

Galen, *On the Natural Faculties*, trans. Arthur John Brock (New York: W. Heinemann, 1916).

1. Since feeling and voluntary motion are peculiar to animals, whilst growth and nutrition are common to plants as well, we may look on the former as effects of the soul and the latter as effects of the nature. And if there be anyone who allows a share in soul to plants as well, and separates the two kinds of soul, naming the kind in question vegetative, and the other sensory, this person is not saying anything else, although his language is somewhat unusual. We, however, for our part, are convinced that the chief merit of language is clearness, and we know that nothing detracts so much from this as do unfamiliar terms; accordingly we employ those terms which the bulk of people are accustomed to use, and we say that animals are governed at once by their soul and by their nature, and plants by their nature alone, and that growth and nutrition are the effects of nature, not of soul.

2. Thus we shall enquire, in the course of this treatise, from what faculties these effects themselves, as well as any other effects of nature which there may be, take their origin.

First, however, we must distinguish and explain clearly the various terms which we are going to use in this treatise, and to what things we apply them; and this will prove to be not merely an explanation of terms but at the same time a demonstration of the effects of nature. When, therefore, such and such a body undergoes no change from its existing state, we say that it is at rest; but, if it departs from this in any respect we then say that in this respect it undergoes motion.

Accordingly, when it departs in various ways from its pre-existing state, it will be said to undergo various kinds of motion. Thus, if that which is white becomes (black, or what is black becomes white, it undergoes motion in respect to colour; or if what was previously sweet now becomes bitter, or, conversely, from being bitter now becomes sweet, it will be said to undergo motion in respect to flavour; to both of these instances, as well as to those previously mentioned, we shall apply the term qualitative motion. And further, it is not only things which are altered in regard to colour and flavour which, we say, undergo motion when a warm thing becomes cold, and a cold warm, here too we speak of its undergoing motion; similarly also when anything moist becomes dry, or dry moist. Now, the common term which we apply to all these cases is alteration.

This is one kind of motion. But there is another kind which occurs in bodies which change their position, or as we say, pass from one place to another; the name of this is transference.

These two kinds of motion, then, are simple and primary, while compounded from them we have growth and decay, as when a small thing becomes bigger, or a big thing smaller, each retaining at the same time its particular form. And two other kinds of motion are genesis and destruction, genesis being a coming into existence, and destruction being the opposite.

Now, common to all kinds of motion is change from the pre-existing state, while common to all conditions of rest is retention of the pre-existing state. The Sophists, however, while allowing that bread in turning into blood becomes changed as regards sight, taste, and touch, will not agree that this change occurs in reality. Thus some of them hold that all such phenomena are tricks and illusions of our senses; the senses, they say, are affected now in one way, now in another, whereas the underlying substance does not admit of any of these changes to which the names are given. Others (such as Anaxagoras) will have it that the qualities do exist in it, but that they are unchangeable and immutable from eternity to eternity, and that these apparent alterations are brought about by separation and combination.

Now, if I were to go out of my way to confute these people, my subsidiary task would be greater than my main one. Thus, if they do not know all that has been written, "On Complete Alteration of Substance" by Aristotle, and after him by Chrysippus, I must beg of them to make themselves familiar with these men's writings. If, however, they know these, and yet willingly prefer the worse views to the better, they will doubtless consider my arguments foolish also. I have shown elsewhere that these opinions were shared by Hippocrates, who lived much earlier than Aristotle. In fact, of all those known to us who have been both physicians and philosophers Hippocrates was the first who took in hand to demonstrate that there are, in all, four mutually interacting qualities, and that to the operation of these is due the genesis and destruction of all things that come into and pass out of being. Nay, more; Hippocrates was also the first to recognise that all these qualities undergo an intimate mingling with one another; and at least the beginnings of the proofs to which Aristotle later set his hand are to be found first in the writings of Hippocrates.

As to whether we are to suppose that the substances as well as their qualities undergo this intimate mingling, as Zeno of Citium afterwards declared, I do not think it necessary to go further into this question in the present treatise; for immediate purposes we only need to recognize the complete alteration of substance. In this way, nobody will suppose that bread represents a kind of meeting-place for bone, flesh, nerve, and all the other parts, and that each of these subsequently becomes separated in the body and goes to join its own kind; before any separation takes place, the whole of the bread obviously becomes blood; (at any rate, if a man takes no other food for a prolonged period, he will have blood enclosed in his veins all the same). And clearly this disproves the view of those who consider the elements unchangeable, as also, for that matter, does the oil which is entirely used up in the flame of the lamp, or the faggots which, in a somewhat longer time, turn into fire.

I said, however, that I was not going to enter into an argument with these people, and it was only because the example was drawn from the subject-matter of medicine, and because I need it for the present treatise, that I have mentioned it. We shall then, as I said, renounce our controversy with them, since those who wish may get a good grasp of the views of the ancients from our own personal investigations into these matters.

The discussion which follows we shall devote entirely, as we originally proposed, to an enquiry into the number and character of the faculties of Nature, and what

is the effect which each naturally produces. Now, of course, I mean by an effect that which has already come into existence and has been completed by the activity of these faculties, for example, blood, flesh, or nerve. And activity is the name I give to the active change or motion, and the cause of this I call a faculty. Thus, when food turns into blood, the motion of the food is passive, and that of the vein active. Similarly, when the limbs have their position altered, it is the muscle which produces, and the bones which undergo the motion. In these cases I call the motion of the vein and of the muscle an activity, and that of the food and the bones a symptom or affection, since the first group undergoes alteration and the second group is merely transported. One might, therefore, also speak of the activity as an effect of Nature, for example, digestion, absorption, blood-production; one could not, however, in every case call the effect an activity; thus flesh is an effect of Nature, but it is, of course, not an activity. It is, therefore, clear that one of these terms is used in two senses, but not the other.

3. It appears to me, then, that the vein, as well as each of the other parts, functions in such and such a way according to the manner in which the four qualities are mixed. There are, however, a considerable number of not undistinguished men, philosophers and physicians, who refer action to the Warm and the Cold, and who subordinate to these, as passive, the Dry and the Moist; Aristotle, in fact, was the first who attempted to bring back the causes of the various special activities to these principles, and he was followed later by the Stoic school. These latter, of course, could logically make active principles of the Warm and Cold, since they refer the change of the elements themselves into one another to certain diffusions and condensations. This does not hold of Aristotle, however; seeing that he employed the four qualities to explain the genesis of the elements, he ought properly to have also referred the causes of all the special activities to these. How is it that he uses the four qualities in his book "On Genesis and Destruction," whilst in his "Meteorology," his "Problems," and many other works he uses the two only? Of course, if anyone were to maintain that in the case of animals and plants the Warm and Cold are more active, the Dry and Moist less so, he might perhaps have even Hippocrates on his side; but if he were to say that this happens in all cases, he would, I imagine, lack support, not merely from Hippocrates, but even from Aristotle himself, if, at least, Aristotle chose to remember what he himself taught us in his work "On Genesis and Destruction," not as a matter of simple statement, but with an accompanying demonstration. I have, however, also investigated these questions, in so far as they are of value to a physician, in my work "On Temperaments."

4. The so-called blood-making faculty in the veins, then, as well as all the other faculties, fall within the category of relative concepts; primarily because the faculty is the cause of the activity, but also, accidentally, because it is the cause of the effect. But, if the cause is relative to something, for it is the cause of what results from it, and of nothing else, it is obvious that the faculty also falls into the category of the relative; and so long as we are ignorant of the true essence of the cause which is operating, we call it a faculty. Thus we say that there exists in the veins a blood-making faculty, as also a digestive faculty in the stomach, a pulsatile faculty in the heart, and in each of the other parts a special faculty corresponding to the function or activity of that part. If, therefore, we are to

investigate methodically the number and kinds of faculties, we must begin with the effects; for each of these effects comes from a certain activity, and each of these again is preceded by a cause.

5. The effects of Nature, then, while the animal is still being formed in the womb, are all the different parts of its body; and after it has been born, an effect in which all parts share is the progress of each to its full size, and thereafter its maintenance of itself as long as possible.

The activities corresponding to the three effects mentioned are necessarily three, one to each, namely, Genesis, Growth, and Nutrition. Genesis, however, is not a simple activity of Nature, but is compounded of alteration and of shaping. That is to say, in order that bone, nerve, veins, and all other [tissues] may come into existence, the underlying substance from which the animal springs must be altered; and in order that the substance so altered may acquire its appropriate shape and position, its cavities, outgrowths, attachments, and so forth, it has to undergo a shaping or formative process. One would be justified in calling this substance which undergoes alteration the material of the animal, just as wood is the material of a ship, and wax of an image.

Growth is an increase and expansion in length, breadth, and thickness of the solid parts of the animal (those which have been subjected to the moulding or shaping process). Nutrition is an addition to these, without expansion.

[...] 9. Now, since the three faculties of Nature have been exhaustively dealt with, and the animal would appear not to need any others (being possessed of the means for growing, for attaining completion, and for maintaining itself as long a time as possible, this treatise might seem to be already complete, and to constitute an exposition of all the faculties of Nature. If, however, one considers that it has not yet touched upon any of the parts of the animal (I mean the stomach, intestines, liver, and the like), and that it has not dealt with the faculties resident in these, it will seem as though merely a kind of introduction had been given to the practical parts of our teaching. For the whole matter is as follows: Genesis, growth, and nutrition are the first, and, so to say, the principal effects of Nature; similarly also the faculties which produce these effects, the first faculties, are three in number, and are the most dominating of all. But as has already been shown, these need the service both of each other, and of yet different faculties. Now, these which the faculties of generation and growth require have been stated. I shall now say what ones the nutritive faculty requires.

10. For I believe that I shall prove that the organs which have to do with the disposal of the nutriment, as also their faculties, exist for the sake of this nutritive faculty. For since the action of this faculty is assimilation, and it is impossible for anything to be assimilated by, and to change into anything else unless they already possess a certain community and affinity in their qualities, therefore, in the first place, any animal cannot naturally derive nourishment from any kind of food, and secondly, even in the case of those from which it can do so, it cannot do this at once. Therefore, by reason of this law, every animal needs several organs for altering the nutriment. For in order that the yellow may become red, and the red yellow, one simple process of alteration is required, but in order that the white may become black, and the black white, all the intermediate stages

are needed. So also, a thing which is very soft cannot all at once become very hard, nor vice versa; nor, similarly can anything which has a very bad smell suddenly become quite fragrant, nor again, can the converse happen.

How, then, could blood ever turn into bone, without having first become, as far as possible, thickened and white? And how could bread turn into blood without having gradually parted with its whiteness and gradually acquired redness? Thus it is quite easy for blood to become flesh; for, if Nature thicken it to such an extent that it acquires a certain consistency and ceases to be fluid, it thus becomes original newly-formed flesh; but in order that blood may turn into bone, much time is needed and much elaboration and transformation of the blood. Further, it is quite clear that bread, and, more particularly lettuce, beet, and the like, require a great deal of alteration in order to become blood.

This, then, is one reason why there are so many organs concerned in the alteration of food. A second reason is the nature of the superfluities. For, as we are unable to draw any nourishment from grass, although this is possible for cattle, similarly we can derive nourishment from radishes, albeit not to the same extent as from meat; for almost the whole of the latter is mastered by our natures; it is transformed and altered and constituted useful blood; but, in the radish, what is appropriate and capable of being altered (and that only with difficulty, and with much labour) is the very smallest part; almost the whole of it is surplus matter, and passes through the digestive organs, only a very little being taken up into the veins as blood, nor is this itself entirely utilisable blood. Nature, therefore, had need of a second process of separation for the superfluities in the veins. Moreover, these superfluities need, on the one hand, certain fresh routes to conduct them to the outlets, so that they may not spoil the useful substances, and they also need certain reservoirs, as it were, in which they are collected till they reach a sufficient quantity, and are then discharged.

Thus, then, you have discovered bodily parts of a second kind, consecrated in this case to the [removal of the] superfluities of the food. There is, however, also a third kind, for carrying the pabulum in every direction; these are like a number of roads intersecting the whole body.

Thus there is one entrance that through the mouth, for all the various articles of food. What receives nourishment, however, is not one single part, but a great many parts, and these widely separated; do not be surprised, therefore, at the abundance of organs which Nature has created for the purpose of nutrition. For those of them which have to do with alteration prepare the nutriment suitable for each part; others separate out the superfluities; some pass these along, others store them up, others excrete them; some, again, are paths for the transit in all directions of the utilisable juices. So, if you wish to gain a thorough acquaintance with all the faculties of Nature, you will have to consider each one of these organs.

Now in giving an account of these we must begin with those effects of Nature, together with their corresponding parts and faculties, which are closely connected with the purpose to be achieved.

[...] 12. It is quite clear, therefore, that nutrition must necessarily be a process of assimilation of that which is nourishing to that which is being nourished. Some, however, say that this assimilation does not occur in reality, but is merely apparent; these are the people who think that Nature is not artistic, that she does not show forethought for the animal's welfare, and that she has absolutely no native powers whereby she alters some substances, attracts others, and discharges others.

Now, speaking generally, there have arisen the following two sects in medicine and philosophy among those who have made any definite pronouncement regarding Nature. I speak, of course, of such of them as know what they are talking about, and who realize the logical sequence of their hypotheses, and stand by them; as for those who cannot understand even this, but who simply talk any nonsense that comes to their tongues, and who do not remain definitely attached either to one sect or the other, such people are not even worth mentioning.

What, then, are these sects, and what are the logical consequences of their hypotheses? The one class supposes that all substance which is subject to genesis and destruction is at once continuous and susceptible of alteration. The other school assumes substance to be unchangeable, unalterable, and subdivided into fine particles, which are separated from one another by empty spaces.

All people, therefore, who can appreciate the logical sequence of an hypothesis hold that, according to the second teaching, there does not exist any substance or faculty peculiar either to Nature or to Soul, but that these result from the way in which the primary corpuscles, which are unaffected by change, come together. According to the first-mentioned teaching, on the other hand, Nature is not posterior to the corpuscles, but is a long way prior to them and older than they; and therefore in their view it is Nature which puts together the bodies both of plants and animals; and this she does by virtue of certain faculties which she possesses, these being, on the one hand, attractive and assimilative of what is appropriate, and, on the other, expulsive of what is foreign. Further, she skilfully moulds everything during the stage of genesis; and she also provides for the creatures after birth, employing here other faculties again, namely, one of affection and forethought for offspring, and one of sociability and friendship for kindred. According to the other school, none of these things exist in the natures [of living things], nor is there in the soul any original innate idea, whether of agreement or difference, of separation or synthesis, of justice or injustice, of the beautiful or ugly; all such things, they say, arise in us from sensation and through sensation, and animals are steered by certain images and memories.

Some of these people have even expressly declared that the soul possesses no reasoning faculty, but that we are led like cattle by the impression of our senses, and are unable to refuse or dissent from anything. In their view, obviously, courage, wisdom, temperance, and selfcontrol are all mere nonsense, we do not love either each other or our offspring, nor do the gods care anything for us. This school also despises dreams, birds, omens, and the whole of astrology, subjects with which we have dealt at greater length in another work, in which we discuss the views of Asclepiades the physician. Those who wish to do so may familiarize

themselves with these arguments, and they may also consider at this point which of the two roads lying before us is the better one to take. Hippocrates took the first-mentioned.

According to this teaching, substance is one and is subject to alteration; there is a consensus in the movements of air and fluid throughout the whole body; Nature acts throughout in an artistic and equitable manner, having certain faculties, by virtue of which each part of the body draws to itself the juice which is proper to it, and, having done so, attaches it to every portion of itself, and completely assimilates it; while such part of the juice as has not been mastered, and is not capable of undergoing complete alteration and being assimilated to the part which is being nourished, is got rid of by yet another (an expulsive) faculty.

13. Now the extent of exactitude and truth in the doctrines of Hippocrates may be gauged, not merely from the way in which his opponents are at variance with obvious facts, but also from the various subjects of natural research themselves, the functions of animals, and the rest. For those people who do not believe that there exists in any part of the animal a faculty for attracting its own special quality are compelled repeatedly to deny obvious facts. For instance, Asclepiades, the physician, did this in the case of the kidneys. That these are organs for secreting [separating out] the urine, was the belief not only of Hippocrates, Diocles, Erasistratus, Praxagoras, and all other physicians of eminence, but practically every butcher is aware of this, from the fact that he daily observes both the position of the kidneys and the duct (termed the ureter) which runs from each kidney into the bladder, and from this arrangement he infers their characteristic use and faculty. But, even leaving the butchers aside, all people who suffer either from frequent dysuria or from retention of urine call themselves "nephritics," when they feel pain in the loins and pass sandy matter in their water.

I do not suppose that Asclepiades ever saw a stone which had been passed by one of these sufferers, or observed that this was preceded by a sharp pain in the region between kidneys and bladder as the stone traversed the ureter, or that, when the stone was passed, both the pain and the retention at once ceased. It is worth while, then, learning how his theory accounts for the presence of urine in the bladder, and one is forced to marvel at the ingenuity of a man who puts aside these broad, clearly visible routes [i.e. the ureters], and postulates others which are narrow, invisible, indeed, entirely imperceptible. His view, in fact, is that the fluid which we drink passes into the bladder by being resolved into vapours, and that, when these have been again condensed, it thus regains its previous form, and turns from vapour into fluid. He simply looks upon the bladder as a sponge or a piece of wool, and not as the perfectly compact and impervious body that it is, with two very strong coats. For if we say that the vapours pass through these coats, why should they not pass through the peritoneum and the diaphragm, thus filling the whole abdominal cavity and thorax with water? "But," says he, "of course the peritoneal coat is more impervious than the bladder, and this is why it keeps out the vapours, while the bladder admits them." Yet if he had ever practiced anatomy, he might have known that the outer coat of the bladder springs from the peritoneum and is

essentially the same as it, and that the inner coat, which is peculiar to the bladder, is more than twice as thick as the former.

[...] 14. Let us pass on, then, again to another piece of nonsense; for the sophists do not allow one to engage in enquiries that are of any worth, albeit there are many such; they compel one to spend one's time in dissipating the fallacious arguments which they bring forward.

What, then, is this piece of nonsense? It has to do with the famous and far-renowned stone which draws iron [the lodestone]. It might be thought that this would draw their minds to a belief that there are in all bodies certain faculties by which they attract their own proper qualities.

Now Epicurus, despite the fact that he employs in his "Physics" elements similar to those of Asclepiades, yet allows that iron is attracted by the lodestone, and chaff by amber. He even tries to give the cause of the phenomenon. His view is that the atoms which flow from the stone are related in shape to those flowing from the iron, and so they become easily interlocked with one another; thus it is that, after colliding with each of the two compact masses (the stone and the iron) they then rebound into the middle and so become entangled with each other, and draw the iron after them. So far, then, as his hypotheses regarding causation go, he is perfectly unconvincing; nevertheless, he does grant that there is an attraction. Further, he says that it is on similar principles that there occur in the bodies of animals the dispersal of nutriment and the discharge of waste matters, as also the actions of cathartic drugs.

Asclepiades, however, who viewed with suspicion the incredible character of the cause mentioned, and who saw no other credible cause on the basis of his supposed elements, shamelessly had recourse to the statement that nothing is in any way attracted by anything else. Now, if he was dissatisfied with what Epicurus said, and had nothing better to say himself, he ought to have refrained from making hypotheses, and should have said that Nature is a constructive artist and that the substance of things is always tending towards unity and also towards alteration because its own parts act upon and are acted upon by one another. For, if he had assumed this, it would not have been difficult to allow that this constructive Nature has powers which attract appropriate and expel alien matter. For in no other way could she be constructive, preservative of the animal, and eliminative of its diseases, unless it be allowed that she conserves what is appropriate and discharges what is foreign.

But in this matter, too, Asclepiades realized the logical sequence of the principles he had assumed; he showed no scruples, however, in opposing plain fact; he joins issue in this matter also, not merely with all physicians, but with everyone else, and maintains that there is no such thing as a crisis, or critical day, and that Nature does absolutely nothing for the preservation of the animal. For his constant aim is to follow out logical consequences and to upset obvious fact, in this respect being opposed to Epicurus; for the latter always stated the observed fact, although he gives an ineffective explanation of it. For, that these small corpuscles belonging to the lodestone rebound, and become entangled with other similar particles of the iron, and that then, by means of this entanglement (which cannot be seen anywhere) such a heavy substance as iron

is attracted fail to understand how anybody could believe this. Even if we admit this, the same principle will not explain the fact that, when the iron has another piece brought in contact with it, this becomes attached to it.

For what are we to say? That, forsooth, some of the particles that flow from the lodestone collide with the iron and then rebound back, and that it is by these that the iron becomes suspended? that others penetrate into it, and rapidly pass through by way of its empty channels? that these then collide with the second piece of iron and are not able to penetrate it although they penetrated the first piece? and that they then course back to the first piece, and produce entanglements like the former ones? The hypothesis here becomes clearly refuted by its absurdity. As a matter of fact, I have seen five writing-stylets of iron attached to one another in a line, only the first one being in contact with the lodestone, and the power being transmitted through it to the others. Moreover, it cannot be said that if you bring a second stylet into contact with the lower end of the first, it becomes held, attached, and suspended, whereas, if you apply it to any other part of the side it does not become attached. For the power of the lodestone is distributed in all directions; it merely needs to be in contact with the first stylet at any point; from this stylet again the power flows, as quick as a thought, all through the second, and from that again to the third. Now, if you imagine a small lodestone hanging in a house, and in contact with it all round a large number of pieces of iron, from them again others, from these others, and so on,, all these pieces of iron must surely become filled with the corpuscles which emanate from the stone; therefore, this first little stone is likely to become dissipated by disintegrating into these emanations. Further, even if there be no iron in contact with it, it still disperses into the air, particularly if this be also warm.

"Yes," says Epicurus, "but these corpuscles must be looked on as exceedingly small, so that some of them are a ten-thousandth part of the size of the very smallest particles carried in the air." Then do you venture to say that so great a weight of iron can be suspended by such small bodies? If each of them is a ten-thousandth part as large as the dust particles which are borne in the atmosphere, how big must we suppose the hook-like extremities by which they interlock with each other to be? For of course this is quite the smallest portion of the whole particle.

Then, again, when a small body becomes entangled with another small body, or when a body in motion becomes entangled with another also in motion, they do not rebound at once. For, further, there will of course be others which break in upon them from above, from below, from front and rear, from right and left, and which shake and agitate them and never let them rest. Moreover, we must perforce suppose that each of these small bodies has a large number of these hook-like extremities. For by one it attaches itself to its neighbours, by another, the topmost one, to the lodestone, and by the bottom one to the iron. For if it were attached to the stone above and not interlocked with the iron below, this would be of no use. Thus, the upper part of the superior extremity must hang from the lodestone, and the iron must be attached to the lower end of the inferior extremity; and, since they interlock with each other by their sides as well, they must, of course, have hooks there too. Keep in mind also, above everything, what small bodies these are which possess all these different kinds of

outgrowths. Still more, remember how, in order that the second piece of iron may become attached to the first, the third to the second, and to that the fourth, these absurd little particles must both penetrate the passages in the first piece of iron and at the same time rebound from the piece coming next in the series, although this second piece is naturally in every way similar to the first.

Such an hypothesis, once again, is certainly not lacking in audacity; in fact, to tell the truth, it is far more shameless than the previous ones; according to it, when five similar pieces of iron are arranged in a line, the particles of the lodestone which easily traverse the first piece of iron rebound from the second, and do not pass readily through it in the same way. Indeed, it is nonsense, whichever alternative is adopted. For if they do rebound, how then do they pass through into the third piece? And if they do not rebound, how does the second piece become suspended to the first? For Epicurus himself looked on the rebound as the active agent in attraction.

But, as I have said, one is driven to talk nonsense whenever one gets into discussion with such men.

Having, therefore, given a concise and summary statement of the matter, I wish to be done with it. For if one diligently familiarizes oneself with the writings of Asclepiades, one will see clearly their logical dependence on his first principles, but also their disagreement with observed facts. Thus, Epicurus, in his desire to adhere to the facts, cuts an awkward figure by aspiring to show that these agree with his principles, whereas Asclepiades safeguards the sequence of principles, but pays no attention to the obvious fact. Whoever, therefore, wishes to expose the absurdity of their hypotheses, must, if the argument be in answer to Asclepiades, keep in mind his disagreement with observed fact; or if in answer to Epicurus, his discordance with his principles. Almost all the other sects depending on similar principles are now entirely extinct, while these alone maintain a respectable existence still. Yet the tenets of Asclepiades have been unanswerably confuted by Menodotus the Empiricist, who draws his attention to their opposition to phenomena and to each other; and, again, those of Epicurus have been confuted by Asclepiades, who adhered always to logical sequence, about which Epicurus evidently cares little.

Now people of the present day do not begin by getting a clear comprehension of these sects, as well as of the better ones, thereafter devoting a long time to judging and testing the true and false in each of them; despite their ignorance, they style themselves, some "physicians" and others "philosophers." No wonder, then, that they honour the false equally with the true.

For everyone becomes like the first teacher that he comes across, without waiting to learn anything from anybody else. And there are some of them, who, even if they meet with more than one teacher, are yet so unintelligent and slow-witted that even by the time they have reached old age they are still incapable of understanding the steps of an argument.... In the old days such people used to be set to menial tasks.... What will be the end of it God knows! [...]

15. Since, then, we have talked sufficient nonsense not willingly, but because we were forced, as the proverb says, "to behave madly among madmen", let us

return again to the subject of urinary secretion. Here let us forget the absurdities of Asclepiades, and, in company with those who are persuaded that the urine does pass through the kidneys, let us consider what is the character of this function. For, most assuredly, either the urine is conveyed by its own motion to the kidneys, considering this the better course (as do we when we go off to market!), or, if this be impossible, then some other reason for its conveyance must be found. What, then, is this? If we are not going to grant the kidneys a faculty for attracting this particular quality, as Hippocrates held, we shall discover no other reason. For, surely everyone sees that either the kidneys must attract the urine, or the veins must propel it, if, that is, it does not move of itself. But if the veins did exert a propulsive action when they contract, they would squeeze out into the kidneys not merely the urine, but along with it the whole of the blood which they contain. And if this is impossible, as we shall show, the remaining explanation is that the kidneys do exert traction.

16. And how is propulsion by the veins impossible? The situation of the kidneys is against it. They do not occupy a position beneath the hollow vein [vena cava] as does the sieve-like [ethmoid] passage in the nose and palate in relation to the surplus matter from the brain; they are situated on both sides of it. Besides, if the kidneys are like sieves, and readily let the thinner serous [whey-like] portion through, and keep out the thicker portion, then the whole of the blood contained in the vena cava must go to them, just as the whole of the wine is thrown into the filters. Further, the example of milk being made into cheese will show clearly what I mean. For this, too, although it is all thrown into the wicker strainers, does not all percolate through; such part of it as is too fine in proportion to the width of the meshes passes downwards, and this is called whey [serum]; the remaining thick portion which is destined to become cheese cannot get down, since the pores of the strainers will not admit it. Thus it is that, if the blood-serum has similarly to percolate through the kidneys, the whole of the blood must come to them, and not merely one part of it.

What, then, is the appearance as found on dissection? One division of the vena cava is carried upwards to the heart, and the other mounts upon the spine and extends along its whole length as far as the legs; thus one division does not even come near the kidneys, while the other approaches them but is certainly not inserted into them. Now, if the blood were destined to be purified by them as if they were sieves, the whole of it would have to fall into them, the thin part being thereafter conveyed downwards, and the thick part retained above. But, as a matter of fact, this is not so. For the kidneys lie on either side of the vena cava. They therefore do not act like sieves, filtering fluid sent to them by the vena cava, and themselves contributing no force. They obviously exert traction; for this is the only remaining alternative.

How, then, do they exert this traction? If, as Epicurus thinks, all attraction takes place by virtue of the rebounds and entanglements of atoms, it would be certainly better to maintain that the kidneys have no attractive action at all; for his theory, when examined, would be found as it stands to be much more ridiculous even than the theory of the lodestone, mentioned a little while ago. Attraction occurs in the way that Hippocrates laid down; this will be stated more clearly as the discussion proceeds; for the present our task is not to demonstrate this, but to point out that no other cause of the secretion of urine

can be given except that of attraction by the kidneys, and that this attraction does not take place in the way imagined by people who do not allow Nature a faculty of her own.

For if it be granted that there is any attractive faculty at all in those things which are governed by Nature, a person who attempted to say anything else about the absorption of nutriment would be considered a fool.

*[For an additional passage on Galen's discussion of the ureter, see the excerpt from On the Natural Faculties in the handouts (not the reading packet) PJR]*