The Pharmacy
Windows on History

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Greece in the 5th and 4th centuries BC saw a cultural flowering, unparalleled in Western history, in fields as diverse as politics and science, literature and art, philosophy and medicine.

Following the Persian War (490–449 BC) and the upsurge in national unity to which this conflict gave rise (with the brilliant victories of the Athenians on land—at Marathon in 490 BC—and at sea—at Salamis in 480 BC), this period witnessed the flourishing of Athenian democracy under Pericles (c. 495–429 BC); the philosophical debate between the Sophists and their determined adversary, Socrates (469–399 BC), a debate which was crucial to the development of rational thought; the first major philosophical systems adumbrated by Plato (428–348 BC) and Aristotle (384–322 BC); the creation of history by Herodotus (c. 484–425 BC at least) and the concerned analysis of the past and present by Thucydides (460–c. 400 BC); the birth of tragedy and its questioning of the meaning of life and fate with Aeschylus (525–456 BC), Sophocles (c. 496–406 BC) and Euripides (c. 485–c. 406 BC); the growth of the city of Athens, with its balanced architecture and superb sculpture (Phidias, c. 490–430 BC) and its painting, which was so realistic, legend has it, that it could be mistaken for reality (Apelles, 4th century BC).

This period of 'the glory that was Greece' did not appear ex nihilo. The forerunners in philosophy, the so-called Pre-Socratics, were known as 'philosophers of nature' because of their endeavours to understand the nature of the world: Thales (6th century BC), Anaximander (c. 610–540 BC) and Anaximenes (6th century BC), who lived in Asia Minor, the mathematician Pythagoras (6th century BC) and the physician Alcmeon, who both lived in Magna Graecia (i.e. southern Italy). Not only was this apogee of Greek culture short-lived and marred by the fratricidal rivalry of the Peloponnesian War (431–404 BC), but it embraced only a small part of society: only the males, and then only those who enjoyed political rights and a certain level of affluence. And it had its dark sides—such as the murder of Socrates—for murder it was, even if carried out with complete respect for democracy, religion and law....

Nevertheless, this period in Greek culture marks the first real awakening of mankind, an intellectual achievement of unmatched proportions, in which reason tried to scale the walls of understanding.

This creative period took a lively interest in health. A rational theory and practice of medicine were developed that, turning away from ancestral tradition, tried to understand the phenomena of life and death, illness and health, without having recourse to mysterious and incomprehensible forces. The medicine of this era sought to analyse, understand and hand down the results of its discoveries. The leading light of ancient Greek medicine was Hippocrates (460–c. 370 BC). For his contemporaries, but even more for later generations, he embodied this new orientation in the art of healing and was known as 'the father of medicine'.

The storm of Greek culture which swept away the ancient traditions was felt in the world of medicine too. Starting in the 4th century, the Greeks began to develop theories of pharmacy. Turning their backs on treatment methods used to date, physicians endeavoured to
explain the nature and activity of drugs, to control them and regulate their use, in short, to bring drug therapy and drugs themselves within the ambit of the world of science, in other words of rational thought.

At the centre of this revolution, there was a school or, at least, a current of thought inspired by one of the fathers of Western philosophy, Aristotle. The aim of this article is to show the role played by the Aristotelian school in this renewal of medicine.

We will proceed by studying the ancient texts on the subject. Although these texts are well known, they have not been examined to any great extent for our purposes. This study will enable us to throw some light on the history of drugs and to write the first chapter of the history of scientific theory, of which drugs were the subject. However, before turning to the Aristotelian texts, we will briefly outline the evolution of drugs from the dawn of Greek civilization until the age of Aristotle. This will not only help us understand the contribution of Aristotle’s school but also — and perhaps even primarily — to gauge properly the extent of the innovation the school made.

The gods, iron and fire

Both The Iliad and The Odyssey, the most ancient Greek literary texts, mention medicines. Current research suggests that these texts were composed, not in the 11th century as was so long supposed, but in the 7th century, by the poet Homer. Whether Homer really existed and, if so, whether he wrote both poems, is a matter of much erudite commentary.

In The Iliad, Podalirios and Machaon, two sons of Asclepius, are seen healing the soldiers wounded by the Trojans by applying medicinal herbs to the wounds. In The Odyssey, Helen pours into the cups of the Greeks returning home the famous ‘nepenthes’, which causes men to forget and relieves them of longing for their native land.

Applying herbs to wounds would certainly have been actual practice. The Homeric ‘nepenthes’ is a trickier problem. It may well have been an opiate. Cretan civilization was certainly familiar with the use of opium, as is demonstrated by the terra cotta representations of poppy capsules, incised in the same way as today in order to extract the sap. However, it may have been no more than wishful thinking, an imaginary drug relieving mankind of consciousness and suffering (the opposite of Pandora’s box, which, when opened, let out all evils on humanity). This latter hypothesis does not seem unreasonable, given that other substances mentioned in The Odyssey, such as the lotus or molu, are imaginary. The lotus makes the eater forget his own country, while molu helped Odysseus resist the charms of Circe.

Despite the mention of such medicines in The Iliad and The Odyssey, no theory of medication is elaborated. However, one phrase of a later date indicates that medicines were thought to act by the will of the gods. Several later texts contain the formulaic expression to the effect that ‘medicines are the hand of the gods’. On the surface, this seems no more than a charming image, comparable to the Homeric ‘rosy-fingered dawn’. The expression would seem to evoke the properties of the drugs, whose unknown mechanism of action was attributed to the gods; this is, no doubt, the right interpretation. The concept of ‘the hand of the gods’ however, is found in other Greek texts, where the hand is described as reaching out towards men, even touching their heads, in order to assist them. Such expressions are found in The Iliad and in later tragedies, where they have a broader significance: the gods will aid men only if the latter work towards their own well-being. Before praying to the gods for assistance, men should work actively to help themselves. So the expression ‘the hand of the gods’ is more than an image; applied to medi-
cines, it outlines an ethos of healing. The drug is help
given by the gods to mankind on the condition that
men try to care for their own health. It is not a free gift:
The idea is found again in the Hippocratic treatise On
Diet, which deals with the therapeutic and nutritional
value of foods:

‘Prayer is doubtless a good thing; but while calling
on the gods, each must also do his part.’

Quite apart from the merit of the individual, who
is justifiably concerned with his health, the drug is a
manifestation of the assistance given by the gods, who
endeavour to lend a helping hand. This pharmaceutical
ethos — the intervention of the gods — is more than an
image: it is explanatory, making medicines into a higher
power that the gods grant to mankind providing they
work towards their own healing.

Although it cannot be pinpointed in time, an impor-
tant — perhaps even radical — change took place in ther-
apeutic methods, though its full import is difficult to
assess. We do not have any direct evidence and have to
make do with a reference which is no doubt much later.
In his Republic, from about 400 BC, Plato mentions that
the therapy practised at the time was one of ‘iron and
fire’. This approach was beginning to be supplanted by
the administration of drugs to be administered orally.

However casual a remark, it is sufficiently explicit to allow
us to reconstruct a major phase in the development of
the drug: the transition from a magic power (as evoked
by the expression ‘the hand of the gods’) to a substance
capable of eliminating a pathogen from the body by
mechanical means.

Iron and fire removed the morbid tissue by acting
directly on the body, by intervening in a radical manner,
either by extraction or by destruction. The therapeutic
perspective had changed drastically. Illness was no
longer generalized, but was now localized in the body.
It had taken on a form, become an identifiable pathogen,
located either on or inside the body. Thereafter, therapy
involved extracting this pathogenic matter by means of
iron and fire.

This change marks an important transition, at least
in theory. Treatment is no longer a higher force which
the gods grant to men willing to treat themselves (a
force which acts on an illness which is just as unknown
in its details as the medication itself). Therapy is now a
human intervention, the aim of which is to remove the
cause of the disease from the body; the disease is iden-
tified with some pathogenic matter. Not only is the drug
desacralized, but the very cause of disease is seen in a
new light: disease is ‘medicalized’, turned into a patho-
gen, a body within the body, which prevents the latter’s
proper functioning.

Drawing a comparison with the therapeutic practices
of contemporary, ‘primitive’ cultures, it has been pos-
tulated that this new approach is a laicized reformula-
tion of an earlier, sacred rite in which the pathogenic
agent was a higher, evil force which the priest exorcized
by prayer, rituals and other practices. If this hypothesis
is correct, this would represent an intermediate stage
between the sacred conception as found in The Iliad and
The Odyssey and the therapy by iron and fire.

The transition to the drug

Regardless of this hypothesis, the drug began to
rival iron and fire in the age of Plato. This era saw the
emergence of Hippocratic medicine, which laid great
emphasis on the importance of diet and the activity
of traditional medicines. One of the contributions of
Hippocratic medicine was to translate traditional medi-
cal therapy into scientific terms, thereby lending it a
rational discourse. It took a clear stance, claiming that
therapy in whatever form had a duty to assist or even
imitate nature.

The Hippocratic school of medicine drew a distinc-
tion between two essential therapeutic actions: assist
and counteract. In certain cases, the therapist was sup-
posed to assist nature by intervening to help the illness
take a positive turn in the aftermath of the crisis. In
practice, this meant administering a drug which would
reinforce the natural healing already underway. In other
cases, however, the physician had to counteract the
disease by administering a drug whose force would
be equal but contrary to that of the illness. This was
thought to restore the body to equilibrium. At any rate,
the physician’s duty was to imitate the processes of
nature, to back up nature.

Polybius, Hippocrates’ son-in-law, gave this theory
of equilibrium clearer contours: in describing the body’s
four humours, he elaborated one of the longest-lived
theories in the history of physiology. The system lasted
for almost twenty centuries and appears in Western lit-
erature as recently as Molière in the 17th century.

The body was thought to function in accordance
with the four physiological liquids (or humours) it con-
tained: blood, choler (yellow bile), melancholy (black bile)
and phlegm. A person in perfect health had a quantita-
tive and qualitative balance of these humours, whereas
illness resulted from an imbalance. The dysfunction
might be of a quantitative nature (a surplus or deficit
of one or more humours) or qualitative (an alteration of
the humours).

Of greater importance for our topic is the concep-
tion of therapy which stemmed from this physiologi-
cal view. In order to compensate for the disequilibrium
caused by illness and restore the body's proper functioning, drugs were supposed to reestablish the balance between the humours. Hence, all foods and medical substances were studied for those of their properties which acted on the humours.

The theory of humours is interesting because it expresses in strictly material (perhaps even materialist) terms the therapeutic role of foods and pharmacological substances. This explains the long lists of foods and remedies in the treatises of Classical Antiquity, in which each substance was listed with the medicinal properties claimed for it. However, from the viewpoint of pharmacology, even if the activity of the drug is clearly explained, this school of thought did not attempt to explain how the drug is absorbed in the body, how it acts there, why it acts on one condition and not another or on one organ rather than another.

This was the contribution of the Lyceum, the school founded by Aristotle. He and his disciples tackled these issues and tried to find answers to these questions.

The logic of digestion

The contribution of the Aristotelian school is known to us from a compendium entitled the Problemata. The work is to some extent controversial, and until quite recently there were doubts as to its authenticity. Scholarship has now shed light on the mystery and demonstrated that the Problemata, as the title suggests, are notebooks compiled by members of the Aristotelian school. The notes take the form of a series of problems, in the true sense of the word, and the various solutions to them propounded at different times. This explains the unfinished character of the work, its contradictions, repetitions and other imperfections — evidence of a progression of ideas, an ongoing search for satisfactory solutions, reflecting the changing perceptions of successive generations of scholars and the wider progress of scientific knowledge.

For instance, while the work bears witness to the Hippocratic system of pharmacology, the iron and fire treatments are still in evidence, at least in some sections (Problemata, 1, 32).

It is undoubtedly this earlier branch of therapeutics that gives rise to some of the questions discussed in the work: the sections concerned with the physical properties of bronze and iron and the consequences of burns and incisions administered with these materials (Problemata, 1, 36).

But, while the older iron and fire therapies are affirmed in these passages, elsewhere they are contrasted with treatments based on drugs (Problemata, 1, 34):

'When is it appropriate to cut, and when to burn? And when is it more appropriate to use drugs? Are not infections of the arm-pits and groin best treated with a drug? For incisions in those areas can have consequences both painful and dangerous. Burning is for large excrescences which present a significant protuberance and occur in venous as opposed to fleshy regions. Landing is for growths which come to a head on the soft parts of the body.'

However, the prescription of drugs signals not so much a rejection of iron and fire treatments as a right assessment of their contraindications, the dangers they give rise to in certain instances. Drug therapy is advocated as a way of overcoming their limitations.

Elsewhere, when drugs are discussed, we find evidence of the Hippocratic idea of the humours we noted earlier, even though it is not mentioned specifically (Problemata, 1, 19).

To eliminate the excess of a particular humour — in this instance humidity — dry medicines are advocated, as one would expect, in conjunction with agents having pungent and sour properties. The imagery is obvious: pungency and sourness attack and open up the wound, subsequently allowing the drying process to take place. There is evidence here of an interesting confusion, to which we shall return later, between the organoleptic qualities of medicinal substances and the therapeutic functions they perform.

The other sections dealing with drugs lead into a deeper and more original train of enquiry. The general framework for this theorizing is the phenomenon of digestion, and the thinking on foods to which it gives rise is equally applicable to medicinal drugs (Problemata, 1, 15):

'Why do changes in diet cause sickness? ... Foods, if different in character, have adverse effects on one another. Some are barely assimilated, others not at all; ... variations in diet are bad for health (as the digestion is disturbed and not permitted to maintain an even course)....'

As we shall see later, a drug is seen as a disruptive element in the patient's normal diet and, for this reason, cannot be assimilated. This view of things contrasts with the Hippocratic theory, the aim of which was to work in concert with the forces of nature. Here we find a radical departure from his doctrine. The drug performs a quite different function.

Further on, we find this fundamental statement about the nature of a drug (Problemata, 1, 47):

'... For the nature of drugs is that they are indigestible....'
This somewhat epigrammatic pronouncement is enlarged on in another passage (Problemata, I, 42):

'...Indeed, all substances which, by reason of an excess of heat or cold, even if their volume is reduced, resist digestion, which are able to overcome animal heat rather than be overcome by it, which are admitted by the two parts of the stomach and are readily diffused through it,... such substances are drugs.'

A drug, then, is defined as a substance which the body — the animal heat referred to in the text — is unable to assimilate or overcome. Drug treatment is therefore to be understood in the context of digestion, and this approach makes it possible to solve the problem that had defeated earlier generations: how a drug is diffused in the body and assimilated by the organism.

The secondary reference to the quantity of a drug ('...even if their volume is reduced') is highly significant in this respect. It points to the fact that the efficacy of medicinal substances depends not on the quantity taken, but on their intrinsic properties. Whatever the dose absorbed into the body, their therapeutic action is the same. This idea is confirmed elsewhere, as we shall see.

This first explicit definition of a drug as a substance not assimilated by the digestive system is confirmed in a passage contrasting drugs with foods (Problemata, I, 42):

'A drug is the opposite of a food. What undergoes coction by natural forces is assimilated into the body and we call it food. The nature of a drug, on the other hand, is that it is not naturally disposed to be overcome and penetrates into the vessels, where it causes disturbance due to an excess of heat or cold.'

This new formulation adds an important point: a drug causes disturbance. The implications will become apparent later. For the time being, suffice it to say that this effect is a logical result of the fact that a drug is not assimilated by the body. Its properties remain constant, not in any way transformed by the process of digestion, and therefore pass intact into the organism.

The disruptive action of a drug is clarified further on, in a section enlarging on the difference between the disturbances caused by foods — with particular reference to the quantity taken — and medicines (Problemata, I, 47):

'Those [substances] which do not purge by their virtue alone are not drugs either. For many foods have the same effect when taken in the right quantity, for instance milk, oil or grape must. All of these substances are purgative because they are not easy to digest; in fact their laxative effect is most pronounced in people who have difficulty in digesting them. For certain foodstuffs are readily digested by some people but not by others. Hence, the same substances are not medicines for all and sundry, and certain people benefit from remedies that are specific to them alone. Generally speaking, it is not enough that a medicine be indigestible; it must also play a motive role, in the same way as exercise. Whether it acts from within or without, it triggers a movement which expels the foreign matter.'

From this passage, it emerges that the disruptive effect of a drug takes the form of a movement. When a drug is taken, an indigestible substance is introduced into the body, and then diffused throughout the organism.

The passage also stresses the different — and in some cases contrary — reactions of patients to the same medicinal substance, thereby affirming the need to adapt medical treatment to the individual. In the language of the Aristotelian pharmacological system, this concept of idiosyncrasy is expressed in terms of variations in the digestive process: some people find it easier to assimilate a certain substance, which therefore exerts no therapeutic effect on them; for those who cannot absorb it, on the other hand, it constitutes a drug, the peculiarity of a drug being, as we have seen, that it is indigestible.

Other passages in the Problemata introduce the idea of a link between the organooleptic properties of drugs and their indigibility, the former being the cause of the latter (Problemata, I, 42):

'Why do some medicines purge the body, while other substances, though more bitter, more astrin gent and endowed with related properties in the highest degree, fail to do so?... Sourness and bitterness are characteristic properties of medicines, as is a disagreeable smell, and it is these properties which distinguish a medicine from a foodstuff.'

There is a basic assumption that a medicine, as opposed to a foodstuff, must be intrinsically bitter, sour and astringent — even evil smelling. Medicines and foods are perceived as being at opposite poles: on the one hand are things agreeable to sensory perception (foodstuffs), on the other, those with unpleasant characteristics (medicines). A bipolar conceptual structure of this kind harks back to pre-scientific thinking, what modern-day research defines as an 'archaic' perception of reality, in that it rests on subjective evaluations rather
than on objective, measurable facts. It may come as a surprise to encounter this type of thinking in Aristotelian writings but, as many scholars have shown, Aristotle, rigorous scientist though he sought to be, was unable to disassociate himself entirely from this kind of mental process, tending to accept premises as conclusions and justifying erroneous observations with off-the-peg platitudes.

In another passage, in an attempt to rationalize this assumption about the negative properties of drugs, the organoleptic property of a substance is associated with its therapeutic effect (Problematum, I, 33):

'...this is why most medicines are pungent: because they are astringent.'

The attempt is renewed at a later stage, this time with a further development, when a connection is made between the disagreeable sensory properties, which, according to Aristotle, are characteristic of medicines, and their indigestibility (Problematum, I, 47).

In the following section (Problematum, I, 48), the connection between organoleptic characteristics and therapeutic properties is referred to in the same terms, though here it is positive properties that are stressed.

From this understanding of digestion emerges a clear, binary structure: warm, sweet-smelling medicinal substances are digestible and diuretic; those with a disagreeable smell and which are sour or pungent are indigestible and purgative. But much of the evidence adduced is false. The writer affirms that '...seeds which smell sweet are warm', a false observation, which is nevertheless used to justify his whole argument. Taken as a proof, it may well ensure the coherence of his reasoning, but the statement is, in itself, totally without foundation.

How drugs work

Within this whole approach to digestion, one of the first problems was to understand how a drug might reach its target, i.e. the organ for which it was intended, the seat of the illness affecting the patient. The notion of a target is explicitly formulated, albeit in the form of a question (Problematum, I, 43):

'Why does pepper relax the bladder when absorbed in large quantities and relax the bowels when taken in small doses, whereas scarmmony in large doses relaxes the bowels and, in small quantities (or when it is old), relaxes the bladder? Is it because each of these substances has an action more specific to one or the other organ?'

The key to the problem lies in the second question, positing as it does a natural relationship between the different drugs and the organs mentioned. This is based on the typically Aristotelian idea of each thing having a purpose (or finality), being created to exercise a certain function, and that alone. In the case in point, pepper has a natural effect on the bladder or the bowels, depending on the dosage. The same is true of scarmmony, but in inverse proportions. Be it noted that this is not really an answer to the question: the specificity of the drug's action is justified in terms of natural finality, which is the very opposite of an explanation. We are merely told that a drug has a certain effect because it is part of its nature to have that effect.

This circular argument is then confirmed in terms of another finality: not the finality of the drugs this time, but that of the bodily organs concerned (Problematum, I, 40):

'Why do some medicines relax the stomach, while others relax the bladder and leave the stomach unaffected? Is it that all substances which are humid by nature and saturated with water, if they are therapeutic, tend to relax the bladder? For that is where the undigested part of a liquid is deposited. For the bladder is the receptacle for liquids that have not been absorbed in the stomach. The liquid does not remain in the bladder, but is evacuated before it can act or be acted on. On the contrary, all substances which are earthy by nature, when used for therapeutic purposes, tend to relax the bowels. For that is where earthy substances tend to collect.'

It is the finality of the organs that is under discussion here: each is designed to receive a given type of substance. It follows that the particular organ affected by a given drug depends on the substance of which the drug is made, as a substance naturally makes its way towards the organ designed to receive it.

Having resolved the problem of how a drug reaches its target, the writers then turn their attention to the question of how the drug acts on the organ itself. The explanation is expressed in terms of the physics of gravity, as the concept was understood at the time and not in its modern, Newtonian sense (Problematum, I, 42):

'...As they [drugs] are not digested, but resist digestion, when evacuated they carry away what acts as an obstacle to them....'

In other words, drugs are bodies within the body and tend to exert pressure on the things they encounter, including the agents of sickness. The Problematum are not specific on this point, but we discover here, by
deduction, that the agents of sickness are also perceived as bodies within the body, indigestible, identical in this respect to the drugs used to combat them. Here we have a concept of pathogens which corresponds in all points to that of drugs. The former has been adopted ready made to fit the latter (though to begin with the therapy rather than the cause of sickness is hardly logical).

Putting two and two together, the explanation offered of the way a drug works is mechanical, if not mechanistic: the action of the pathogen, seen as an obstacle, is opposed by the gravity specific to the drug. In other words, the drug, an undigested and therefore doubtless compact body, is drawn downwards on account of its weight, pushing before it the pathogens present in the patient’s body.

This concept — more a picture of the kinetics of the process than a real explanation of the action of the drug — is enlarged on elsewhere, in particular to explain how certain medicines can have different effects on the same organs (Problemata, I, 18):

‘...What is wet is lent weight by the fact that it is earthy, and what is heavy tends to make its way downwards. The upper parts are therefore purified by the passage of what is heavy, while the lower parts become full of excreta and corruptible matter.’

Once again, it is the physics of gravity which predominates here, and the writer makes a further connection between movement and the nature of the drug. The idea is confirmed, clarified and enlarged upon elsewhere (Problemata, I, 41).

We have already been introduced to the idea that drugs provoke movement, the physics of the process and the affinity between bodily organs and medicinal substances. The writer now refines the theory by giving a specific explanation of the different effects of certain drugs. The movements whereby wastes are eliminated from the body — vomiting and excretion — are explained in terms of the physics of ascent and descent, any given movement being conditioned by the relative weight of the drug involved: lighter ones tend upwards, heavier ones act downwards. Sketchily outlined as a backdrop to this physical process are references to the four elements, the four ultimate constituents of matter, and the influence of their specific weights on the mobility of bodies incorporating them.

At the same time, there is a new explanation of the effects of certain drugs, this time involving gases. The heat of the drug gives rise to a ‘breath’ — the gas — which, by exerting pressure on the contents of the stomach, causes vomiting. A distinction is made: such gases appear only in the case of powerful drugs, or when a drug is administered in over-strong doses, in which case the formation of gas is an abnormal, undesirable effect of the drug.

Dosage and the abnormal effects of administering a drug in excessive quantity is the subject of another section (Problemata, I, 43).

What is interesting here is not an actual change in the way the drug works, as when a gas is formed for instance, but the way the drug’s effects vary as the dose is increased. And conditioning the whole therapeutic process, there is the emphasis on digestion and whether or not a drug can be assimilated.

In connection with the question of dosage, the Problemata also explicitly tackle the matter of habituation, a phenomenon traditionally discovered by Mithridates, king of Pontus, who was famous for his studies of poisons (Problemata, I, 45).

The physicians of Classical Antiquity devoted much energy to studying medicinal plants and their therapeutic properties. As they were unable to provide a rational explanation for this process of scientific discovery, they personified it in the form of the Greek deity Heuresis, who guided men to medicinal plants. Here we see an illustration depicting Heuresis (right), who is showing a pharmacognostic, Dioscorides (1st century AD), how to gather mandragora. The illustration is taken from a manuscript of Dioscorides’ De materia medica. The manuscript dates from about 512 AD. Österreichische Nationalbibliothek, Vienna.

In the same manuscript of Dioscorides’ De materia medica, the artist (left) is shown drawing the mandragora. The plant is held by Heuresis (in the centre), while Dioscorides (right) is busy writing up a description of the plant, its medicinal properties and therapeutic uses. Österreichische Nationalbibliothek, Vienna.

Scammony as represented in a Greek manuscript of Dioscorides’ De materia medica. This MS probably dates from the 11th century, but it is not known whether the copyist worked in Southern Italy or the Near East. Although medicinal plants have been known at least since the time of Hippocrates (460–c. 370 BC) and Aristotle, the first representations date only from the 3rd century AD. At any rate, no botanical illustration from this period has come down to us. The oldest picture of medicinal plants in our possession are those in manuscripts of Dioscorides’ De materia medica (the oldest manuscripts are from the 6th century AD). Bibliothèque nationale, Paris.

Aristotle (384–322 BC) is shown here in an Arab manuscript of the 13th century AD in conversation with a fellow philosopher. Although the iconography is typically Arab (in particular, the book on the lectern, symbolizing knowledge and erudition), the illustration certainly reflects the climate of lively intellectual debate which typified the medical schools of Classical Antiquity such as that of Aristotle. The Aristotelian Problemata analysed in this article are a product of this school. British Library, London.
‘Why renew poultices? Is it because a more powerful effect is obtained? The medicines to which we become accustomed — in the same way as we become accustomed to foodstuffs — are no longer medicines but foods. The same holds good for poultices.’

To understand the explanation, it is important to remember the starting point for this whole understanding of pharmacology: the idea that a change in diet causes a disturbance. It follows that, if change is eliminated, the disturbance disappears. When a new habit is formed, it opens the way to assimilation, whereas the initial disturbance resulted in rejection.

The problem of variability in the effects of a drug is dealt with again in another section, this time focusing on changes in the effects of medicinal substances in relation to their age (Problemata, I, 43):

‘...Why is it that, when administered in strong doses relaxes the bowels, whereas in small quantities, or when it is old, it relaxes the bladder?’

The idea that a drug that has been kept for a long time is less effective shows considerable insight into the way medicinal substances lose their efficacy over time.

Another view of the way drugs work

While the system presented in the preceding pages is complete in itself, albeit raising a whole series of problems, the text of the Problemata also contains references to another system, dependant on a more complex mechanism. This new layer of thinking undoubtedly reflects the nature of the notebooks themselves, which were added to and changed over many years.

The new and more refined approach is concerned with the mechanics of the way in which pathogens are eliminated from the body. The previous way of looking at it was to view the pathogen as an obstacle, to be pushed out by the therapeutic substance. The new system envisages progressive diffusion through contact (Problemata, I, 41):

‘For, rising from there through the passages and bearing with them all the products of excretion and dissolution they can master, they (the drugs) convey them by the same route.’

The significant term here is ‘dissolution’. It appears again in another section, linked with the concept of heat (Problemata, I, 48):

‘Why do seeds and plants with a pleasant smell have diuretic properties? It is because they are warm and digestible and substances of this kind are diuretic? For the heat in them quickly renders them light, and the smell is not of any significance, since even strong-smelling plants, such as garlic, are diuretic, but the important thing is their power to dissolve. The fact is that pleasant-smelling seeds are warm.’

Elsewhere, heat and smell are associated, and both are linked with the phenomenon of dissolution (Problemata, I, 48):

‘...Do seeds and plants which smell pleasant have diuretic properties? ...The heat in them quickly renders them light, and the smell is not of any significance, since even strong-smelling plants, such as garlic, are diuretic, but the important thing is their power to dissolve,...’

This concept of dissolution suggests that drugs might work in another way: not a mechanical action based on the physics of movement, but diffusion and action by contact. Thus the pathogen, which is viewed as a solid body, effectively melts — the exact sense of the Greek term — on contact with the drug, and gradually reduces in size as the action of the drug continues. It follows that the pathogen must change its form, without any matter being destroyed. As the drug works on it, the matter of the pathogen actually changes from the solid to the liquid state, is absorbed into the body and finally eliminated. The process is not one of combustion, for instance, of the pathogenic material, but a change in its state, whereby it can eventually be evacuated from the body.

This concept is undoubtedly more sophisticated than the mechanical theory we looked at earlier. Whereas the latter was a simple binary system of presence or absence, being or non-being, the system of dissolution is more subtle, involving gradual change, with intermediate states reflecting the progress of the dissolution process. It replaces the dialectic of present and absent, full and empty, with the idea of qualitative change, but without any change in quantity.

The road from the thinking of the Aristotelian school to our more accurate understanding of the way drugs work has been a long one. Their contribution was nevertheless momentous. Even though their explanations were erroneous, credit is due to them for identifying an important series of concepts: the idea of a drug's target; its kinetics; the variability of its effects as related to dosage and age; the possibility of habituation; its diffusion by gradual contagion; and the transformation of pathogenic material under its influence. The wider sys-
tem of Aristotelian thought made it possible to elab-
orate the first theory of pharmacy, bringing drugs out of
the realm of magic and the obsessive preoccupations of
earlier periods and into the sphere of change, progress
and transformation — a rational approach fully in keep-
ing with modern conceptions of science.

Summary

This article analyses the birth of the science of phar-
macy in ancient Greece, starting with the oldest literary
evidence in The Iliad and The Odyssey, and continuing
down to the Aristotelian school in the 4th—3rd centuries
BC. The theory is found in the notebooks of this school,
the Aristotelian Problemata, which are here analysed
in detail. The importance of this theory is that it was
the first attempt to explain rationally the nature of
medicines, their diffusion in the body and their action.
The Aristotelians identified two activities of medicines.
One was modelled on the then current conception of
digestion, while the other posited a model of pro-
gressive diffusion, a more revolutionary — and at any
rate more modern — view.

References

References on the theory of drugs in Classical Antiquity are
sparse. We quote the Greek text in French translation of the
Aristotelian Problemata and some recent works which put classical therapy in
its overall context. We also mention certain other works, for instance by
Issekutz and Weatherall, and the collective volume La philosophie
du remède. They give us a wider perspective and throw some light on
recent research in this field.

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