owes less to his acquaintance with the internal anatomy of the body (or with earlier writers on this theme) than to his own preconceptions about the soul. In the *Republic* he had exploited a complex series of mutually reinforcing analogies between the city and the soul to argue that there were three parts to the soul, concerned, respectively, with reason, spirit or energy, and desire.<sup>14</sup> Just as in the healthy or just city all its citizens had to work together, each doing his or her appropriate task and, in Plato's view, guided by the wisdom of the philosopher rulers, so in the healthy person all parts of the soul must co-operate together under the guidance of reason. Just as the much more numerous third portion of the state always endangered its good working, so in the body uncontrolled desire had a damaging effect on reason and, in the end, its own well-being.

In the *Timaeus*, a mythic account of reality, this tripartition is extended further by locating each part of the soul in a specific part of the body.<sup>15</sup> The highest part of the soul is placed in the brain, the energetic part in the heart, and the lower, appetitive part in the belly, where can be found the liver, stomach and spleen. Plato does not make clear the detailed physiology of these lower organs, although he makes the liver the chief controller among them, just as his picture of the heart and its vessels is highly schematic, and it was left to later scholars, Galen in particular, to correlate the tripartite soul with three largely independent bodily systems, the brain and nerves, the heart and arteries, and the liver and veins. Plato does not go this far, not least because a clear-cut distinction between the venous and arterial systems had not yet been drawn.

Plato's linkage of soul and body in the *Timaeus* also introduces a physicalist strain into his explanation of diseases of the soul. Simply by being located in the body, the immortal soul is hampered in its activity, and affected by both nature and nurture. Some psychic disorders are the result of bad upbringing, but others have a physical origin. Morbid humours, in particular bile and phlegm, send out vapours, which have a different effect depending on which part of the soul they reach. Madness (*mania*) and stupidity may both have their origin in changes in the body: alterations in the marrow, for instance, affect one's perceptions of pleasure and pain. If this is so, the correction of these mental or psychic aberrations must involve treatment of the underlying physical condition. So from one's earliest years one should receive a suitable physical and mental training, with appropriate regimen and gymnastic exercises, in order to keep the physical body as healthy as the mind. Drugs are not recommended by Plato, except as a very last resort.<sup>16</sup>

The medical sections of the *Timaeus*, then, are far from lacking in interest. They show a non-medical man, Plato, utilising ideas which, as we know from

both the Hippocratic Corpus and Anonymus Londinensis, were at the forefront of medical debate at the time in order to write his own account of the creation of the human body and to explain some of its mental or psychic defects. His subsequent influence brought these ideas to a wide audience, and they in turn were developed by commentators who might themselves introduce further medical arguments and evidence.<sup>17</sup> Galen, as we shall see, was convinced that Plato had studied medicine with Hippocrates, and that Plato's notions of the body could reveal much about the teaching of Hippocrates that was otherwise unclear from the Hippocratic Corpus.<sup>18</sup> But, even if Galen's belief in Plato the medical student is largely his own invention, other more sober commentators brought their own medical information to bear on philosophical problems.<sup>19</sup> The celebrated (and disputed) passage about Alcmaeon's introduction of anatomy, for example, is preserved today only because a late Latin commentator on the *Timaeus*, Chalcidius, used it to explain further what Plato was doing in his account of sight (at 67d–e).<sup>20</sup> Unlike modern medical historians, Chalcidius was not concerned with what Alcmaeon had actually done (even if he could have found out), but only with the relevance of his theories to those of Plato.

Plato's pupil, Aristotle, the son of a court physician to the King of Macedonia and an Asclepiad on both his mother's and his father's side, continued this interest in matters medical, although in a very different way from his master.<sup>21</sup> He posited a continuum between doctors and natural philosophers: most natural philosophers in their account of the world had also to consider medicine, while the more thoughtful physicians grounded their medical theories upon the principles of natural philosophy.<sup>22</sup> He himself brought into harmony both the medical theories about opposites and the philosopher's ideas about elements, and, in particular, the four basic elements, the hot, cold, wet and dry. In the Aristotelian universe medical theory, and most notably the four-element theory of *The Nature of Man*, could find a secure home. The human body was built up out of the four elements, and its natural processes could be explained by Aristotle's physical principles. The inner heat of an animal was, so to speak, an 'internal fire', and the main function of air or pneuma was to cool this heat and prevent it from getting out of control and damaging the organism. The brain, Aristotle believed, acted as a refrigerator to cool down the fiery heart, the seat of the single and unified organic soul.<sup>23</sup>

Aristotle, like Plato, established his own school, the Lyceum, in Athens, where he and his pupils embarked on a wide-ranging and ambitious programme of empirical investigation. They collected and studied information on the whole world of nature and of human endeavour, from records of the constitutions of the various city-states and the opinions of doctors, to botany and mineralogy.<sup>24</sup> This enterprise was backed by influential patrons. Aristotle had worked first at the small court of Assos (now W. Turkey), before becoming the tutor of the future Alexander the Great. The support of Alexander allowed Aristotle to exploit immediately the conquests made by his army as it traversed

the Persian Empire as far as the mountains of Afghanistan and the plains of the Punjab between 334 and Alexander's death in 323. The conquering troops were accompanied on their marches by scholars who kept records, measured distances and sent back to Aristotle in Athens specimens of the new minerals and plants that they found.<sup>25</sup>

Aristotle himself was passionately interested from his earliest years in what we would now term biology and zoology. He collected information on a wide range of animals, birds and fishes, even going so far as to perform systematic dissections on at least fifty different kinds of animal. He was as well informed about the development of the chick in the egg as about the habits of bees or the feet of the ostrich.<sup>26</sup> His credo, as set out in his treatise *The Parts of Animals*, is a stirring call to investigate the natural world, 'for every realm of nature has something marvellous about it'.<sup>27</sup> He was prepared to acknowledge that looking at the constituent parts of bodies, blood, flesh, bone, vessels and so on might easily appear disgusting and shameful, but that was only if one concentrated on the individual building blocks and not on the whole house, of form. If one did that, then one would see the beauty of the craftsmanship of nature, and one would derive great pleasure from being able to discover and recognise the true causes of things. In particular, one would quickly become aware that 'in the works of nature, purpose, not chance, predominates'.

Aristotle is here committed to the study of biology in accordance with his general philosophical principles, and the primary object of this study is not the individual detail of any part but their composition as a whole. In particular, the abundance of his information served to confirm one of Plato's central tenets in the *Timaeus*, teleology – or, in Longrigg's words, the doctrine of internal finality within nature – although Aristotle did not commit himself to his master's belief in a comprehensive and conscious design on the part of nature.<sup>28</sup> One studied the natural world, not only for what it was itself, but in order to gain insights from more accessible, albeit also transitory, material than was possible from the contemplation solely of the precious and divine heavenly bodies. That knowledge was more pleasing, but inevitably only partial; it needed to be supplemented by the empirical study of the things on earth.

These included animals, living beings, of which humans were only one. Aristotle's project aimed at encompassing all of them, 'noble and ignoble alike'. There is thus no specific anthropology in his writings, no treatise devoted to an examination of the human body by itself. This would have been an extremely difficult task, as he himself admits, for 'the inner parts of the body are unknown, especially those of man', but also an unnecessary one, if the requisite information that contributed to the overall understanding of nature could be obtained by other means. Analogy with other animals provided that means, 'looking at those animals which have parts similar to those of humans'.<sup>29</sup> Since at this time there were strong taboos in Greece against interfering with a human body, let alone dissecting it, human anatomy was out of the question. That of animals, birds and fishes was not, and Aristotle refers often to his own

investigations (and to those of others, including, almost certainly, Diocles) into their organisation, structure and, above all, functions.<sup>30</sup> His results are far more detailed and wide-ranging than those of his predecessors, although at times his account is not easy to follow. His description of the vascular system, for example, both includes new observations and omits (or misunderstands) much that we might consider obvious. His description of the heart as having three chambers continues to divide modern interpreters into those who believe that Aristotle erred in what he saw when he carried out his dissection and those who argue that it is Aristotle's starting point for the description that differs from ours, not his observation.<sup>31</sup> His notions that the hearts of large animals, like horses, had a bone within and that the number of chambers in the heart was related to size are a nice blend of fact and misunderstanding.<sup>32</sup> But there are times when Aristotle got things wrong beyond any dispute. Because he failed to find any blood vessel extending to the brain, he concluded that the brain in all animals was bloodless.<sup>33</sup> His belief that females have fewer teeth than males, and fewer cranial sutures, may be based on incomplete observations, but was also influenced by his underlying conception of woman as an inferior and somehow incomplete version of man.<sup>34</sup> But his mistakes are relatively few in comparison with his accurate descriptions of phenomena in the living world, and do not detract from the example he set to others (and to their patrons) of the value of such empirical research. He raised big questions about the whole process of life, from movement and sensation to aging and sleep, although almost all that he himself wrote specifically on medicine has disappeared.<sup>35</sup>

His influence, which was substantial, took many different forms. Through his teaching of logic at the Lyceum, Aristotle created what might be described as the scaffolding for future intellectual debate, emphasising correct logical argument and the importance of a proper definition of terms in any exposition of medical or scientific material. In turn, by setting medicine and the human body within the wider system of the cosmos he allowed a dialogue about the causes of the natural processes within the body to be conducted at a deeper level of explanation. We can trace a whole series of debates with Aristotle over the interpretation of medical phenomena from his immediate pupils through to Galen, whose own influential systematising depends on a basically Aristotelian epistemology and on a combination of data drawn from the Hippocratic Corpus and Plato and inserted into a world of Aristotelian physics.<sup>36</sup> Aristotle's successor as head of the Lyceum, Theophrastus (c.371–287), not only included many medicinal plants in his *Enquiry into Plants*, but also wrote short tracts on such obviously medical topics as sweating, fatigue and giddiness.<sup>37</sup>

Aristotle refers several times in his zoological treatises to a book that he had written, entitled *Dissections*, which contained figures and drawings of dissected animals.<sup>38</sup> The relationship of this treatise to one written by his contemporary, Diocles of Carystus, is a moot point. In the opinion of Galen,

Diocles was the first to write a specific treatise on (animal) anatomy, and he used the evidence of his dissection of mules to make inferences about the human womb.<sup>39</sup> But it is not easy to determine when Diocles, 'second in time and fame to Hippocrates' and a younger Hippocrates', lived and worked, since all we have of his writings are fragments and reports preserved by much later authors.<sup>40</sup> Most recent scholarship would put him as a contemporary of Aristotle, but their precise relationship is unclear.<sup>41</sup> Neither refers to the other for certain. It is true that Diocles' idea that in the womb there were 'breast-like outgrowths . . . made with forethought by nature to give the embryo practice at sucking the nipples of the breast' partly resembles a theory expressly criticised by Aristotle, but he does not mention Diocles as its author.<sup>42</sup> Conversely, the statement in Anonymus Bruxellensis 44 that the heart has four chambers has been interpreted as a direct contradiction by Diocles of Aristotle's view that it had only three, although, once again, Diocles is not mentioned and the hypothesis that he is the critic is far from proven.<sup>43</sup> Even the clearest citation of Aristotle, in an attack on his theory of seed, turns out on inspection to be problematical, for the relevant passage could be the work of the compiler, not of Diocles.<sup>44</sup> Nevertheless, it remains likely that Diocles' work as an anatomist and embryologist overlapped with that of Aristotle, some of his writings being available to Aristotle, other parts written in reaction to him.<sup>45</sup>

But anatomy was only one part of his activity, and perhaps not that most familiar to his contemporaries. The titles of his books, for example *Gynaecology*, *Bandaging*, *Treatments*, *The Surgery and Affection, Cause and Treatment*, give only a hint of the variety and the extent of their contents. What survives today from them indicates that he ranged widely over all aspects of medicine, and that it was this comprehensiveness that gained him comparison with Hippocrates. In surgery he was credited with the introduction of a special spoon-shaped instrument for the removal of arrowheads from a wound.<sup>46</sup> He wrote on poisons and on vegetables, as well as a *Rhizotomikon*, a treatise on plants with medicinal properties; one of his remedies has recently been found in a prescription from Egypt written in the sixth century.<sup>47</sup> His discussion of fevers emphasised the importance of critical days, the days on which a fever might be expected to change crucially for better or worse, for remission or relapse, and he paid special attention to those that were multiples of seven.<sup>48</sup> There are obvious parallels here with the Hippocratic *Epidemics*, and Diocles' own *Prognostic* falls clearly within the same tradition as the Hippocratic treatise of that name, but proof of direct acquaintance with any specific tract from the Corpus is elusive.<sup>49</sup>

Diocles' overall theory of health and disease, typical of that of learned medicine in the fourth century, is marked by an increased methodological sophistication. He believed strongly in causation, and ascribed the internal causes of disease to some excess or deficiency within the body's four elements and the four primary qualities.<sup>50</sup> He accepted four humours, blood, phlegm, bile and black bile, which arise from nutriment and are differentiated within



Figure 8.1 Ancient bathing as a treatment for fever, as imagined by a mediaeval artist. Dresden, Sächsische Landesbibliothek, Db 93, fol. 581v.

the blood vessels through a process of alteration by innate heat.<sup>51</sup> He paid particular attention to *pneuma* ('breath' or 'refined air'), which spread through the body's vessels to effect voluntary motion. The blockage of *pneuma* was especially serious, and the cause of a variety of diseases. If its passage round the body was blocked by congealed phlegm within the aorta, it resulted in epilepsy and apoplexy.<sup>52</sup> More frequent was the interruption of the flow of *pneuma* taken into the body via the pores of the skin as a result of an excess of bile or phlegm. Phlegm cooled and compacted the blood, whereas bile caused it to boil and curdle. This obstruction not only caused fevers and headaches, but also brought on melancholy when it affected the heart, the source of the 'psychic *pneuma*' of the body.<sup>53</sup> Diocles' interest in *pneuma*, although many details remain obscure, confirms the growing importance of this substance among philosophical and scientific writers of the fourth century, as he links it both to mental states and to physical disorders. But there is not yet a systematic doctrine of *pneuma*, such as we find in the next century.<sup>54</sup>

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Like many writers in the Hippocratic Corpus, Diocles emphasised the individuality of the patient, as the body changed over time, with the seasons of the year, the weather and the process of aging. Health was the restoration of the individual's natural balance by appropriate treatments.<sup>55</sup> This was not always easy: for example, since male semen was drawn from the brain and spinal cord frequent intercourse was potentially dangerous, since the body might not be able to replace such vital fluid easily and quickly.<sup>56</sup> Women were even more at risk, for they had, of course, their own diseases, as well as those they shared with men.<sup>57</sup>

Although Diocles wrote on pharmacology and bandaging, his major interest in therapeutics was in diet and exercise – Galen was particularly enthusiastic about his advice on gymnastics, on which he considered him a real expert.<sup>58</sup> It was a skill Diocles may have inherited from his father, for he expounded his ideas on the use of oil in anointing and rubbing the body in a book entitled *Arthidamus*, which was also his father's name.<sup>59</sup> His largest treatise on the subject was his *Hygiene*, in which he considered in a sophisticated manner the problems of prescribing diets.<sup>60</sup> The effects of foodstuffs cannot always be predicted from a knowledge of their properties, and, vice versa, it is not always possible to explain why a particular food has produced the effect that it has. On the whole, experience is here a better guide than theory, and one will make fewer mistakes if one assumes that what normally happens when a particular food or drug is given is caused by the whole nature of its substance, i.e. by the specific interaction of all its constituents together. To assume that foods with apparently similar individual properties, for example of hotness or pungency, will always work in a similar way is often refuted by experience.<sup>61</sup> Diocles is not here rejecting the possibility of an enquiry into causation, as the later Sceptics or Empiricists were to do, but acknowledging the practical difficulties of constantly carrying out such a procedure in dietetics. Indeed, while on some occasions such an enquiry might add to our understanding and to the plausibility of dietary prescriptions, in the great majority it would be unnecessary for the proper treatment of the patient.

Diocles, along with his contemporaries the Athenians Mnesitheus and Dieuches, the Coans Praxagoras and Phylotimus, and Pleistonicus, constituted a group of physicians and writers whose beliefs Galen thought essential knowledge for any competent practitioner.<sup>62</sup> The work of none of these authors has survived intact today, and it may be doubted how much even Galen had of their writings within his own library. Certainly the average physician in Rome would have had little chance of buying copies of the complete works of Mnesitheus, and it is probable that Galen was expecting him to use a manual that presented the opinions of earlier doctors in the form of a doxographical summary of their views on particular diseases. An impression of what such a manual might have contained can be gained from the anonymous treatise on acute and chronic diseases generally referred to as Anonymous Parisinus, so called because it was first edited from a manuscript

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in the Bibliothèque Nationale in Paris.<sup>65</sup> Written probably in the first or early second century AD, it lists the views of 'the ancients', and specifically Hippocrates, Diocles, Praxagoras and Erasistratus, on the cause or causes of a range of diseases, including epilepsy, ileus and tetanus. Discussing pleurisy, for instance, the author reports that Erasistratus believed that it was the result of an inflammation of the membrane on the inner side of the ribcage, whereas Diocles thought that it was due to some obstruction in the veins around the pleura. Praxagoras, however, considered it was an inflammation of the extremities of the lung itself. This anatomical precision is then contrasted with the view in the Hippocratic *Plaver in Man* that ascribed pleurisy to a flux moving from the head to the chest.<sup>64</sup> After causes comes a description of the symptoms, followed by recommendations for treatment. The general organisation is clear and simple, and the treatise is short and relatively easy to use.<sup>65</sup> One can see how such a document could fulfil Galen's demand that the competent practitioner (and, indeed, his learned patient) should familiarise himself with the main outlines of the ideas of the major authors among the 'ancients'.

What links Galen's classic writers together, and the reason why later commentators often labelled them as 'Dogmatic' or 'Logical Physicians', was their belief in the use of reason to establish a chain of causation.<sup>66</sup> Mnesitheus, for example, 'second to none in his methodical practice', was alleged to have followed closely Hippocrates' method of division in determining the causes of disease.<sup>67</sup> They all believed in the importance of humours and elemental qualities, although what they meant by these terms is not always clear, however much Galen, our major source, might insist that they shared his opinions. Even when, like Diocles, they accepted four cardinal humours, they did not always agree with Galen on what these were or how they came into being.<sup>68</sup> Others understood the same Greek word in very different ways. Mnesitheus used the word 'humours' to refer to savours, and called bodily fluids 'chyles', without apparent differentiation.<sup>69</sup> Praxagoras identified eleven different humours, including a 'vitreous humour' responsible, among other things, for the shivering fever; Phylorimus may have spoken of even more.<sup>70</sup> Galen, wishing to claim both of them as forerunners, explained that they were merely giving precision to what Hippocrates had said. By contrast, Rufus of Ephesus, another Hippocratic, clearly saw their ideas as divergent.<sup>71</sup> Galen looked back to these 'ancients' also to support his views on the need to treat the whole patient rather than just the affected part. He may well be right in this, although his further claims that they appreciated the importance of venesection and of prognosis are far from assured.<sup>72</sup> Even Galen had to admit that they relied on prognosis solely to decide who was likely to recover and who was not. Mnesitheus, for example, announced that a craving for onions at the onset of 'pneumonia' indicated a future recovery, a craving for figs death.<sup>73</sup> Even if one accepts his (and Galen's) argument that these cravings reveal the underlying constitution of the patient, this is still a long way from Galenic

prognosis as the essential guide to diagnosis and treatment, and one may doubt the basis on which Mnesitheus made this sweeping assertion.

These 'ancients' are also praised for their therapeutics. Dieuches is credited with discovering a means of applying dangerous drugs in a relatively safe way, no bad thing in view of what Praxagoras and his pupils at times advocated – hellebore, a very powerful emetic, whether taken orally or in a pessary.<sup>74</sup> Despite the risks involved in its use, hellebore in both its black and white varieties was continuously prescribed down to the twentieth century, not least because its effects were very obvious and because it might work when all else failed.<sup>75</sup> But hellebore was at least less deadly than Praxagoras' treatment for ileus, which, in some extreme cases, might involve abdominal surgery to remove impacted residues, a 'magnificent death' as the later Methodist writer Caelius Aurelianus scathingly described it.<sup>76</sup>

Although a later author claimed that Praxagoras had brought dietetics to perfection, his contribution is represented only briefly in the surviving fragments of his writings, by contrast with Mnesitheus and Dieuches.<sup>77</sup> Like Diocles, they put diet at the very forefront of medical therapy in a way that was far more sophisticated and more thoroughly argued than the brief hints in the Hippocratic Corpus. Their writings and their practical example are an important contribution to a development which led to dietetics being placed on the same level as surgery and pharmacology in the battle against disease; indeed, some placed it above them, on the grounds that dietic medicine plays a role in preventing as well as in curing disease.<sup>78</sup> Mnesitheus was famous for his careful description of diets for children, while Dieuches was quoted by Orbasius verbatim and at length on the preparation and use of foods.<sup>79</sup> Some of his advice reads extremely practically today. It is useless to offer those taking to the sea for the first time a remedy against vomiting. Indeed, if one's stomach is disturbed vomiting may actually help, but then one needs to take light and gentle food. Until one has gained one's sea legs it is unwise to gaze upon the tossing waves. But the best way of all to prevent seasickness is to take on board a bunch of thyme or another sweet-smelling substance to counter the stench that is always to be found on board ship.<sup>80</sup>

Their interests were continued by their slightly younger contemporary Diphilus of Siphnos, whose book *Diets for the Sick and the Healthy* covered a wide variety of foods, including cherries, damsons, nuts and mushrooms, both in their natural state and in their cooked forms. His comments on mussels, oysters and salt fish, to which he devoted a whole section, or possibly even a separate book, were much less enthusiastic, for he thought they had little or no nutritional value.<sup>81</sup> His treatise, however, is not cited by any medical author, unlike that of Phylorimus, which extended to at least thirteen books, and recommended likewise a range of diets for use in both sickness and health.<sup>82</sup> Phylorimus preferred pears to apples, and raw leeks to cooked ones, which he thought fibrous and difficult to chew. He had even less time for olives. Black olives were very oily, hard to digest, and likely to produce a feeling of nausea

for some time, whereas white olives kept in brine, although more digestible, were liable to engender a sharp, acid humour, like the yolk of an egg.<sup>83</sup>

Along with an interest in diet came an interest in anatomy, although what precisely Dieuches did in his dissections to gain the approval of Galen is unknown.<sup>84</sup> For Praxagoras and his pupils, however, the evidence is clearer. They not only meditated on the processes within the body (Pleistoniscus thought digestion a sort of putrefaction), but they also examined its structures, for example the womb, the heart and the blood vessels. In doing this, presumably in animals, they provided an important bridge between Aristotle and the human anatomy of the Alexandrians.<sup>85</sup> Praxagoras, for instance, was both the teacher of Herophilus and influenced by many of Aristotle's ideas, although there is no evidence that he ever studied in Athens at the Lyceum.<sup>86</sup> Nor should we expect this. Like Phylotimus, who later became chief magistrate of Cos, he came from a distinguished Coan medical family that claimed descent from Asclepius and that was to remain prominent in the public life of the island for several generations to come.<sup>87</sup> Cos was and remained the centre of his medical world.<sup>88</sup>

The influence of Aristotle can be seen not just in Praxagoras' decision to dissect and to write at least one book on his discoveries, but also in his belief that the heart was the seat of the soul and the brain a mere outgrowth of the spinal cord, a doctrine he shared with his pupils and for which he claimed anatomical proof.<sup>89</sup> He posited that the arteries became progressively divided as they passed through the body until they collapsed inwards and became tiny 'nerves'.<sup>90</sup> He attempted to distinguish between the veins and the arteries (which had formerly both been called '*phlebs*', the word that later applied only to the veins), the arteries beginning in the heart, the veins in the liver. He then made the further assumption that the veins carried blood, the arteries only *pneuma*.<sup>91</sup> These findings and theories may not be entirely Praxagoras' own. Galen, our major source for his beliefs, reports that his father Nicarchus also thought that the arteries carried only *pneuma*, and Diocles, as we have seen, was certainly interested in the role of *pneuma*.<sup>92</sup> But even if the ideas were not entirely his own, it would appear to have been Praxagoras who worked out and justified their implications. The distinction between veins and arteries, and the link he claimed to have observed between the arteries and the nerves, allowed him and his pupils to raise further questions about the movement of the arteries, which he called the pulse, and about the source of the *pneuma* within it.<sup>93</sup> Was it all produced in the heart? Or was some of it also drawn in from all over the body? How was the actual pulse produced?<sup>94</sup> What was the relationship of the actual pulse to the beating of the heart itself? For Praxagoras pulse and heartbeat were independent of each other, and pulsation differed from similar movements of the arteries, such as tremor or palpitation, only quantitatively and by being natural, not the result of some disorder.<sup>95</sup> Most significantly for the future development of medicine, Praxagoras was the first to see in the pulse a valuable diagnostic aid and to take the movements of

the arteries as an index of changes going on elsewhere in the body. How he himself used the pulse to identify diseases is not made clear by the sources, and what survives of ancient pulse lore or sphygmology suggests that a sophistication of both diagnosis and terminology had to wait until his pupil Herophilus.<sup>96</sup>

Nonetheless, Praxagoras' discovery had profound consequences for medicine, and it was perhaps for this reason that he was regarded in Antiquity as one of the great figures of medicine. At least one statue was erected in his honour, which around 30 BC became the subject of an epigram by a distinguished man of letters, Crinagoras of Mytilene. Its eight lines convey in high-flown couplets the image of the great physician:

Phoebus' son himself, anointing his hand with All-heal, rubbed the pain-killing science of your art into your breast, O Praxagoras. Therefore however many pains arise from long fevers, however many when the flesh is cut, you have been taught by gentle Epione to apply remedies enough. If mortals had had such physicians, the ferryboat would never have crossed over with its load of corpses.<sup>97</sup>

With Diocles, Mnesitheus and the other medical writers discussed in this chapter, we begin to glimpse for the first time individual named physicians instead of the anonymity or pseudonymity of the Hippocratic Corpus. They are often also consciously reacting to their own medical heritage, and can be seen to be building on and developing earlier ideas. Although we still remain ignorant about much of their doctrines and their relations with one another, and although it is clear that even that which we have may not correspond exactly to what they said or wrote themselves, the history of medicine from now on can more easily be written in terms of individual achievement and personalities.<sup>98</sup> They remind us that medicine in Classical Greece did not end with the Hippocratic Corpus, and that the interrelationship between medicine and philosophy was far more fruitful than the strictures of the author of *Ancient Medicine* might suggest.<sup>99</sup>



## ALEXANDRIA, ANATOMY AND EXPERIMENTATION

Few episodes in the history of ancient medicine have been so well studied as the rise and development of human anatomy in the first half of the third century BC.<sup>1</sup> Herophilus and Erasistratus are rightly famous for their pioneering investigations, which for the first time in the Western tradition of medicine revealed many of the hidden structures of the human body.<sup>2</sup> But this concentration solely or even largely upon the achievements of these two men in anatomy and physiology is not without its dangers. There is a tendency to forget that their dissections were performed within the wider pattern of their activity as physicians, and, even more, that what might be termed investigative or experimental anatomy based on human beings was carried out only for a limited period and in a limited area.<sup>3</sup> Although anatomical demonstration by means of a skeleton or surface musculature continued longer in medical teaching, especially at Alexandria, anatomical experimentation, whether using humans or animals, seems to have died out well before the end of the third century BC and not to have been revived until the late first or early second century AD.<sup>4</sup> When discussions of anatomical and, especially, physiological phenomena appear in later Hellenistic texts, they are largely, if not entirely, based either on chance observation or on the data provided by these early anatomists. The achievements of Herophilus, Erasistratus and the less familiar Eudemus thus mark not only the beginning of Greek human anatomy but also, paradoxically, its ending, leaving historians to account for its restricted temporal and geographical development.

As we have seen, the second half of the fourth century BC saw a vigorous interest in describing and interpreting a wide range of diverse natural phenomena. Aristotle and his followers, to say nothing of Diodorus, had dissected animals, birds and fishes to gain a wider understanding of the world of nature, while Praxagoras' investigations into and speculations about the pulse led to further consideration of the physiological processes within the body.<sup>5</sup> Euenor, an Acarnanian doctor resident in Athens in the 320s, is said to have called the horns of the uterus the 'coils', although whether this was as a result of animal dissection or his experience with difficult births is far from clear.<sup>6</sup> The theories of these medical thinkers were elaborated with the aid of reason, but within a new epistemological space, that of the visible.<sup>7</sup> The influence of

these developments on the anatomists of early Alexandria can be easily surmised. Herophilus is said to have been a pupil of Praxagoras, presumably on Cos, and tradition linked Erasistratus with the school of Aristotle through his alleged master, Theophrastus of Eresus.<sup>8</sup> At one level, then, the decision to cut into a human body is an understandable extension of a technique of investigation that had become relatively commonplace in Greek intellectual circles: from seeing the internal structures of a bird or a sheep to seeing those of a human being had thus become a small step.<sup>9</sup>

But it was a step fraught with problems, not least because it breached a long-standing Greek taboo on touching, let alone mutilating, a human corpse. Religious laws imposed a ban on interfering with a dead body, and continued to do so in Greece long after the arrival of human anatomy.<sup>10</sup> Although by now it was widely believed, especially among intellectuals, that the soul was something transient and immaterial, residing merely temporarily within the body and leaving it, at death, an empty physical shell, this view was not accepted by most Greeks, for whom the corpse continued to represent an individual human being.<sup>11</sup> Studies of the introduction of human dissection into renaissance Europe and elsewhere have revealed the strength of the reluctance to interfere with a human corpse, and there can be little doubt that such a repugnance was also widespread among the Greeks.<sup>12</sup>

But there was one area of the ancient world where this taboo apparently did not exist. The Greeks had been familiar since the days of Herodotus, if not long before then, with the common practice among the Egyptians of removing the major organs of the dead and storing them in large jars before proceeding to mummify the body. Herodotus expresses a mixture of fascination and disgust at this strange procedure, and other travellers sent back similar reports.<sup>13</sup> Alexander the Great's conquest of Egypt in 332–331 BC brought the Egyptians under Greek rule, and his foundation of the city of Alexandria 'by Egypt', just west of one of the mouths of the Nile, was a symbol of Greek domination. This was a Greek city, created to be a military as well as a political strong point in the newly acquired land. Although it later became a cosmopolitan giant, in its earliest years the relationship between the Greeks and the native Egyptians was far from equal. The Greeks were firmly in control; the administration, economy and culture of the city were entirely in their hands; and for a long while native Egyptians were barred from obtaining Alexandrian citizenship.<sup>14</sup> Added to the common Greek urban prejudice against those who lived and worked in the countryside, this would have helped to create an apartheid mentality, which regarded the natives, and particularly Egyptian peasants, as almost sub-human. If they showed no abhorrence at what was, to Greek eyes, the mutilation and desecration of their own dead, there was little reason why the Greeks should be concerned about what happened to Egyptian corpses.<sup>15</sup> Whether Herophilus or Erasistratus owed anything more to Egyptian mummifiers than the freedom from the Greek taboo is controversial. Those who seek a non-Greek origin for human anatomy and for an understanding of

the internal organs of the body can rightly point to the sophisticated Egyptian anatomical vocabulary and to the technique of the Egyptian mummifiers in opening up the body.<sup>16</sup> But there is no clear evidence that Egyptian mummifiers carried out any systematic investigations into the human organs they removed or that their cutting open of the corpse served any purpose other than the ritual preparation for burial.<sup>17</sup> Egyptian medical authors and practitioners, if one may judge from what little survives of their medical texts, did not make use of the information provided by the removal of bodily organs to create new theories or provide further justification for old ones. While there was nothing to stop Greek anatomists from observing Egyptian mummifiers in action, without an interpreter to explain what was being done (for the Greeks were notoriously reluctant to learn the language of others) many of the details of their procedures would have remained obscure.<sup>18</sup> Contacts between leading Greek intellectuals and Egyptians in early Alexandria were slight at best, and, even as these developed over time, no evidence for any linkage between medicine and mummification emerges. Mummifiers and medics remained separate professional groups.<sup>19</sup> At most, then, the Egyptian practice of mummification would have provided an encouragement to break a Greek taboo in pursuit of an intellectual challenge that had been foreshadowed in medical and scientific discussions for at least a generation.

Alexandria under the early Ptolemies offered a remarkably supportive environment for intellectual innovation.<sup>20</sup> The example of Aristotle in his close relationship with Philip of Macedon and Alexander undoubtedly encouraged their successor monarchs to invest in culture and science. The new courts, especially in Alexandria, Antioch and, later, Pergamum, attracted intellectuals of all kinds, poets, sculptors, mathematicians and doctors. Their presence should not be taken simply as a sign of a disinterested love of culture on the part of the ruler: it served also more practical purposes – propaganda, warfare and the supervision of his general health.<sup>21</sup> When the savage persecutions of the Alexandrians by Ptolemy VIII in 145–144 BC drove many intellectuals to become refugees, they were eagerly welcomed elsewhere in the Greek world, with the result that, as one contemporary put it, Alexandria became the teacher of Greeks and barbarians alike.<sup>22</sup>

It was Ptolemy I who, perhaps around 300 BC, established the two intellectual institutions that gave Alexandria its great reputation as a cultural centre, the Museum and the Library (or rather libraries, since there was more than one in the city). If Galen is to be believed, Ptolemy endeavoured to obtain by fair means or foul copies of everything written that he could find. Once in Alexandria they were placed in one of the royal libraries, where they were catalogued by a distinguished series of scholar-librarians. It was probably in Alexandria, as part of this process, that the writings that form our Hippocratic Corpus were first brought together.<sup>23</sup>

Of still greater significance was the creation by Ptolemy I of the Museum, the 'Hall of the Muses', near the royal palace. This was a community of scholars

and intellectuals, who in return for fulfilling their duty to the Muses (and their monarch) were provided with lodgings and free meals for life.<sup>24</sup> They included poets and critics, mathematicians and geographers, and, although in later centuries the range of the membership was extended to include government officials, it still retained its prestige as a cultural centre.<sup>25</sup> There was an interchange of ideas between the members of the Museum: the poet Callimachus shows an awareness of contemporary medical discoveries, while, as we shall see, the theories of Herophilus and Erasistratus depend in part on the new scientific and technological developments of others.<sup>26</sup>

While there is no evidence that the members of the Museum were obliged to teach or lecture, their very presence attracted students wishing to converse and study with the great men of the time in a vibrant intellectual atmosphere.<sup>27</sup> The pupils of Herophilus constituted his 'household', which implies that they lived communally, but not necessarily within the Museum.<sup>28</sup> Where he carried out his anatomical investigations is also unclear. If we accept Longrigg's attractive suggestion that he dissected within the protecting walls of the Museum, the corpses would thus have become a sort of sacrifice to the Muses (the religious character of the Museum is shown by the fact that its head was a priest, nominated by the ruler), and any violent opposition to their performance would perhaps have been reduced.<sup>29</sup>

Royal involvement (probably through both Ptolemy I and Ptolemy II who ruled 282–246) extended beyond mere protection: for official permission would have been required for these anatomies to be carried out even on the bodies of condemned criminals. If, as Celsus reports, the criminals were still alive when they were handed over to the anatomist from the royal jails, high-level approval would have been still more imperative.<sup>30</sup> Proof of Celsus' claim is, however, not easy to find, especially as many of the reported results could have been obtained from a combination of human dissection and animal vivisection. Galen, who might have been expected to mention Alexandrian vivisection, not least because he wrote one tract specifically on the practicalities of (animal) vivisection, says next to nothing about this human precedent.<sup>31</sup> Most later Galenists, whether in Byzantium or in Islam, never refer to human vivisection, and the exceptions, John of Alexandria and Agnellus of Ravenna, may be indirectly dependent on Celsus or his source.<sup>32</sup> The most strident condemnation of Alexandrian vivisection, by the Christian theologian Tertullian in the early third century, could be easily dismissed as a vivid exaggeration by a committed opponent of all dissection.<sup>33</sup> But in general Celsus shows himself to be well-informed about Hellenistic anatomy and surgery, and his claims are made within the context of a Hellenistic academic debate about the value of anatomy. Given also that the later pharmacological experiments of Atralus III of Pergamum and Mirhridates V of Pontus were certainly made on living subjects, there is no reason a priori to reject the possibility that some of these anatomical investigations were carried out on living humans, especially if, as criminals, they might be thought to have forfeited their humanity and their