INTERNATIONAL PLATO SOCIETY

DEZ 2001

ISSN 2079-7567
eISSN 2183-4105

Established 1989
http://platosociety.org/

PLATO JOURNAL

Société Platonicienne Internationale

Associazione Internazionale dei Platonisti

Sociedad Internacional de Platonistas

Internationale Platon-Gesellschaft

Hemlock Poisoning and the Death of Socrates: Did Plato Tell the Truth?

BLOCH, Enid, *in 1. Plato 1 (2001)* , [En ligne] , January 2001

Introduction

The closing pages of Plato's *Phaedo* provide a stunning picture of the effects of poison upon the body of Socrates. Plato describes a slowly ascending paralysis, beginning in Socrates' feet and creeping steadily up his legs toward his chest, with Socrates' mind remaining clear until the end. Death arrives calmly and peacefully. It is a remarkable account, rich in emotive power and in clinical detail. But is it true?

Let us recall once again those final hours. After Socrates drank the poison, 'he walked about and, when he said his legs were heavy, lay down on his back, for such was the advice of the attendant.' The jailor then began to examine Socrates, much in the way a modern physician might do.

The man … laid his hands on him and after a while examined his feet and legs, then pinched his foot hard and asked if he felt it. He said 'No'; then after that, his thighs; and passing upwards in this way he showed us that he was growing cold and rigid. And then again he touched him and said that when it reached his heart, he would be gone. The chill had now reached the region about the groin, and uncovering his face, which had been covered, he said – and these were his last words – 'Crito, we owe a cock to Asclepius. Pay it and do not neglect it.' 'That,' said Crito, 'shall be done; but see if you have anything else to say.' To this question he made no reply, but after a little while he moved; the attendant uncovered him; his eyes were fixed. And Crito when he saw it, closed his mouth and eyes.
Plato, *Phaedo* 117e-118a, trans. Loeb Classical Library, Harvard University Press, Cambridge, Mass., 1990 edition, pp. 401-3.

So vivid is this process of dying, most readers through the ages probably have accepted Plato's account without question, its very attention to clinical detail sufficient evidence of its veracity. Yet it has hardly gone unchallenged. In the 1970's the classicist Christopher Gill ('The Death of Socrates', *Classical Quarterly,* 23, 1973, pp. 25-8) and the pathologist William Ober ('Did Socrates Die of Hemlock Poisoning?', *New York State Journal of Medicine*, 77.1, Feb., 1977, pp. 254-8) suggested that Plato had deliberately distorted the truth for his own dramatic or philosophic purposes. Hemlock poisoning, they claimed, would have produced a far nastier and more violent end. Because Plato wished to portray the philosophic idea of the soul departing peacefully from the body, he needed to envision a quiet, dignified unfolding of symptoms.

In 1991 these same arguments would be repeated by Bonita Graves *et al.*, in a paper claiming to shed 'twentieth century scientific light' on the death of Socrates (Graves, B.M. *et al*., 'Hemlock Poisoning: Twentieth Century Scientific Light Shed on the Death of Socrates,' pp. 156-68 in Boudouris, K.J., ed, *The Philosophy of Socrates,*International Center for Greek Philosophy and Culture, Athens, 1991). But why would Plato have expected his readers to accept so bold a distortion? Socrates' death had hardly been a secret affair. Not only had his final hours been witnessed by a large group of talkative friends, in politically volatile Athens such executions were a frequent event. Would it not have made much more sense for Plato to write honestly and accurately about a poison with which he and his contemporaries already were far too familiar?

It might seem a simple matter to resolve this issue, perhaps with one phone call to a physician, poison hotline, or botanical garden. But accurate knowledge of hemlock is hard to come by these days, and to discover it one must navigate a veritable thicket of botanical, toxicological, neurological, linguistic, and historical complexities. In this paper I report the results of such a journey. Plato not only told the truth, I conclude, but much more of it than anyone has recognized. The calm, peaceful death of the*Phaedo* was an historical reality.

To arrive at this conclusion, I have found it necessary to explore the writings of Theophrastus, Pliny, Dioscorides, and many other ancient authors, as well as the scientific works of such figures from the seventeenth to the nineteenth centuries as Wepfer, Störck, Linnaeus, Christison, Bennett, and Harley, piecing together their bits of information like a huge jig-saw puzzle. I also have spoken at length with practicing neurologists and pathologists, researched the recent medical and even veterinary literature, and brought plants from Cornell University's Poisonous Plants Garden into my own home, growing familiar enough with their features to make sense of

the ancient writings.

Determining the likely ingredients in Socrates' cup proved in itself a difficult task, for Plato never identified hemlock, *kôneion* in Greek, as the actual poison, speaking only of*to pharmakon*, 'the drug'. How can we be sure it was hemlock? And which hemlock? A number of plants with different properties are called by that same name. Plato's Greek also presents a challenge. What exactly did he mean when he stated that Socrates' legs were 'growing cold and stiff,' *psuchoito te kai pêgnuto?* Should we understand 'cold' as an actual drop in temperature, a subjective feeling of chill, or simply a lack of energy? Does 'stiff', or 'congealed' in the Greek, imply a rigid paralysis or a flaccid one? In the answers to these questions lies all the difference between central and peripheral nervous system pathology, and therefore between toxins from a plant such as water hemlock, which attack the brain and spinal cord, and those from poison hemlock, which target peripheral nerves.

In the end I have been able fully to align Plato's description with modern medical understanding. Socrates suffered a peripheral neuropathy, a toxin-induced condition resembling the Guillain-Barré syndrome, brought about by the alkaloids in *Conium maculatum*, the poison hemlock plant. Plato proves to have been entirely accurate in every clinical detail, while Gill, Ober and Graves were mistaken in the violent demise they imagined for Socrates.

How Many Hemlocks?

Most ancient writers seem to have known very well which herb they were talking about when they spoke of hemlock, and they did not question its ability to provide a peaceful death. According to Theophrastus, the speed and ease of hemlock's effects depended on the thoroughness of its preparation. Hemlock must often have been combined with other drugs in an attempt to enhance its virtues. Theophrastus tells us of a certain Thrasyas of Mantineia, who discovered 'a poison which produces an easy and painless end; he uses the juices of hemlock, poppy and other such herbs, so compounded as to make a dose of conveniently small size.' (Theophrastus, *Enquiry into Plants* 9.16.8, trans. Loeb 1916 edn., pp. 302-3.). We can well imagine Socrates' jailor doing likewise. It is evident that he crushed the hemlock, for when Socrates asked him to 'prepare' the poison, he used a form of the verb *tribô*, which means to crush, as in a mortar.

Yet as time passed, the identity of the Athenian plant grew less certain. The great Greek herbalist Dioscorides (4.79), writing in the first century A.D., and his Roman contemporary, Pliny the Elder (*Natural History* 25, 94.151-5), still possessed a great deal of information about the plant and its powers. Indeed, their accounts would be regarded as authoritative for many centuries to come. Yet with the translation of Greek *kôneion* into Latin *cicuta* and then into English 'hemlock,' the name took on a more or less generic meaning.

In English, 'hemlock' refers not only to poison hemlock, but to water hemlock, hemlock water dropwort, lesser hemlock (fool's parsley), and other herbs as well, all resembling each other in their lacy, umbrella-like flowers and tiny fruits. They are members of the *Umbelliferae* plant family, a very large and widespread group that includes such edible vegetables as carrots, celery, dill, parsley, and parsnips. It is easy for the various hemlocks to be mistaken for these vegetables, often with dire results. The root of poison hemlock, for example, looks like a white carrot or parsnip, and its leaves, especially in the first year of the plant's two-year cycle, closely resemble parsley.

Through the centuries Latin *cicuta* became virtually an English word, a synonym for all types of hemlock. At the same time it acquired a somewhat more scientific veneer, for botanical works were written in Latin all the way through the eighteenth century. With no agreed upon system of plant names, each botanist not only used the names however he wished but invented more of his own. By the seventeenth and eighteenth centuries the confusion of the hemlocks was enormous, with literally dozens of different plants assigned various versions of the names *cicuta* and *cicutaria,* in scores of botanical works. No one could keep up with it anymore.

Linnaeus brought some order to the world of plants with his great scheme of plant classification, but paradoxically, when it came to the confusion of the hemlocks, he seems to have made matters even worse. For he separated Greek *kôneion* and Latin *cicuta*, assigning the name *Conium* to poison hemlock and *Cicuta* to water hemlock (Carolus Linnaeus, *Species plantarum*, 1753, pp. 243, 255-6). But the Greek and Latin terms had travelled together through the ages, and they could not so readily be divorced, whether in popular language or in general medical discussions.

Even as late as the eighteenth century botanists tended to assume the various hemlocks all shared the same poisonous qualities and effects, if in lesser or greater amounts. Though eventually realizing this was not quite so, they still possessed little accurate knowledge of the true differences. The question arose, especially in England, as to whether poison hemlock was poisonous at all, a doubt apparently shared even by Linnaeus.

In light of this history it is easy to understand why so many people have mistakenly associated seizures with poison hemlock, for it takes an expert to tell the various plants apart, and reports of poisonings have so frequently been attributed to the wrong species. As lists of symptoms were handed on, various pieces of information fell out or were tacked on, until misinformation took on an historical tradition of its own. Modern toxicology texts unfortunately still draw upon these older compilations, and scholars who rely upon them unwittingly reproduce their centuries-old errors.

Poison hemlock is in fact a unique plant, with chemical properties different from any other of the thousands of members of the *Umbelliferae* family. For it is the only one, apparently, among these many thousands, that produces the toxic substances known as alkaloids. This striking botanical fact is little known even today, and it certainly was not recognized in the past. Could this profound chemical difference be the reason poison hemlock, of all the hemlocks, is the only one to attack primarily the peripheral nervous system, rather than the central?

About Nicander

Even in the ancient world the identity and properties of *kôneion* had not remained entirely clear. Nicander, possibly a Greek-speaking Roman army doctor of the second century B.C., composed a poem on poisons and their antidotes, the *Alexipharmaca.* In it he presented a gruesome picture of *kôneion* poisoning:

Take note of the noxious draught which is hemlock, for this drink assuredly looses disaster upon the head bringing the darkness of night: the eyes roll, and men roam the streets with tottering steps and crawling upon their hands; a terrible choking blocks the lower throat and the narrow passage of the windpipe; the extremities grow cold; and in the limbs the stout arteries are contracted; for a short while the victim draws breath like one swooning, and his spirit beholds Hades.
Nicander, *Alexipharmaca* 186-194, edd. and trans. Gow, A.S.F. and Scholfield, A.F., in *Nicander: The Poems and Poetical Fragments*, Cambridge University Press, Cambridge, 1953, pp. 106-7.

A fearsome portrait indeed, and one upon which Gill and Ober heavily depend in their attempt to refute Plato. But why should Nicander's account be credited above that of Plato? Not only was Nicander writing a good two centuries after Socrates' death, he was describing illness, not execution. The victim in Nicander's poem is not a prisoner, forced to ingest a toxin known at the very least to his executioner, but a man free to wander about and 'totter' through the streets. We are not told how he came to be poisoned.

Nor was Nicander regarded as much of an authority even in his own day. There has to be 'doubt', report Nicander's modern translators, A.S.F. Gow and A.F. Scholfield, 'whether the poet knew what he … was talking about', for 'his descriptions do not always tally with the known habits of the plants of which he is supposed to be speaking.' (p. 24). Indeed, the great Greco-Roman physicians of the following centuries were largely to ignore his work.

Most important, we cannot simply assume that Nicander and Plato were talking about the same plant. Some years ago R.M. Dawkins warned of the difficulty in establishing ancient plant identifications ('The Semantics of Greek Names for Plants,' *Journal of Hellenic Studies*, 65.1, 1936). The Greeks did not think as we do, and 'of Linnaeus and still more of the modern natural system of classification we must completely clear our minds.' (p. 6). Plant names in the ancient world emerged not from botanical principles but from the uses of plants, their scent, or sometimes their general appearance.

Could Nicander have been thinking not of hemlock but of an entirely different plant when he described the effects of *kôneion*? Aconite, perhaps? Significantly, nineteenth and twentieth century reports of aconite poisoning correspond almost exactly with the symptoms portrayed by Nicander. Modern aconite victims suffer burning of the mouth, constriction and pain in the throat and chest, greatly labored breathing, vertigo, diminished vision or blindness, slight convulsive twitching, and a sense of impending doom. Surprisingly, Nicander's account appears to have been remarkably accurate, but only if we recognize the *kôneion* of the *Alexipharmaca* as aconite rather than hemlock.

Seizures and Swellings

Confusion among the hemlocks has long fueled a scholarly debate over the death of Socrates. Modern writers such as Gill, Ober and Graves seem unaware of their predecessors, but the controversy over the demise of Socrates has in fact been going on for centuries, ever since the appearance of Johannes Wepfer's monumental treatise, *Cicutae aquaticae historia et noxae* (Basel, 1679).

Wepfer, a Swiss physician, had been deeply impressed by the effects of water hemlock on eight local children. After eating various amounts of its root the children had suffered horrendous seizures, and two of them died terrible deaths, with backs arched and jaws clenched, foaming at the mouth. Wepfer interviewed surviving children and their parents, and his treatise provides what still today are the classic descriptions of water hemlock poisoning. His work was a scientific masterpiece, bringing all the known botanical literature together with his own toxicological experiments and observations.

Behind Wepfer's inquiries lay a fundamental question. His treatise is filled with references to the *Phaedo* and the death of Socrates, about which he expressed the gravest doubts. Hemlock could not have been a 'cold' poison as reported in all the ancient works, he contended, for the experiences of the eight poisoned children proved how very 'hot,' that is, conducive to violent seizures, it actually was. It did not occur to Wepfer that his studies of water hemlock might be irrelevant to the hemlock of the Athenians, for he was convinced all varieties of *cicuta* shared similar toxic properties. Wepfer's treatise set the stage for the ensuing debate, and throughout the seventeenth, eighteenth, and nineteenth centuries scores of physician-botanists, some of them the best scientific minds of their age, were to weigh in on the issue.

In the middle of the eighteenth century medical interest shifted away from water hemlock to poison hemlock, thanks to the enthusiasms of the Baron Anton von Störck, a Viennese physician convinced that *Conium maculatum* could cure cancer and all other

manner of 'swellings.' (Störck, Anton von, *Libellus, quo demonstratur cicutam no solum usu interno…* Vienna, 1760). No doubt he had arrived at his ideas after reading in Pliny and Dioscorides of hemlock's reputed power to shrink breasts and wither testicles. Störck fed extracts of poison hemlock to his patients and proclaimed his efforts a total success. It was not long before physicians all across Europe were following his lead, and by the beginning of the nineteenth century doctors were routinely prescribing hemlock for a vast range of illnesses, as the pharmacological dispensaries of the period amply reveal.

Treasure Trove

No one, not even the ancients, knew more about the effects of poison hemlock than did a group of nineteenth-century physicians and toxicologists, who together amassed a veritable treasure-trove of first-hand observations. These men were poisoning humans and animals right and left – and they were keeping records of it. Especially in the first half of the century, doctors not only were feeding extracts of hemlock to their patients, toxicologists were deliberately poisoning themselves and dispatching huge numbers of laboratory animals as they studied the plant's physiological effects, and chemists were breathing its vapors as they sought to isolate its alkaloids. The resulting poisonings were carefully documented, as were deaths through ingestion of the plant growing wild.

This hard-won knowledge, culled from the misfortune of so many victims, soon would be entirely forgotten. Today's physicians and toxicologists remember nothing of their nineteenth-century colleagues, but for our purposes their prolific experiments and precise observations are priceless. We may use the cases they describe, especially those reported by the three great Scottish toxicologists, Robert Christison, John Hughes Bennett, and John Harley, to establish beyond the shadow of a doubt the truth of Plato's account.

In virtually every one of these experimental or accidental cases, whether human or animal, a flaccid paralysis began in the distal parts of the body and moved progressively toward the trunk. Consciousness was preserved throughout, though in animals it was sometimes hard to determine. Death arrived when paralysis reached the muscles of respiration, preceded by a terminal seizure due to lack of oxygen to the brain. The seizure appeared mild, for the already paralyzed muscles of the body could not strongly convulse. But death was not always inevitable. If the amount of poison was insufficient to paralyze breathing the victim survived, slowly recovering over a period of hours. Toward the end of the century, after the discovery of cardio-pulmonary resuscitation, victims could be saved by supporting their breathing through the critical period of respiratory failure.

Harley's Account

John Harley, an avid proponent of hemlock's medicinal use and a careful student of its physiological effects, did not hesitate to poison himself. He described his adventures in *The Old Vegetable Neurotics*, (Harley, J., *The Old Vegetable Neurotics: Hemlock, Opium, Belladonna and Henbane*, Macmillan, 1869):

After taking three drachms of the *succus conii* of the 'British Pharmacopoeia,' I set out walking; and three-quarters of an hour after the dose, I felt a heavy clogging sensation in my heels. There was a distinct impairment of motor power. I felt, so to speak, that 'the go' was taken out of me. It was not that I felt fatigued just then, but it seemed as if a drag was suddenly put upon me, and that it would have been impossible to walk fast, if urged to do so. After walking about a mile up-hill, this sensation was very decided; and on putting a foot on the scraper at the door of the hospital, the other leg was shaky, and felt almost too weak to support me. My movements appeared clumsy to myself, and it seemed necessary that I should make an effort to control them. At the same time, there was a sluggishness of the adaptation of the eye. My vision was good for fixed objects; but, when an uneven object was put in motion before the eyes, there was a haze and dimness of vision, producing a feeling of giddiness. The pulse and pupils were unaffected. These were the whole of the effects; and, after continuing for an hour, they rapidly disappeared, and left me in the possession of my usual vigour. (p. 3).

On another occasion Harley had ingested even more of the drug:

An hour and a quarter after taking the dose, I first felt decided weakness in my legs. The giddiness and diminution of motor power continued to increase for the next fifteen minutes. An hour and a half after taking the dose, these effects attained their maximum … The legs felt as if they would soon be too weak to support me. There was a positive diminution of voluntary power in every part of the muscular system, and this nearly amounted to complete paralysis as far as the hamstring and levator palpebrae muscles were concerned. At one time, the greatest exertion was required to elevate the eyelids. The mind remained perfectly clear and calm, and the brain active throughout; but the body seemed heavy, and well-nigh asleep. After continuing for about half an hour at their maximum, the symptoms began rapidly to decline, and within three hours and a half of taking the dose they had totally disappeared. (pp. 4-5)

Could he have come any closer to Socrates' own experience? Harley was luckier perhaps than he realized in having escaped the same fate. He went on to poison many of his patients, finding hemlock especially helpful in treating unmanageable children, those whom we today would call hyperactive. The drug did indeed slow them down.

The Unfortunate Gow

In 1845 a poisoning occurred that would capture the attention of leading toxicologists. A poor Scottish tailor named Duncan Gow had enjoyed a sandwich lovingly made for him by his children, from what they thought to be parsley growing wild.

In from fifteen to twenty minutes there was loss of power in the lower extremities; but he apparently suffered no pain. In walking, he

staggered as if he were drunk; at length his limbs refused to support him, and he fell. On being raised, his legs dragged after him, and when his arms were lifted they fell like inert masses, and remained immovable. There was complete paralysis of the upper and lower extremities within two hours after he had taken the poison. There was a loss of the power of swallowing, and a partial paralysis of sensation, no convulsions, but only slight occasional motions of the left leg; the pupils were fixed. Three hours after eating the hemlock the respiratory movements had ceased. Death took place in three hours and a quarter; it was evidently caused by gradual asphyxia from paralysis of the muscles of respiration; but the Intellect was perfectly clear until shortly before death.
Smith, S., ed., *Taylor's Principles and Practice of Medical Jurisprudence*, 10th edn., vol. 2, J & A Churchill, London, 1948, p. 683.

Gow died in the Edinburgh hospital where John Hughes Bennett practiced medicine. Bennett immediately recognized the significance of the case for the on-going debate over the death of Socrates, and he carefully interviewed all who had witnessed any aspect of Gow's demise, whether passers-by in the street, police officers, or hospital attendants. Bennett performed an autopsy on the body, carrying the stomach contents to Robert Christison, who confirmed absolutely that Gow had ingested *Conium maculatum*. Reporting the case in great detail, Bennett emphasized its remarkable correspondence with the facts of the *Phaedo* (Bennett, J. H., *Clinical Lectures on the Principles and Practice of Medicine,* Samuel & Wood, New York, 1860, pp. 413-8). For a while, at least, the long debate seemed all but settled. Poison hemlock could indeed bring on the symptoms of Socrates' death.

Cold and Stiff

Christison was at that time the world's authority on hemlock poisoning. Yet until the case of Gow he himself had doubted *Conium maculatum* was the plant responsible for Socrates' death. The difficulty for him lay in Plato's description of Socrates' legs as 'growing cold and stiff,' *psuchoito te kai pêgnuto*. Though neurology in Christison's day had not yet advanced to the point of clearly distinguishing central and peripheral nervous system pathology, he nevertheless knew enough from his own experience with poisons to recognize that 'cold and stiff" did not make much sense together with the ascending paralysis of Socrates and his clear mind.

Christison was correct, for lowered temperature in the extremities indicates a reduced blood circulation, and it usually is accompanied by impaired consciousness, for the circulation to the brain has been compromised as well. And rigidity in the legs is a sign of central nervous system pathology. Instinctively Christison understood that a poison which paralyzed the extremities but left the mind clear had to have produced a flaccid paralysis, not a rigid one.

In 1835 Christison had addressed the issue directly. 'I think it will puzzle the most learned toxicologist', he told the Royal Society of Edinburgh, 'to point out any poison which has the property of occasioning coldness and stiffness of the limbs, proceeding gradually upwards, and proving fatal without causing either pain or sopor. There seems, then, no alternative but to conclude, either that the description of Plato … is not a detail of facts, but an embellished narrative, written for effect; or that, although we are now acquainted probably with fifty times as many poisons as the ancient Athenians, and with many which are fifty times as active as any in their list, we have lost acquaintance with one with which the ancients were quite familiar, and which differs totally from every known poison in its action.' (Christison, R. 'On the Poisonous Properties of Hemlock and its Alkaloid Conia', *Transactions of the Royal Society of Edinburgh*, vol. 13, 1836, p. 407.)

It had never occurred to Christison or his colleagues that the translation of Plato's words might be wrong, or that the implications of 'cold and stiff' in English might not be the same as in the original Greek. Even Bennett, despite noting the flaccid paralysis of Gow, still thought Plato had been talking about rigidity, and thus he admitted he could not explain the 'cold and stiff' reference in the *Phaedo*, despite having found so many other aspects of Gow's case fully in accord with Plato. Today's scholars persist in this same mistake. Graves points to the supposed coldness and stiffness of Socrates' legs as proof that Plato's account could not have been medically accurate. (*Ibid*., pp. 165-6.)

But the problem immediately disappears when we remember that Plato lived in his world, not ours, and when we correct our English translations accordingly. *Psuchoito*, from the verb *psuchô*, 'to make cool or cold,' and *pêgnuto*, from *pêgnumi*, 'to congeal,' reverberated in Greek ears with a resonance that today is not easy to recall.

Pêgnumi did not necessarily imply rigidity, but pointed more to the action of congealing than to the thing that is congealed. Milk curdles, water freezes, pudding thickens - all are 'congealing'. We do not get the feeling, either in Plato or elsewhere, that the congealed substance itself is necessarily rigid or hard to the touch, just that it is relatively thick, and most important, that it stays put, not flowing or changing shape like a liquid. Homer, for example, sang of spears flung into the hearts of enemies, which then stick out of their chests, or, having missed their target, stick into the ground. It was not the rigidity of the spears as such, but the characteristic way they retained their position without coming unstuck, that Homer seems to have had in mind (*e.g. Iliad* 4.260, 22.283).

Pêgnumi in the sense of congealing is even more evident in Hippocratic writings. Phlegm, for example, is described as a congealed 'cool' substance, which if not sufficiently dispersed on entering the 'warm' bloodstream will thicken the blood as well. When such thickening prevents *pneuma*, the very breath of life, from getting through to the body, the result is the convulsions of epilepsy or even death, if the blockage is severe enough. Hippocrates depended upon *psuchô* and *pêgnumi*, the very same verbs employed by Plato, to describe 'cold' and 'congealing.' (Hippocrates, 'The Sacred Disease' 10.30-11.26, Loeb 1998 edn. vol. 2, pp. 154-7.) He certainly did not mean to imply that phlegm is solid or that blood becomes rigid, just that both may thicken. Had any of

these writers wished to describe something that felt hard to the touch, or to specify the rigidity of muscular contractions, they could have called upon other far more suitable words, such as *sklêros* and *spasma.*

In this larger sense, 'hot' and 'cold' did not so much refer to temperature as to a level of physical and emotional energy or activity. 'Warmth' implied strength, motion, or strong feeling, whereas 'cold' suggested passivity, restraint, and lack of feeling. Thus it was not the rigid flexion of Socrates' muscles or a drop in body temperature that Plato meant to imply by 'cold and stiff,' but a lack of movement, energy, or feeling. Socrates' legs were 'stuck' or 'congealed', remaining fixed where they were. They were 'cold', that is, inert, lacking in activity or energy, unable to move and unable to feel. In other words, Socrates' legs were paralyzed.

Speaking of Paralysis

Why then did Plato not simply say so? Paralysis, after all, is a good Greek word. But when we look carefully we see that it had not been available to him, for it belonged to a somewhat later period in the development of Greek medicine.

As a noun rather than a verb, and as the technical name for a specific physical disability, *paralysis* would be a long time in coming. We encounter it for the first time in a fragment from Theophrastus, (*Fragments* 11) and not until the first and second centuries A.D., in the texts of Galen, Aretaeus, and others of the great Greco-Roman physicians, do we find its consistent and authoritative use.

A related noun, *apoplêxia*, did exist in Plato's day, for we find it in Hippocratic writings. *Apo-* means 'from' or 'away from,' and *plêxia* denotes a sudden striking, as when a lyre is struck with a *plectrum*. Thus *apoplêxia* referred either to something like a stroke, in which one side of the body was affected, or to a sudden loss of consciousness. Plato might also have turned to *paraplêxia*, but this too would have implied a sudden event, such as sunstroke. The gradually ascending paralysis that Plato needed to describe, with its symmetrical effect on Socrates' limbs, could not have been suggested effectively by either of these words. And so Plato called upon the most evocative terms he could find, and these were *psuchoito te kai pêgnuto*.

Plato's choice of words was not an unusual one. Indeed, in his comedy *Frogs* Aristophanes had employed almost identical terms to describe the effects of hemlock poisoning (Aristophanes, *Frogs* 116-26, Loeb 1989 edn. vol. 2, pp. 306-9). In the play, the protagonist Dionysos has been looking for a way to kill himself in order to visit the underworld. Heracles suggests suicide by hanging, but Dionysos rejects that method as 'too hot.' All Heracles then has to do is hint at a 'beaten path', by mortar and pestle, for Dionysos immediately to respond, 'hemlock, you mean?' (p. 309) But he dismisses that idea as well, declaring it 'too cold and wintry, already the stiffness (congealing) is reaching the shin' (my translation). In Greek Dionysos' words are: *psuchran ge kai duscheimeron/ euthus gar apopêgnusi tantiknemia. Psuchran* and *duscheimeron* mean 'cold and wintry,' *apopêgnusi*, from *pêgnumi*, connotes something being 'made to congeal,' and *tantiknemia* refers to 'the shin'.

Socrates' symptoms exactly, are they not? Yet Aristophanes first produced *Frogs* in 405 B.C., six years *before* the death of Socrates. How then does it make any sense to accuse Plato of fabricating these very same effects? Far from trying to deceive their audiences or their readers, Aristophanes and Plato were employing the ordinary language of their day, building their jokes and their dialogue upon the shared experiences of their fellow Athenians. Aristophanes evidently expected his audience not only to recognize the symptoms of hemlock poisoning, but to understand how the toxin was prepared, by crushing the plant in a mortar. Why should Plato have expected any less?

Guillain-Barré Syndrome

Once Plato's language is properly translated, there is absolutely nothing in what he reports of Socrates' demise that cannot be aligned both with the experimental evidence of the nineteenth-century toxicologists and with the requirements of modern neurological understanding. Were Socrates brought today to a hospital emergency room, the attending physicians would immediately recognize his ascending paralysis as a peripheral neuropathy of the Guillain-Barré type.

Socrates stopped breathing, and with his brain deprived of oxygen he suffered a terminal seizure. Though the seizure was generalized it would have appeared quite mild, for with his limbs already paralyzed Socrates could not have convulsed in any dramatic fashion. In Plato's simple term, *ekinêthê*, 'he moved' (*Phaedo* 118a). A Guillain-Barré patient whose respiration has ceased would expire in this same way.

Yet none of the modern doctors would think to associate Socrates' condition with hemlock poisoning. For in neither their modern texts on peripheral neuropathy and the Guillain-Barré syndrome, nor in their training, would they ever have come across references to poison hemlock. It is a strange failure, especially since the syndrome of 'acute ascending paralysis' was first identified in the mid-nineteenth century, when reports of hemlock poisoning abounded in the medical literature. The physicians who defined the 'new' syndrome, four French neurologists, apparently were unaware of the writings of Christison and his colleagues – or those of Plato, for that matter.

'Acute ascending paralysis' was first described in 1859 in a landmark paper by Octave Landry. Commenting on five cases he had observed for himself and five he had found in the literature, he set forth a set of symptoms which we may once again recognize as identical to those of Socrates:

The sensory and motor systems may be equally affected. However the main problem is usually a motor disorder characterised by a gradual diminution of muscular strength with flaccid limbs and without contractures, convulsions or reflex movements of any kind … One does not observe any symptoms referable to the central nervous system … The intellectual faculties are preserved until the end …The weakness spreads rapidly from the lower to the upper parts of the body … The first symptoms always affect the extremities of the limbs and the lower limbs particularly …The progression can be more or less rapid. It was eight days in one and fifteen days in another… More often it is scarcely two or three days and sometimes only a few hours. When the paralysis reaches its maximum intensity the danger of asphyxia is always imminent.
Landry, O., 'Note sur la paralysie ascendante aiguë,' *Gazette hebdomadaire*, July 29, 1859, pp.482-8. Quoted in Hughes, R., *Guillain-Barré Syndrome,* Springer-Verlag, London, 1990, pp. 1-2.

In 1916 a second landmark paper appeared, by Georges Guillain, Jean-Alexandre Barré, and André Strohl (Guillain, G., Barré, J.A., Strohl, A., 'Sur un syndrome de radiculo-revrité avec hyperalbuminose du liquide céphalorachidien sans réaction cellulaire', *Bulletin Societé Médicale des Hôpitaux*, Paris, October 13, 1916, pp.1462-70). Interestingly, these men wondered whether a toxin or infection might be responsible for the syndrome, but they did not think about hemlock. Eventually Strohl's and even Landry's names receded, and 'acute ascending paralysis' came to be known as the 'Guillain-Barré Syndrome,' or GBS.

Technically speaking, Socrates' paralysis is not a case of GBS, for neurologists in recent years have restricted the label to conditions in which a known toxin is not involved. Most cases of GBS are assumed to have been caused by viral infection, or are labeled 'etiology unknown'. Nevertheless, there is surely much that might be learned by bringing hemlock poisoning into the neurological discussion.

Conclusion

The long, persistent controversy over the death of Socrates may finally have reached its end. By moving back and forth between the ancient and modern records, by uncovering the many layers of botanical and linguistic confusion, by learning the lessons of modern neurology, and by entering fully into the centuries-old debate, we have been able to bring every piece of the puzzle together. After so much complexity, the answer is almost simple. Socrates died gently and peacefully, just as Plato said he did. For Plato not only told the truth, he did so with astounding medical accuracy.

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