

Rise and Fall of Dissection in Ancient Alexandria

By Isabella Beard

Though it is a practice many of us look away from, we know human dissection is a useful tool for learning about anatomy. The first scientist recorded to perform this procedure was Herophilus of Chalcedon (335-280 BC), who primarily practiced in Ptolemaic Alexandria (Von Staden 1989, 36-37). His dissections led to several important anatomical discoveries, but after him, the practice seems to have ceased to exist for thousands of years. Why would there be such a dramatic pause in scientific research of anatomy, research that today would be considered vital knowledge to have, for such a long period of time? The cause is most likely due to the change in views within the physician community, rather than influences from wider culture.

Our first instinct may be to look toward that which we know has been a common blockade of scientific expansion before: religious and cultural antagonisms. Today, such barriers may be easily written off as simply irrational resistance, supported by those who cannot tolerate that which is contrary to their orthodoxy. We do see countless examples of this throughout history: the conflict between the scientific theory of evolution and the origin stories of many religions or the trial of

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Galileo for heresy for promoting the heliocentric model are two clear examples of religion blocking scientific discovery.

However, it was neither religion nor cultural interference in the case of dissection; instead, the practice likely ceased because of evolving philosophical views within the physician community in the ancient world. In fact, it was one of Herophilus's own pupils who brought the quest for discovery through dissection to a screeching halt around the mid-third century BC (Von Staden 1992, 235). Even though that student, Philinus, had learned from the man now famous for being one of the first anatomists, the student's views drastically diverged from the teacher's. Ultimately, Philinus introduced a new school of thought contradictory to Herophilus's: a new ideology that regarded dissection as unnecessary.

Concurrently, physicians started to shift away from the experimental and toward the theoretical when it came to studying medicine and the human body (Von Staden 1992, 236). To discover why the practice of dissection stopped so abruptly, it's necessary to take a look into the history of Mediterranean civilization and its influences and conflicts, particularly those surrounding Ptolemaic Alexandria in Herophilus's time and afterwards in the mid-third century BC.

Alexandria in Ptolemaic Egypt was a hub of Mediterranean civilization. In Herophilus's time, Ptolemaic Egypt was one of the wealthiest Hellenistic states that evolved from the dissolution of Alexander the Great's Macedonian empire. Alexandria, as the capital of Ptolemaic Egypt, experienced an intertwining of culture and thought, primarily of the local Egyptian population and the newly established Greek population, but also other Mediterranean cultures, as it became a leading city in the ancient world. The wealth of the Greek Ptolemies influenced the growth of Alexandria,

especially as a scientific capital, as they extended their patronage to notable scientists and researchers. It was their funding that established the Mouseion, an institute for research and learning, and the Library of Alexandria, which housed thousands of texts in its prime and is one of the most well-known aspects of Alexandria today. However, this relatively sudden intertwining of thought and culture as people from all across the Mediterranean, researchers, nobles, and the like flocked to the city, did not come without its complexities and conflicts. These developments may be particularly relevant influences on how Herophilus's dissections came to be and, possibly, how the practice disappeared.

The new wave of Greek thought toward death and the corpse largely conflicted with the existing Egyptian culture. Mummification is one of the most well-known aspects of ancient Egypt and is one practice that continued under Greek rule after Ptolemy I took over the territory and established the Ptolemaic dynasty starting in 305 BC. Though the Ptolemies were Macedonian, coming from the far northeast of the Greek mainland, and therefore originally far away from Egyptian influence in comparison to more southerly Greek states, the royal family still adopted or promoted a few Egyptian practices, likely to establish more validity in their ruling of the Egyptian territory. Mummification seems to be one of them; many mummies have been discovered of Greek nobles and even one of the doctors of Ptolemy II, a man named Nespmadu, which shows that the practice was prevalent among those closest to the Ptolemies (Olaya, 19 Jan. 2019). This is perhaps enough to suggest that the early Ptolemaic pharaohs may have taken part in it as well, though their tombs are lost. In Egyptian culture, interfering with a corpse was commonplace, at least among those wealthy enough to afford it, as it was

viewed as a necessity to properly transition into the afterlife. In Egyptian religion, a maintained physical form was required for the soul to possess and experience a proper afterlife. This, however, was essentially contradictory to Greek attitudes around death and the corpse. While the Greeks did have their own respective burial rites, these rites did not commonly include attempts at long-term preservation of their dead. As Galassi and Varotto (2021, 877) wrote, “Greeks rejected the importance of preserving bodies for eternity because, as it can be found in Plato’s work *Phaedo*, the soul was considered more important than the body and the only truly immortal element.” In addition, the Greeks viewed the corpse as a source of pollution. The residence of any dead body was immediately seen as completely polluted, and those who took charge of preparing and moving the body for burial were seen as polluted as well; to the point that priests were barred from involvement in the process and the polluted persons could not enter a temple or shrine for at least a few days after burial, and had to restrict their interactions with the divine, as the pollution was believed to be so inherent that even the gods would be repulsed by it (Von Staden 1992, 227). This, again, is largely contradictory to the death practices of the Egyptians, where priests and religion were thoroughly involved in the process of mummification.

If this was how Greeks viewed their dead, there must have been some influence that pushed the Greek Herophilus to carry out dissections. The largest contributions, naturally, were a desire for the satiation of scientific curiosity and incurring knowledge, but also the monetary and political influence of the Ptolemaic rulers of Egypt and Alexandria, who likely funded and provided for Herophilus’s studies directly:

“First, the circumstances: vivisection of humans, according to Celsus, became possible only through royal intervention and patronage—Herophilus obtained imprisoned criminals ‘from the kings’. This part of the account seems compatible with the ambitious patronage extended by the first two Ptolemies. Given the tenacious Greek taboos against opening human bodies, the active intervention of ambitious, relatively freethinking Macedonian autocrats (whose ‘ancestral’ hero—Alexander the Great—had also not shrunk from cruelty in the name of progress) is perhaps exactly what it would have taken to make a vivisectionary exploration of human subjects possible” (Von Staden 1989, 144).

This explanation is plausible for both Herophilus’s alleged vivisections and his dissections. However, while royal support and scientific exploration are clearly ascertainable reasons for the practice, a question still remains as to what influences caused Herophilus’s viewpoints on death and the corpse to differentiate so widely from traditional Greek viewpoints that he would consider the act of dissection in the first place.

In the years prior to Herophilus’s work, there are some notable changes in the viewpoints of Greek intelligentsia and philosophical schools toward death. For example, Aristotle, Herophilus’s elder who likely influenced him as Aristotle too performed his own dissections and vivisections on animals, states:

“And yet a dead body has exactly the same configuration as a living one; but for all that is not a man. So also, no hand of bronze or wood or constituted in any but the appropriate way can

possibly be a hand in more than name. For like a physician in a painting, or like a flute in a sculpture, it will be unable to perform its function. Precisely in the same way no part of a dead body, such I mean as its eye or its hand, is really an eye or a hand” (Aristotle, *Parts of Animals*, 6).¹

This shows a much different attitude toward the corpse; in Aristotle’s view, it is no longer human, for it no longer contains the essence of one. Through this lens, dissection can be seen as much more viable, transforming the taboo of cutting into a human itself into cutting into an object of sorts. Not only were the minds of individual intellectuals seeming to change, but entire schools of thought that began developing in the third century BC also promoted viewpoints that went against the traditional beliefs of the majority of Greek society. Primary of these schools were Stoicism and Epicureanism which, while opposing each other in many other views, both agreed that death and the corpse should not be feared, as death was merely a rearrangement of matter (Von Staden 1992, 233). Here, we see that at least in Greek intellectual society, views on death were beginning to shift, and it can be assumed that these changes influenced Herophilus and his decision.

These political and philosophical developments in Alexandria are what likely led to Herophilus being able to practice dissection. Within a short time frame, his work began to show a wide range of fruitful results and solidified him as a leading researcher on the human body. His discoveries spanned almost every part of the human body, and his influence in anatomy can still be noted today. For example, he was the first to describe the liver: “The liver of humans is of a good size, larger than in certain other animals which match

¹ Translation from Ogle 1991

humans [sc. in size]. And where it touches against the diaphragm, it is convex and smooth, but where it touches against the abdominal cavity and against its lump, it is concave and uneven. Here it may be likened to a certain fissure by which in embryos, too, the vein from the navel naturally extends into it" (Herophilus, *On Anatomy*, 60a). He had also described the uterus, noting the anatomy of the ovaries and the uterine tubes:

"In females the two 'testicles' [ovaries] are attached to each of the two shoulders of the uterus, one on the right, the other on the left, not both in a single scrotum but each of the two separate, enclosed in a thin, membranous skin. They are small and rather flat, like glands, sinewy at their surrounding covering but easily damageable in their flesh, just like the testicles of males. In mares they are also quite sizable. And they are attached to the uterus with no small number of membranes and with a vein and an artery implanted from the uterus into these 'testicles.' You see, the attachment is from the vein and the artery that go to each of the two 'testicles,' a vein from the vein and an artery from the artery" (Herophilus, *On Anatomy*, 61).

Lastly, some of his most notable discoveries were of the human nervous system. He was one of the first scientists to differentiate nerves from blood vessels, and he realized that they carried signals from the brain, as evidenced by Rufus: "Nerve (neuron) is a simple, solid body, the cause of voluntary motion, but difficult to perceive in dissection. According to Erasistratus and Herophilus there are nerves capable of sensation... According to Herophilus, on the other hand, the *neura* that make voluntary [motion] possible have their origin

in the cerebrum (enkephalos) and the spinal marrow, and some grow from bone to bone, others from muscle to muscle, and some also bind together the joints" (Rufus, *De anatomia partium hominis*, 71.5). It is also believed that Herophilus was one of the first to recognize the difference between motor nerve and sensory nerve pathways, and he made the connection between damage to the motor nerves and paralysis:

"If, therefore, on the basis of dissection a person has gained knowledge of the beginnings of the nerves that reach each part, he will more successfully treat the loss of sensation and movement in each part. Since this [sc. the beginning of each nerve?] was left undefined by Herophilus and Eudemus, the first persons after Hippocrates to record carefully their dissection of the nerves, it provided physicians with no small investigation into why some paralyse destroy only sensation, while others destroy voluntary motion, and others again destroy both" (Galen, *De locis affectis*, 3.14).

In the brain itself, he discovered and noted the meninges and ventricles, and made note of the difference between cerebellum and cerebrum: "Herophilus dissected the brain meticulously enough to distinguish its ventricles and to differentiate between several of its other parts with stunning and unprecedented accuracy" (Von Staden 1989, 150). He also, notably, made the assertion that the brain was the source of human intelligence, which was still a topic of debate in his time (Von Staden 1989, 138-241).²

² All referenced information from this paragraph sourced from Von Staden's *Herophilus* Chapter VI: Anatomy, including translations of Galen (p. 200, and including his quoted fragments of Herophilus's *On Anatomy*, p. 183, 185) and Rufus (p. 201).

If Herophilus's methods led to numerous anatomical breakthroughs, then why did other physicians not continue the practice in his wake? After Herophilus, in the mid-third century BC, the medical school of Empiricism emerged at the forefront of Alexandrian medicine. As referenced previously, this school was founded by one of Herophilus's own pupils, Philinus of Cos, and its physicians focused solely on experience; relying on those practices and observations which are considered tried-and-true, and often disregarding anything which would be non-evident to the experienced physician: "... the empiricist not only uses definitions and determinations, which rely solely on what is evident, but also makes use of causal accounts and proofs based on what has been ascertained antecedently by means of perception in an evident manner" (Galen, *Three Treatises*, 4.33).³ The Empiricist idea of relying on that which is essentially already known or easily perceived inspired little reason to look at the practices of dissection. Their examination of the body was largely based on deductive reasoning, looking at the obvious to determine an underlying cause instead of seeking for an underlying reason.

As physicians of the Empiricist school cared largely about that which was visible and easily accessible, they viewed attempts at studying the internal and obscured causes of disease as unnecessary. As is stated in Celsus's *De Medicina*: "On the other hand, those who are called 'Empirici' because they have experience, do indeed accept evident causes as necessary; but they contend that inquiry about obscure causes and natural actions is superfluous, because nature is not to be comprehended" (Celsus, *On Medicine*, 27).⁴ To add to this, the Empiricists further argued that the action of cutting open the

³ This translation of Galen is from R. Walzer and M. Frede 1985.

⁴ Translation from W.G. Spencer 1935

body is altering the parts within. Against dissection in particular, it was argued that the act of death alters the parts of the body, and therefore dissection was a useless undertaking, as the corpse would be so different from a live person (Von Staden 1992, 236). Not only this, but they claimed that even the parts of the living may look different, due to factors that weren't exclusively pathological. Therefore, the practice of dissection was seen as having no purpose, causing harm for very little or no gain. Thus, the practice of dissection was frowned upon by practitioners of this school which grew to become predominant in mid-third century BC Alexandria and lasted for an extensive amount of time, as it was still a well-known school by the time of Galen in the second-century AD. Therefore, it is likely that it held enough presence and influence within the medical community to promote a decline in any interest regarding the practice of dissection.

Yet the Empiricist school of thought was not the only one to prevail in third century Alexandria and in the ancient world afterwards. Why did physicians belonging to other schools of thought not attempt the practice? It appears that this likely wasn't an intentional disregard of the practice, but simply due to the shifting priorities of physicians in the ancient world. Instead of cutting-edge experiments such as dissection, many physicians focused their research on the past. Research was focused on such tasks as analyzing prior texts and collecting and debating upon the views of previous physicians and medical writers, such as Hippocrates. Thus, even though the breakthroughs in anatomy and physiology brought upon by Herophilus's work were no doubt still important, as there were still physicians who followed his ideas, they simply fell to the wayside as physicians looked toward pursuits focused more on analytical and deductive reasoning in the years following

Herophilus. Physicians could still learn from analysis of old texts, especially those as expansive as the Hippocratic corpus, without the risk of potential failure or backlash that performing certainly radical experiments such as Herophilus's dissections may have caused.

Even though these changes of philosophy in the medical community in Alexandria after Herophilus are clear and likely the largest factor in the disappearance of the practice of dissection, there remains the fact that Greek culture and religion were still present after the death of Herophilus. His dissections did not change the way the average Greek in Alexandria viewed the corpse and the manipulation of one. It is a possibility, then, that the cause of the immediate disappearance of dissection may be due to social upheaval against the royal patrons of dissection. However, societal backlash does not seem to be the root cause of the end of dissection. The Ptolemaic dynasty was one of the strongest and wealthiest to come out of the wars to divide the territory of Alexander the Great's Macedonian Empire, and the kingdom remained relatively affluent until around the mid second-century BC. The royal family during the time of Herophilus would have had immense wealth and power. Notably, as the royals adopted more and more Egyptian customs, principally those particularly disgraceful to the Greeks, such as sibling-marriage and Egyptian religion, it is likely that there was at least some dissent among the Greek nobility in Alexandria. However, there were no notable rebellions or periods of intense backlash during the time Herophilus lived, and none recorded against Herophilus's practices directly. It was also a likely possibility that most of the Greek people in Alexandria, particularly those of common or lower noble class, did not know of Herophilus's practices at all. The royals' overarching

power meant that their spending did not have to go to a vote, such as in other Greek states, and therefore patronage of Herophilus's practice did not need to be widely public. Therefore, many Greeks would not know of nor have a reason to seek out Herophilus's research, unless they were wealthy and seeking education or studying to be a physician, as otherwise it would not have been important in their daily lives. Any groups seeking out his research may have been more open to the idea, in comparison to the average Greek at the time, as it would have advanced their potential knowledge or career. These factors make it highly unlikely that social upheaval led to the demise of the practice of dissection.

Therefore, it seems most likely that the quick dissolution of the practice of dissection was primarily due to the large shifts in philosophy experienced by the medical community after Herophilus instead of possible social backlash. The dominant school in Alexandria, the Empiricists, dissuaded physicians from attempting dissection. While there were other physicians belonging to schools of thought that were neutral or approving of dissection, the medical community as a whole seemed to have changed focus from experimental research to analysis and deductive work, especially regarding prior texts such as the Hippocratic corpus. The combination of these factors would be enough to cause doctors to naturally abandon the practice, regardless of the school of thought they belonged to or their personal opinion on dissection.

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