ABSTRACT

Monumental Medicine: The Practicality of Physicians and Public Health in Late Republican to Early Imperial Rome

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Roman society was uniquely suited to be a perfect crucible of public health experiments – they had access to the records of previous civilizations, a large population, and a set of pathological tests that needed to all be contended with. This thesis investigates the practicality of Roman medicine through first, an identification of common ailments and detrimental conditions, followed by the addressing of these issues in various fields. Diseases and disabilities were addressed in the military through advancement in the science of surgery and trauma care and eventually resulted in the formation of a specialized group of healer-soldiers, the *medici*. Simultaneously with physician developments in the military, physicians began to specialize in order to better address unique medical concerns among the populace. The rise of specialization in the military and civilian fields allowed for medical care to progress from a purely *domus*-to-*domus* domain. Finally, monuments such as aqueducts functioned as public health agents because they could provide a public resource in a large enough amount and at a high enough quality to bring a good to the most citizens. The combination of military and domestic personnel alongside physical constructions allowed for Roman society to enjoy a level of public healthcare that was the envy of pre-modern civilizations.

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MONUMENTAL MEDICINE: THE PRACTICALITY OF PHYSICIANS IN LATE REPUBLICAN TO EARLY IMPERIAL ROME

Republican to Early Imperial Rome

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Introduction to Practicality as a Concept

The question of whether the Romans had a medical system or not is simple, easily answered, and ineffective in addressing the actual question it was asking. “Medicine” as a term can involve or refer to a tremendous variety and certainly the Romans would have adopted one or more of these myriad measures to improving health or wellness. Therefore, instead of asking “what” Roman medicine was, we must ask “why” and “how”. Now, these questions are by themselves nebulous and need a framing mechanism that will look at existing knowledge in a new way; that framing mechanism will be the term “practicality”. The practicality of Roman medicine first involves addressing what unique and shared challenges existed during the late Republican and early Imperial period in Rome and secondly, what was done in a greater societal context in addressing these challenges.

Practicality is a concept that has not been thoroughly covered in reference to medicine from ancient and classical cultures because either scholars do not see direct evidence towards the question or when the analysis is done, there is a coloring by modern standards imposed on the ancient standards. Essentially, modern scholarship sees medicine as a constant concept projected with modern allopathic medicine and procedures as inherently superior to what was done in the past. Undoubtedly modern medicine does have advantages in safety and efficacy especially considering chemotherapies and surgical treatments, but the Romans did not have access to this

knowledge. Practicality is defined by what knowledge the time period specifically had and how it adjusted to apply that knowledge to treat unique circumstances. Modern scholarship is useful if this consideration is kept at the forefront – combining the direct Roman sources from authorities such as Celsus, Seneca, and Frontinus with modern archaeologists and biologists provides the most comprehensive collection to answer the question of practicality. The former group presents the mindset of the time and the perspective of their existence; the latter reflects on the actions taken and translates the Roman perspective into an accessible modern perspective. In other words, practicality is answered by measuring the Roman innovations to Roman problems while clarifying the situation with respective retrospection.

Advantages exist especially regarding archaeology – the permeation of biological and chemical studies into anthropology has resulted in the ability to investigate issues with confidence such as what diseases past populations had. Therefore, while there needs to be a dedicated zeal in addressing what diseases and disabilities the Romans had to contend with, since human diseases have changed little in the span of two millennia, this is a unique exception to the rule of seeing Rome as a Roman. The discussion of diseases and disabilities will rely on present sources primarily and frame the clearer definitions of ailments using historical figures and findings. Another advantage exists in the retention of authorial sources such as Seneca and Celsus that provide sufficient detail not only about the actual interventions taken for public health but also a reflection on why the measures were taken. Limitations exist in two important considerations: first, the ancient sources are not infallible because the authors may have acted as historians of today – compiling information that they were not necessarily experts of and therefore being

limited in veracity to the degree of personal research and investigation they carried out. Second, there is no outright designation made by sources regarding the initiatives as "practical" or not; the initiatives simply existed and were carried out.

The second limitation ultimately is what this investigation seeks to answer. Were the measures the Romans took effective in answering their plights? There is the explicit answer found in comparing the disease to the initiative and judging whether the answer addressed the issue to which but there is also an implicit answer in the degree the undertaking resulted in a change of great magnitude. Since there is a dearth of epidemiological or cause-effect analysis from the Roman period, the best method by which to answer the question of practicality will be to determine whether the Roman changes to medicine continued to contribute after their inception. If the change was added to the growing repertoire of medicine, then it can be deemed effective and practical, but if not, then it will be understood to have been not wholly practical even if important.

CHAPTER TWO

Diseases and Doctors: The Illnesses Contended by Rome

Introduction

The scope of this paper regards the presence of physicians in the Roman empire in various fields such as the military and within civic society. Before one can delve into such a topic, it is important to gain an understanding of what diseases the Romans were either directly or indirectly combating. This would influence both governmental initiatives and the focus of individual physicians. Furthermore, through an analysis of the diseases found in Roman antiquity and the response made by the Romans, the question of whether they regarded medicine in a practical perspective can be answered more completely. Although there are certain limitations to this undertaking, such as having to extrapolate endemicity of diseases based on modern factors, archaeological and historical data exist that would support the investigation. The diseases that plagued the Romans are still extant but now regarded as diseases of disability, poverty, or because of living in a tropical or subtropical climate. All three of these modern factors applied to the Romans just as well, compounded by the simple fact that the medical scene of the time lacked antibiotics, antidiuretics or any other drugs to combat the pathogen or symptoms. This chapter will discuss some of the most prominent diseases and disorders experienced by the Romans and will introduce the initiatives by which they grappled with and addressed the conditions.

Malaria and Thalassemia

The Mediterranean basin is home to not only substantial human civilizations, but abundant populations of mosquitoes and other infectious arthropods. Certainly, the Romans did not know of the intimate connection between *Plasmodium* and *Anopheles* mosquitoes, but they did understand and theorize that something about the presence of mosquitoes was detrimental to health. Horace, during a journey along the Appian way, records in his *Satires* that the swamps were difficult to cross because *mali culices ranaeque palustres avertunt somnos* "malicious mosquitoes and boggy frogs turned away sleep" (Horace *Satires* 1.14-15).[1] Horace's isolation of *mali culices* in addition to the *palustres* suggests that mosquitoes were notable to Horace for correlating to ailments or being the epitome of pestilence. The region Horace was crossing was undoubtedly the Pontine Marshes, notable for their stubbornness against efforts to drain the waters until the 1940s. These pestilent marshes were a perfect breeding ground for malaria due to both geographic features and Roman endeavors; geographically, the region is bounded by arid mountains towards the spine of Italy and a sandy barrier on the side. Within this is a depression that permits water flow to be retained with no outflow (Frost 1934, p. 586). Add onto this the effects of Roman construction, the *Via Appia*. The construction of the road consisted of packed gravel and earth for a considerable segment and joined a southward continuation with a wooden bridge spanning the River Liris. Here, the marshland was drained enough so that cultivation of Rome-bound crops may be undertaken, but due to the need of wet soil for the crop production, there was not full drainage (Evans 2013, p. 300). Nor could there have been complete drainage even if that

[1] Unless otherwise noted, all translations are my own.

was the goal because the construction of the road itself functioned as a barrier – the road was raised sufficiently above the marshes to act as a dam and prevent the runoff from passing through. A canal was present, but even here the presence of any standing water served to retain a large enough breeding population of mosquitoes to maintain endemic levels of the disease. Post 1940s mapping perhaps undercuts the prevalence of malaria, but Luigi Torelli's map of malarial distribution throughout Italy presents a more accurate situation to what malaria in Roman Italy would have seemed:

Figure 1. Luigi Torelli, map of malaria in Italy at the scale 1:1,500,000, reproduced in Carta della malaria dell'Italia (Florence: 1882)

Here, the darker region corresponds to the highest levels of incidence, and both Rome and the southern branch of the *Via Appia* fall within such a region. The reason this map was chosen as an approximation of the malarial extent during the Roman period is twofold: one, a map from 1882 lacks the bias of having a curbed, lowered prevalence due to control methods arising from chemical and infrastructural changes in the 20th century and two, because the Torelli initiative was spurred on by the development of a railroad network, mirroring the construction of the Roman roadway.

Now, since the presence of anopheline mosquitoes in Rome during the Republican period has been established, it is fitting to discuss why the Romans would have had to address malaria and why their success in doing so was limited. First, the region surrounding Rome is endemic to two mosquito species suitable for the transmission of malaria – *Anopheles atroparvus* and *Anopheles labranchiae*. While both are related species, *Ae. atroparvus* can complete their life cycle in brackish or saline water and *Ae. labranchiae* can survive in higher altitudes. This results in the habitat of both species extending into the region the *Via Appia* spans and preventing the complete elimination or control of the threat since the undertakings would be different for these two species. Compound this with the lack of scientific knowledge regarding vector-borne infections or a germ theory in general and so the marshes became a sanctuary for these *mali culices*. Furthermore, the partial reclamation of the marshes during the Republican period and the development of agricultural regions filled not only constantly irrigated fields but also livestock and human built shelters facilitated the retention of these species seasonally. Both of the mosquito species lower in activity during the cooler months and

perform either migration for up to 3 kilometers to find overwintering sites or become dormant within closed shelters ("*Anopheles atroparvus* – Factsheet for Experts", 2014 and "*Anopheles labranchiae* – Factsheet for Experts", 2014). Human shelters and stables that were parts of the colonization process following the development of the *Via Appia* made it so that the mosquitoes did not have to migrate out to overwintering sites and instead could hide within the shelters and feed on a ready supply of livestock or human blood. The exacerbation of malarial burden was so heavy at a point that the population of the Pontine Marshes collapsed and did not recover for nearly 2000 years until the time of Mussolini (O'Sullivan et al., 2008).

This is not to say that the Romans lacked biological knowledge about malaria completely, but in a pre-microscopic time, the brightest physicians could only diagnose and treat symptomatically. Even in pre-Galen Rome, Celsus had identified a seasonal fever that presented as *quotidian*, *tertian*, or *quartan*, all three malarial diagnoses used in modern infectious medicine (Reteif et al. 2004, p. 132). Not only does Celsus describe the general temporality of the fever varieties, but provides prognoses of notable fevers, alerting other physicians of the time on when to prepare anti-febrile treatments and therapies:

> *Atque haec quidem sanis facienda sunt, tantum causam metuentibus. Sequitur vero curatio febrium, quod et in toto corpore, et vulgare maxime morbi genus est. Ex his una quotidiana, altera tertiana, altera quartana est: interdum etiam longiore circumitu quaedam redeunt; sed id raro fit: in prioribus et morbi sunt, et medicina. Et quartanae quidem simpliciores sunt. Incipiunt fere ab horrore; deinde calor erumpit; finitaque febre biduum integrum est: ita quarto die revertitur* (Celsus, *De Medicina,* 3.1)
>
> But there are [treatments] to be done by those healthy ones who nevertheless have cause to be timid. There follows a treatment of fevers, which is borne in the whole body and is borne to be exceedingly rampant in morbidity. From these [fevers], one is quotidian, another tertian, another quartian; amongst these some return in

> longer cycles; but it is rare: in the former there are both various treatments and medicines. And the quartan ones have somewhat simpler symptoms. They often start with shivers, next a warmth erupts; and with the fever ended, there are two days in-between: thus on the fourth day it returns.

What is notable is that modern analysis of remains suggest that *Plasmodium falciparum*, one causative agent for malaria, was the most widespread variant of the *Plasmodium* genus throughout central Italy (Marciniak et al. 2016). *P. falciparum* is interesting because it does not follow as strict a fever cycle as *P. vivax* or *P. malariae*, two other species endemic to Mediterranean regions, but can sometimes adopt a malignant variant of tertian fever. The extrapolation made here is that the cases Celsus saw of definite cyclical fevers must have originated from immigrants stemming from Roman expansion. Ancient sources provide some evidence towards this theory, if looked at in the reverse direction – Fabius Maximus acquired symptoms suggestive of malaria in Gaul in 121 BC and Julius Caesar remarked that the autumn of Gaul was more salubrious than autumn in Central Italy (Cilliers and Reteif 2000, p. 133). Maximus demonstrates that a more cold-tolerable organism was present in Gaul to infect individuals with malaria, fitting the description of *P. vivax* and Caesar's comparison of his experiences in Gaul with his bout with quartan fever during his hiding from Sulla suggests a presence of *P. malariae*. Even Cicero, in his correspondences with Atticus communicates how the latter fell ill with a quartan fever lasting from September of 50 to May of 49 BC. He even notes the remission of fever experienced by Atticus in February of 49 followed by a resurgence of symptoms, all of which are confirmed by modern studies into malarial fever (Cilliers and Reteif 2000, p. 133). The casual connection between boggy environments and the potentially severe fevers influenced Marcus Terentius Varro, who

by 100 BC stated that small swampy animals were the cause of malaria. This observation and other similar ones ultimately carried the Romans to deciding that large-scale drainage projects could perhaps alleviate the pestilence (Hart 2001).

Whereas the Romans could not cure or prevent infection from malaria properly, nature had attempted to confer some form of immunity in the form of another condition, thalassemia. Thalassemia is a genetic disorder of hemoglobin in humans that correlates with poor infectivity by *Plasmodium* due to changes in red blood cell (RBC) structure (*Genetics Home Reference – Beta Thalassemia* 2020). Essentially, there is a shortage of RBCs in the affected and while this leads to anemia, the hemoglobin alterations prevent *Plasmodium sp.* from being able to degrade hemoglobin (a toxic compound for their metabolism) to hemozoin. Nature, therefore, provided those living amid high malarial transmissions with an alternative but more manageable disease – anemia. Furthermore, if the thalassemia was the major variant, the individual would have a highly truncated lifespan, ensuring that the only necessary treatment one would expect for a decent life would be anti-anemia measures. Now, it should be said that the ancients did not have access to safe blood transfusions or the like, but dietic treatments for anemia were well known. Interestingly, the most common dietic treatments for anemia, consuming iron-rich foods such as bone marrow and animal organs, were also used as treatments for epilepsy, and current medical studies have shown that epilepsy and seizures have a positive correlation with iron-deficiency (Fallah et al. 2014). Again, what this shows is that Roman healthcare practitioners were well-versed in treating symptoms arising from valid and significant diseases throughout their territory. Even if physical changes in geography or sanitation did not work, experimental treatment and a medical corpus built

from intervention and observation were effective in consideration of the pre-microscopy world.

Camps, Cuts, and Coughs

Roman camps were ideal in presenting patients with a variety of conditions – both traumatic injuries through battle and infectious diseases through camp living and being on campaign. The specifics of disease in distress will be covered thoroughly in a later chapter, but this subsection has the main goal of illustrating the condition of the camps and providing background on some common conditions found within. Inference must be made at some sections because biological matter has a habit of decaying but the evidence for trauma or disease can be found within archaeological remains and other assorted relics, not to mention written accounts. Additionally, the exact ages of the injuries and archaeological discoveries are more varied due to the inherent difficulties regarding post-mortem forensics of bodies more than a couple thousand years of age, not to mention the inherent limitation of this chapter's structure that prevents a comprehensive discussion of every possible condition. Therefore, certain case studies will be used from which the prevalence of distress could be extrapolated to the broader society.

The first discussion should be made regarding physical or traumatic injuries, primarily due to their significance in the field of war and the simple fact that such injuries could be treated by physicians with accessible instruments. The investigation of weapon injuries among 641 individuals from Zadar (Iader) in Croatia revealed that weapon injuries fell into two broad categories and did not necessarily result in fatalities. The two

categories are sharp-force lesions and projectile injuries and both these types of injuries are found to be either antemortem or perimortem (Novak 2013). Consequences from this include the blood loss from the wound, possible damage to vital organs, and importantly, secondary infections. Infections were so grievous not only due to the lack of antibiotics or antiseptics for immediate first aid, but also because pathogens could be introduced during both the injury and afterwards in camp clinics or even the *valetudinaria*, the usually fortified field hospitals used by the Roman army from the late 1st century AD onwards. Three pathogens stand out as especially important: tetanus, gas gangrene, and infectious blood sepsis. Tetanus, caused by *Clostridium tetani*, an anaerobic bacterium ubiquitous in soil, would have thrived in deep penetrating wounds. It also forms endospores, dormant but durable cells that would have survived environmental factors long enough to enter the victim's body and cause extreme muscle spasms and deadly paralysis. Gas gangrene caused by *Clostridium perfingens* is also soil-borne and would cause muscle necrosis once introduced in deep wounds. Finally, septicemia caused by *Staphylococcus bacteri* would also have resulted in heightened death rates. In fact, extrapolation of pre-World War I data to correspond to ancient warfare suggests that 13.8% of wounded soldiers would die from initial shock or trauma, with 6% developing tetanus (80% mortality), 5% developing gangrene (80-100% mortality), and 1.7% contracting sepsis (83-100% mortality) (Gabriel and Metz 1991, pp. 98-99). In total, mortality rates due to these three infections easily reached 24% of soldiers. It is to be noted, however, that in the case of tetanus and gangrene, the ancient practice of rinsing a wound with wine or vinegar and not immediately bandaging it allowed for oxygen to

penetrate the wound and kill some of the bacteria, thereby reducing the incidence somewhat.

Although military medicine would have assuredly required combating these diseases, there is another category of disease that would have been rampant throughout army camps – arboviral diseases. The section on malaria briefly discusses the phenomena whereby military campaigns introduced foreign diseases to the Roman populace, but there is evidence that suggests the camps themselves did not need to travel much to spread infections. A notable example of one such disease is scabies, and this notable disease affected a very notable man – Sulla. The evidence regarding what ailed Sulla is divisive, but all the conditions were common diseases in the camps and environments Sulla would have contacted, and so, they provide a definite disease background for the Roman soldier. Scabies is an infestation of the human itch mite, *Sarcoptes scabiei* that commonly presents as scarred lines throughout an infected site. Some of the greatest risk factors for scabies includes cramped living conditions and prolonged skin contact with an affected individual – and among adults, sexual transmission of scabies is exceedingly common (*CDC - Scabies - Epidemiology & Risk Factors* 2019). Sulla undoubtedly experienced a combination of these conditions, the very establishment of military camps ensured that he would have been in frequent contact with a variety of soldiers and, as Plutarch put it "with actresses, harpists, and theatrical people" (Plutarch *Sulla,* 36.1). Of interest is "actresses" which may have included physical companions left Sulla with a souvenir during his rambunctious years. Certainly, this would be true for other soldiers who enjoyed creature comforts during their time abroad and even Celsus notes that

scabies was a thoroughly studied disease with its own bevy of treatments at hand (Celsus *De Medicina*, 5).

Nevertheless, although scabies is reasonable for Sulla to have acquired due to his lifestyle, it fails to explain the facial scars he developed. Equally likely is cutaneous leishmaniasis, caused by *Leishmania infantum, L. major,* or *L. tropica* imported by trade and war from north Africa to the rest of the Mediterranean basin by the time of Rome. The cutaneous variety of leishmaniasis is the most common variety and explains the persistent skin lesions which can last many years but does not result in the type of skin lesions Sulla was noted to have, nor does it necessarily cause the progression of symptoms the dictator is said to have experienced (*CDC - Leishmaniasis - Resources for Health Professionals* 2019 and Cillers and Reteif 2000, p. 38). Cutaneous leishmaniasis, however, can provide an open wound for secondary, opportunistic pathogens to invade and cause further distress to the body. This would have been a significant issue for soldiers to contend with as the wounds could also inhibit a full range of motion and impair performance on the field. The greatest burden of leishmania would have been the psychological burden – soldiers undoubtedly would have attempted to hide away the disfigurement due to the stigma against grievous wounds. Nor could the medical professionals have helped terribly much for leishmania even in a modern era of medication is still considered a neglected disease and is morbid for the same stigmatic reasons of the past.

The only notable disease capable of disfiguring and eventually killing Sulla while being present amongst the soldier population would be tuberculosis. Tuberculosis, caused by *Mycobacterium tuberculosis* is an ancient scourge that was simultaneously revered for

its dramatic symptoms and feared for the death it often brought. Pliny comments on the permanence of tuberculosis using an experience with Zosimus, a servant:

> *Nam ante aliquot annos, dum intente instanterque pronuntiat, sanguinem reiecit atque ob hoc in Aegyptum missus a me post longam peregrinationem confirmatus rediit nuper; deinde dum per continuos dies nimis imperat voci, veteris infirmitatis tussicula admonitus rursus sanguinem reddidit* (Pliny the Younger *Letters Liber V: Plinius Valerio Paulino Suo*, 6).
>
> For some years ago, he exerted himself by too great a summoning [of voice], that he vomited blood after which by me he was sent to Egypt and after a long leave of absence, he soon returned; next while he had commanded his voice substantially for the following days, he was reminded of his old disease by a return of his cough and a retching of blood.

Pliny conflates the coughing up of blood as a condition of vocal strain, but the returning cough and hemoptysis suggest an infection by tuberculosis as a more probable cause. Tuberculosis, however, can lay dormant in the lungs but also cause a systematic infection, including that of the skin. This type of tuberculosis, tuberculosis luposa, presents most often on the face and corresponds to the type of rash expressed on Sulla (Cilliers and Reteif 2000, pp. 39-40). The only possible route of preventing infection among the camps by tuberculosis would have been quarantine, a practice that would have undoubtedly taken both manpower and resources out of the campaign and would have not necessarily been practiced. Therefore, tuberculosis, like the secondary infections from wounds, would have been the deadliest threats to camps throughout the Republican period, the various bandits and enemy factions dwarfed in danger by microbes.

Water and Crowds

The camps demonstrated that foreign diseases were contracted and imported by the military, but there are also the diseases found within the walls of the city that had high

mortality and morbidity rates that would shape healthcare practices of Rome. Plagues and gastrointestinal distresses are two broad and poorly defined categories present in ancient sources, but in terms of a modern audience, they can be thinned into two refurbished groups: viral endemic diseases or epidemics and food or waterborne illnesses. These diseases, while not comprehensive, are wonderful in explaining why they would be important considerations to Roman public health and how they may relate to some of the infrastructural interventions within Rome.

Malaria is the only confirmed disease of significant weight to have impacted Republican and early Imperial Rome, but the historic Antonine plague, which most resembled smallpox, suggests that there was a circulation of the *Variola* virus in Italy already. There are numerous accounts of plagues spreading throughout cities such as Athens, but these literary references only come about due to exceptional increases in incidence. If the disease were endemic, having a constant presence with similar annual incidences, then it may be that historians simply considered it a consequence of urban living or being crowded. To compound this limitation further, the reports of plagues that had Rome as a focus only occur five or so times from 150 BC to 200 AD (Scheidel 2009). This is purely a limitation of evidence and not of disease case because the lifespan of the average Roman was much too short to definitively rule out that innate health-keeping practices were enough. Therefore, it is impossible to rule out the lack of influenza, measles, or other viruses in Republican Rome; in fact, the more possible outcome is that these viruses were more virulent in Rome because of urban crowding and a lack of a vaccinated populace.

Although viral cases are not easily distinguishable due to the similarity in symptoms, bacterial infections of the gastrointestinal tract are much better recorded. Celsus even says that if a patient comes in with fever, Asclepiades recommends treatment so long as the treatment does not result in a gastrointestinal upset: *Antiqui medicamentis quibusdam datis concoctionem moliebantur, eo quod cruditatem maxime horrebant*, "the ancients tried to work on such fevers by giving certain medications, for they feared indigestion the most" (Celsus *De Medicina,* 3). This insinuates that whatever was causing the indigestion was not only annoying to the sufferer, but also had the capability to be deadly. Only a few diseases fit such a category, the first being *Salmonella typhi* and the other being *Escherichia coli*. Both bacteria are significant pathogens historically and contemporarily and intimately intertwine with Roman infrastructure. The challenge here is that while these pathogens can be food or water borne, there is little recorded public health interventions for food quality control but there is an abundance of resources on water control. Aqueducts brought a constant supply of water into Rome and there is little doubt that this resulted in an access to water that other premodern cities did not have, but the aqueducts were not closed systems and were not sentient beings that could prevent infection of the resource within the city (Scheidel 2009, p. 9). The benefits and limitations of aqueducts will be discussed in a later chapter, but the simple fact of the matter is that there is far too much correlative information suggesting the high prevalence of these two diseases to state that water supplies were truly effective in eliminating disease.

Regarding *E. coli*, the bacteria is commonplace because it inhabits the large intestine of humans and while there, participates in the synthesis of vitamin K, an

important metabolite. Some bacteria are shed from every human during defecation, and if this waste is proximal to water or food, the bacteria will colonize the material and potentially become infective when eventually ingested (*Resources for Clinicians and Laboratories E. Coli* 2019). This means that even if the purest meltwater from the most isolated mountain was brought into Rome, the very presence of humans participating in biological activity would result in the potential spread of infection throughout a family or community.

Conclusion

The Romans were besieged with the same hidden threats that modern society must contend with, and although their actions may have at times exacerbated their own distresses, ingenuity would be demonstrated to effect a radical change to their ecological state to survive as a civilization. Malaria, infections in wounds, and endemic or epidemic infections all long called Italy home before an Aeneas ever made landfall, yet the presence of such an ancient force was not enough to deter colonization, incorporation, and *imperium*.

Now we must specifically discuss where each of these categories of disease fell in the development of medicine as a practical science or philosophy in Rome. The first, malaria and thalassemia, led to the Romans having to embrace their scientific limitations and develop alternative but still practical methods of addressing an issue. Celsus demonstrated that observation was a powerful tool in determining a diagnostic procedure – that of serial fevers. Modern science realizes *Plasmodium* infection requires a chemical

intervention, but the Romans saw fever and knew the general symptomatic care for such an ailment. Much as how natural selection can only work with the genes already present, Celsus took whatever knowledge was present and applied it to a variant disorder. No radical invention was made or necessary, and the success of his practices may not be possible to measure empirically, but the very idea that Roman society existed in the presence of malaria for many centuries demonstrates that some intervention had worked. The thalassemia that conferred protection to some individuals of the past is retained in the continuation of those ancient lineages today, presenting the idea that anemic therapy was practiced even limitedly.

Second, military injuries and management of their secondary conditions showed that the military field was the ideal crucible to become familiar with novel diseases and to practice surgical and clinical techniques. Water and wine or vinegar on a wound to limit the effects of tetanus demonstrated that the Romans did fine enough without phenol or betadine to survive and propagate their culture long enough to put Gaul under the yoke. Credit must be given to the Romans for having had a similar rate of survival to pre-World War I soldiers, demonstrating that modern medicine is really only a few centuries old and that before then, the Roman method and its derivatives had survived fairly unchanged for millennia.

Finally, Rome was to be envied for its water supply but also admonished for having gotten so close to a remarkably modern system but ruining it at the very conclusion. Essentially, the Romans showed that practical and grandiose public initiatives were ideal in the sense of a platonic ideal – human ingenuity and labor would be undone by the simple fact that humans are biological and prone to error. Nevertheless, there was

a precedent set for the casual connection between clean water and a healthier populace, but this topic is deserving of further depth. To the credit of the ancients, however, in the sense that both *Salmonella typhi* and *E. coli* are diseases present in the modern world with "better" water sanitation – perhaps suggesting that medical practicality reaches only so far, and that individual cognizance is equally important.

Disease birthed ingenuity and industry spurred on by an adamance to carve out a living in a hostile environment. Whereas societies usually adapted to the geography they inherited, the Romans demonstrated that the environment could be coerced to adapt to the presence of humans. Although not all their endeavors bore fruit, the possibilities made by the undertakings led to future societies taking inspiration from ancient works and applying them in a newer and more technologically potent society. The word *maturus* comes to mind – not necessarily that something has achieved a certain age but that the time is ripe for execution. If the Romans were the gardeners who planted the seeds of anthropomorphic change leading to survival, then modern societies are the harvesters who found the fruits to have finally ripened.

CHAPTER THREE

Medicine and Wellness in the Camps: The *Medici*

Introduction

Medical practices in the Roman military serve as tangible examples to the degree by which medicine impacted the Roman identity. The military itself is an embodiment of the Roman identity – even Livy records how Rhea Silvia, mother to Romulus and Remus, claimed she was impregnated by Mars, binding the foundation of the city to an armed spirit. Therefore, since the military, Roman identity, and medicine are all related, surely medicine should occupy the forefront of military practice; but the relationship is more complicated than such a linear association.

There are two main types of sources that will allow discussion on the matter of medicine or wellness in the military: written records or theses and archeological evidence of both large structures and smaller tools and personal affects. The question is not whether physicians existed in the army or if the health of the army was a part of military science – both these concerns are addressed in the writings of individuals such as Vegetius (Vegetius Translated by Milner 2001, p. 65). The question remains as to what sort of organization the *medici* had – in terms of education, types of common practices, and even government or military support through the presence of clinics, formal pay, etc. If there is a system of sufficiently robust organization, then it supports the notion that the military doctors were put to a higher standard than the usual rabble of quacks or untrained charlatans so common in the streets of Rome. Furthermore, understanding the

medical practices carried out in the field would at least partially address to what degree the medical advancements in the Roman military complimented its success and how much of the treatments done in the camps contributed to the extinct and extant medical corpus.

Developmental History of Field Medicine

The discussion of why and how the Roman army developed a medical system leads into another question – did the Roman military follow an altruistic or utilitarian perspective towards their troops? In other words, did the Romans want to heal those wounded in war because it was the right thing to do or because there was a military advantage in not only maintaining the health of the army, but restoring soldiers to battle-standard. The answer to this question can be gained through analysis of the historical foundations of military medicine and how the Romans applied a history of health into their expansionist operations.

First, there is a definite mythological and semi-mythological record throughout Hellenistic and pre-Roman sources that describe how wounded soldiers were not relinquished to their fates but actively rehabilitated. For example, Eurypylus, after being wounded by an arrow, was carried off to be cared for by Patroclus (Prioreschi 1998, p. 538). This was not just a comment on the virtue of Patroclus but an embodiment of practice. Furthermore, the *Iliad* has an admirable level of understanding for the arrowhead extraction procedure that suggests such care was routine enough to have been known by individuals outside the medical field (Homer *Illiad,* Xi 842-848). Surgery was

also practiced on the field if Homer is to be believed; Machaon, son of the god Asclepius, performed the first documented arrow extraction and wound bandaging on King Menelaus (Filippou et. al 2020). Although Homer's detailed account suggests a fairly wide distribution of knowledge regarding basic field medicine, it is important to establish that according to later sources, such intensive care was reserved only for the most prominent warriors and the basic soldier would most likely not have received the same level of care. When Aeneas was injured, the physician who worked on him was none other than the goddess Venus who used the *dictamnum* to heal his bleeding after the failure of the physician Iapyx in surgically extracting the arrowhead (Prioreschi 1998, p. 539). A goddess caring for her own son after a renowned physician failed carries much more weight as to the specialization of the care than what would be expected for the general body of the army. These findings may make it seem that the chance of receiving care was poor for the ordinary soldier, but certain cultural assurances demonstrate the backbone upon which medical care would ultimately become more ubiquitous. From the start of warfare, a wounded soldier could expect to at least be carried off to safety if possible, already increasing chances of survival (Prioreschi 1998, p. 539). In addition to the benefits of being removed from the battlefield, Greek physicians-in-training would be stationed in the camps, and these students might have dealt with non-celebrity warriors for their training, reinforced during the Roman era since Greek physicians were still in demand.

Now, moving onto the Roman era after enough military science had been developed, the dominant theme of military medicine becomes one of avoiding the need to use healing procedures. Vegetius records that military officers had determined that "daily

exercises in arms were more conducive to soldiers' health than doctors" (Vegetius translated by Milner 2001, p. 66). This may seem counterintuitive to a modern audience, but this preference was more lifesaving than placing a soldier under the blade. Even by Galen's time in the second century AD, surgery frequently experienced failure due to a lack of antibiotics, antiseptics, anesthesia, and pre or post-operative care (Prioreschi 1998, p. 470). Additionally, the general tendency of warfare in the classical period followed a "winner-take-all" logic; that is, the victorious army experienced few losses in personnel while the defeated forces were practically wiped out.

During the Republican era until about the time of Caesar, most Roman military endeavors were much more limited in spatial scope than during the expansionist years of Late Republican to Imperial Rome, therefore allowing for the quartering of the wounded in allied cities. This was still the preferred practice during Caesar's campaigns, as seen when he recorded in his *De Bello Civili* that he had to retreat to Apollonia to quarter his injured soldiers (Prioreschi 1998, p. 541). There was a societal expectation of generals to follow this procedure – a general who refused to provide refuge for his wounded would be considered cruel and poorly capable (Scarborough 1968, p. 255).[1] This pressure placed on the generals alongside their zeal for greater and greater achievements most likely resulted in the increasing employment of physicians alongside the legions. An important consideration, however, is that the first of these physicians most likely followed the Hellenistic model – that is, as personal attachments to the commanding officer and not a member of the legion (Scarborough 1968, p. 255). Alongside these more professionally trained physicians, there must have been troops trained in first aid responding to the

[1] See Note 3 in Scarborough 1968 for primary sources.

needs of the rank-and-file unless lest the officer be unnaturally generous in sharing his physician.

Uncertainty exists at this distinction because Cicero in his *Tusculanae Disputationes* laments that a young soldier laments in pain while a veteran bears the dressing of wounds in a tempered way*: at vero ille exercitatus et vetus ob eamque rem fortior medicum modo requirens*, "but the older and stronger soldier only requires for the *medicus* to do the same" (Cicero *Tusculane Disputationes*, Liber II 38).[2] The *medicus* in this case is treating both a green and a veteran soldier, both of whom seem to be of a more common stock than the venerable names found in mythological scenes of battlefield health care. Certainly, this means that the *medicus* was not the commander's personal physician who was treating the soldiers, and neither is it a fellow soldier acting like a *medicus*. Cicero provides a portrait of some intermediary – a non-combatant whose job was to heal anybody in a legion that was injured in battle.

The Identity of the Medicus

The question of whether the Roman army was practical or altruistic regarding medicine correlates to the position of the *medicus* in the army. Whether the *medicus* was a member of the army hierarchy or if he was a private individual who happened to practice his craft amongst soldiers will reveal just how intimate the military-medicine connection was. It is necessary to set some foundations for analysis; one of the most critical of these foundations is to suspend the tendency to relate the logistical practices of

[2] Unless otherwise noted, all translations are my own.

a foreign and past civilization to a modern framework beyond reason. For example, the terms "professional" and "formal" will be used but only in reference to the *medicus* and the army.[3] One cannot expect modern notions of professional doctors or medics to apply to the Roman era, even if by the imperial period there was a distinct improvement in organization thereof. The questions, therefore, will be: was the *medicus* a soldier first or a doctor first, why did Rome decide to incorporate physicians into the army, and what role was accomplished by the incorporation of solider-physicians?

The first of these questions is of interest because the *medicus* was not a rank by itself – rather, there were distinctions between the *medicus legionis, medicus ordinarius, medicus cohortis* and so on. What is of agreement is that by the time of Caesar and Augustus, the role of the *medicus* had become more formal than in the past in terms of being a dedicated healer in the army. Therefore, the *medicus* was a true soldier-doctor, like the medics found in various military branches of the modern world. One argument towards this comes from the notion that the *medicus* must have taken the military oath when he joined the military, becoming a soldier by default (Nutton 1969, p. 262). Furthermore, demographic information garnered from inscriptions and in text suggests that the *medici* were of the correct age for military service. A tablet dedicated to Ancius Ingennus, a *medicus ordinarius* who died at the age of 25 exists, insinuating that Ingennus had started military service long enough ago to have risen to a respectable *medicus* rank by the time of his death (Scarborough 1968, p. 258). Celsus had mentioned some characteristics of surgeons that hearken to the qualities a *medicus* ought to have,

[3] For further limitations on modern terminology regarding the Roman Army, see Vivian Nutton, "Medicine and the Roman Army: A Further Reconsideration". *Medical History* Vol 13, 1969. P. 261

and considering that both professions often dealt with traumatic medicine, the demographics for the groups seem to overlap:

> *Esse autem chirurgus debet adulescens aut certe adulescentiae propior; manu strenua, stabili, nec umquam intremescente, eaque non minus sinistra quam dextra promptus; acie oculorum acri clarique; animo intrepidus; misericors sic, ut sanari velit eum, quem accepit, non ut clamore eius motus vel magis quam res desiderat properet, vel minus quam necesse est secet; sed perinde faciat omnia, ac si nullus ex vagitibus alterius adfectus oriatur* (Celsus *De Medicina* 1971, Liber VII).
>
> A surgeon should be an adolescent or at least close to an adolescent; with strong hands, stable, which never shakes, and just as able to use the left as well as the right; with sharp and clear vision, and an intrepid spirit; thus with pity, so that he wishes to cure who is accepting [the cure], not so that he is moved by his clamor either to go faster than what the matter desires, or to cut less than what is necessary; but he does all things just as if the cries of pain cause him no emotion.

Not only does this reveal who could become a potential *medicus* from the ranks of the soldiers, but the constant military training would be the perfect crucible to continue tempering a doctor. Essentially, the sphere of war would be the ideal environment to temper doctors from the soldiers, contributing to the notion that the *medicus* was a soldier by the time he became an experienced enough physician. A visual example of how the *medicus* was virtually indistinguishable from the general population of soldiers can be found on Trajan's column:

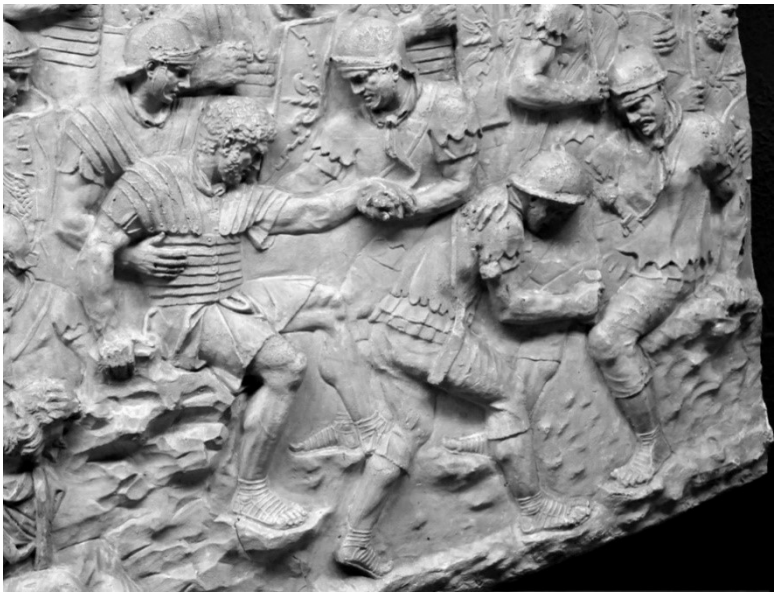

Figure 2: Roger B. Ulrich, "Reliefs Scene-by-Scene on Trajan's Column in Rome". Dartmouth College, 2017. Trajan's Column Scene XL, Rome, early 2nd Century AD.

In this scene, there are two *medici* wearing the same uniform as that of their patients. One *medici* is examining the arm of a noticeably fatigued soldier and perhaps taking his pulse, the other, to the right of the scene, is bandaging a war-wound of a fellow. This portrayal corroborates the notion that physicians and medics were wholly incorporated into the Roman army system and served on the field directly for the practical reason that if first aid care was provided to the wounded in a prudent manner, survival rates of trained veterans would increase and contribute to further military success. Aside from the field, in the early *valetudinaria* which were usually designated tents within frontier camps for the treatment of wounded soldiers, the medical practitioners tended to multiple patients simultaneously, which, according to Celsus, made them different from "true physicians" (Nutton 2004, p. 191). Celsus may have been biased in this regard, but the perspective shows that there was some inherent difference

within the *medici* that placed them in a peculiar limbo – neither were they wholly soldiers or physicians but a hybrid thereof.

While the incorporation of a medical corps had a practical benefit to the military in terms of easier access to first aid, already trained physicians also had a practical reason to join the ranks. For one, certain protections existed towards army physicians, most notably being considered among the *immunes* on account of their responsibility in maintaining the health of the legion (Nutton 1969, p. 262). Essentially, a physician was expected to hone their craft and did not have to trouble themselves with the physical chores others in their cohort would be expected to. The monetary benefits were also notable; there is agreement between various sources that unlike other soldiers, the *medicus* received a *stipendum* as opposed to a *salarium*, like an officer of centurion rank (Prioreschi 1998, p. 546). A guaranteed salary would doubtless have been exceptionally attractive to the youth or to trained physicians who fell upon hard times, keeping in mind that physicians so well-celebrated and wealthy such as Galen and Celsus were rare and often employed by various noble courts. Furthermore, Augustus' tendency to self-promote worked to the benefit of the pre-medical corps physicians as he began the process of organizing the various semi-formally hired physicians under a scheme he funded – providing free medical care for soldiers in exchange for their loyalty to the princeps (Jackson 1988, p. 129 and Israelowich 2015, p. 93).

The duties of the physicians, whether they were *medici*-in-training or if they were physicians who joined the military for its benefits, were similar on account of the limitations to medical care. Although specializations of fields nevertheless existed, most of the post-incidence medical care in the army would have involved trauma surgery, first

aid, and some infectious disease care. Principal cohorts and legions had medical staff that corresponded to their station – Cohors IV Praetoria is noted to have had a surgeon and an internal ailment specialist amongst their ranks (Jackson 1988, p. 134). Nevertheless, a common set of responsibilities were present for all medical staff, a remarkable one being the selection of recruits.

Selection of recruits does not seem as though it would have a direct medical relationship, but what one needs to keep in mind is that even in modern society, medical factors do in fact influence selection of military members. Vegetius writes extensively on how a recruit ought to be chosen, for example:

> "the adolescent who is to be selected for martial activity have alert eyes, straight neck, broad chest, muscular shoulders, strong arms, long fingers, let him be small in the stomach, slender in the buttocks, and have calves and feet that are not swollen by surplus fat but firm with hard muscle. When you see these points in a recruit, you need not greatly regret the absence of tall stature. It is more useful that soldiers be strong than big." (Milner 2001)

These guidelines served the purpose of visually evaluating an individual as being fit for military service. One may consider this a type of preventative medicine – someone who would be unconducive to the strict training experienced in the military and the physical rigors of campaigning would be filtered out before their unfortunate physiology became a detriment to their health and the success of the army. Therefore, the evaluation of the recruits was a clinical and bureaucratic duty of the *medici*, a notion that corroborates the utilitarian need of military physicians. This aspect of their employment resulted in a streamlined and comparatively centralized recruitment process, but simultaneously, since there was a guideline on what a recruit ought to look like, there was a reciprocal action on

the identity of the *medici*, leading them to become more evenly trained in the art of physical evaluation and therefore allowing for a more cohesive body to form.

Conclusion

The inclusion of soldier-physicians by the Roman army into it ranks was a calculated, tactical, and utilitarian move that directly contributed to success in campaigns. The historical foundations of the medical body within the military demonstrate that either unconsciously or consciously, the classical Mediterranean cultures realized the benefits of preserving their troops. Although the rationale of the military planners and politicians might have been practical in nature, it is important not to forget that the reason why individuals were either chosen or they themselves chose the path of military medicine had a definite amount of beneficence tied to it. Those that went into military medicine had to have a personal volition towards helping a peer because although the *medici* were free from the need to do some menial chores, they certainly were not regarded as virtuous as the men in combat roles. Therefore, the *medicus* had to be an individual of not only physical and academic aptitude, but also one who realized that the best way he could contribute to the cause of the state was through preservation rather than a penchant for destruction.

Roman artifacts have also revealed that for the definition of "formalized" as would best suit the era, the *medici* were exceptionally organized. They had defined roles and purposes and slowly became regulated as much as any other military branch. Various tasks were outlined and as the Republic transitioned to an Empire and more resources

were allocated to a more centralized healthcare system than the traditional community-based model, these tasks developed into specializations and the resources into remarkably modern developments such as colleges and hospitals. Certainly, the early soldier-physician was homogenous with the rest of the army, but the career field developed rapidly. In fact, it could be argued that the *medici* acted as a liaison between the civilian academic life and the traditional rustic-militant life within Rome.

CHAPTER FOUR

Medicine and Wellness in the *Res Publicae*

Introduction

A constant question that has been investigated is whether the Romans saw medicine as a practical or altruistic measure. Although the presence of it in the military via the *medici* demonstrated that it was a definite practical measure meant to improve military efficiency, turnover, and success, the presence of the healing sciences and practices within the society in an organized form beyond what was practiced in the *domus* will demonstrate that utilitarianism was the philosophy beyond the camps and into the streets. As mentioned before, the Romans were not scornful of medicine or healing – they were scornful of Greek-style medicine. Yet, these hesitations gave way, especially around the fall of the Republic and the rise of the Augustan regime. Newly imperial Rome was a lucrative playground for the prospective physician –economic and social benefits combined with an abundance of vacant specializations to fill and identification of how and why to provide healthcare to both male and female citizens constructed a crucible in which public health became truly practical.

The following chapter will discuss the rise of physicians outside of the military in Rome due to economic benefits, availability of training facilities, and the opportunity to specialize. Doing this, the answers to what degree medical practice in Rome was practical will become clearer and the progression from domestic medicine to more public medicine will also be outlined. Although it will be difficult to determine causality regarding

whether the physicians or the opportunity for their discipline arose first, certainly correlations and a symbiotic relationship between the physicians and factors for their success will be elucidated.

Socio-Economic Reforms and Opportunity

Providing socio-economic benefits to physicians originated early in Rome, even during the immigration of the first foreign physicians and the shift from medical care and wellness being solely in the realm of the *paterfamilias* to those outside the domus. Pliny the elder writes that:

> *Cassius Hemina ex antiquissimis auctor est primum e medicis venisse Romam Pelopenneso Archagathum Lysaniae filium L. Aemilio M. Livio cos. Anno urbis DXXXV, eique ius Quiritum datum et tabernam in compito Acillo emptam ab id publice* (Pliny *Historia Naturale*, 29.6).[1]
>
> Cassius Hemina, one of the first writers, states that the first physician who had come to Rome was Archagathus, son of Lysanias, who had come from the Peloponnesus during the year of the city 535 [~219 BC] when Lucius Aemilius and Marcus Livius were consuls, and Quirite rights were given to him and a shop at the Acillian crossroads was bought with public funds for [his use].

At first, this seems nearly altruistic in its conception – a foreign, skilled physician arriving to a new city and being given citizenship seemingly easily, however, underlying public need was the overall mechanism for action. Medicine was not unknown to Rome nor was the importation of Greek ideas and gods unknown to Rome, but the immigration of Archagathus and his reception of citizenship and public funds for his work was an innovation brought on by the need to treat a growing city (Israelowich 2015, p. 13). The

[1] Unless otherwise noted, all translations are my own

growth of the city and a shift in lifestyle from rural to urban resulted in a constant need for healers and there were simply not enough *domi* for traditional healthcare or wealthy benefactors who would allow personal slave-physicians to treat the public. Both Caesar and Augustus realized this and implemented tax-relief programs and immunity from expulsion during times of scarcity, respectively (Prioreschi 1998, p. 577). Some may criticize that defining the immigrating physicians as "Roman" is a mistake, and that in reality these were Greek or foreign physicians simply practicing in Rome, but therein lies the validation for the labeling. There is no doubt that many physicians were of different ethnicities, but because they practiced within the boundaries of Rome and targeted the health of the Roman populace, they are Roman physicians for this discussion.

These benefits came with a trade-off meant to alleviate some of the grievances held by the general Roman society regarding physicians, namely that it seemed that anyone good enough at carving flesh could call himself a surgeon and that there were simply far too many slaves and foreigners mutilating good Romans. This trade-off was registration for citizenship, which would theoretically allow for monitoring and limiting on the number of physicians and some form of rudimentary quality control (Prioreschi 1998, p. 578). Although theoretically sound, the benefits were simply too great of a draw and Rome was often flooded with qualified individuals seeking public funds for their medical practices. This resulted in another series of legislation throughout the 2nd century AD where the number of privileged public physicians became limited per city (Jackson 1988, p. 57). The question yet remains, however, as to why there seemed to be such a rise in public physicians or at least those registering with the city and beginning to formalize the process. Some theories exist that suggest that the importing and noting of physicians

was an action by the state to provide a needed service and avert turmoil from a disgruntled sickly public, but the timing does not agree with this theory. Some of the most physician-favoring legislature arose during the time of Caesar and especially Augustus, which was a time period of relative stability as the Principate progressed. Essentially, the underlying factors that resulted in the governmental warming towards Greek medicine while authors and traditional Romans still held unfavorable opinions towards doctors can be summed in the phrase "expansion and integration".

Rome the city and Rome the state both overflowed their banks during the 1st to 2nd centuries AD. From a practical standpoint, the hallmarks of traditional Roman identity could no longer comfortably fit into the nature of a cosmopolitan city or country. Roman medicine was among these traditional values that had to be modified or replaced for practicality and effectiveness. Although wealthy enough families could still provide medical care within the home and rural individuals or those with a lineage of the craft could still rely on herbal remedies and techniques, there simply was a strict limitation of both populations when it came towards helping the greater society (Israelowich 2015, p. 18). Simultaneously, the eastward expansion of Rome led to more interactions with Hellenistic culture and emigrating individuals. These individuals came from a society that already had an established tradition of public physicians and were more than capable of filling the vacuum of a public health system in the Roman urban centers. Once this niche was initially filled, unlike with herbalists who required years of experience and great familiarity with local environments, the niche of public physicians could be propagated through existent apprenticeship systems already in Roman identity (Jackson 1988, p. 58). The apprenticeship system was also effectively intertwined with the body of physicians

because the Hellenistic foundations of the latter included comprehensive written documentation and access to an ancient corpus of texts.

There is a limitation here, however, which indirectly influenced the Hellenization of Roman public health. Medical books, just as any other books, were rare and often only accessible in the homes of wealthy individuals or in the libraries of wealthy cities (Jackson 1988, p. 58). Greece had such facilities in Athens, but not all aspiring pre-physicians could hope to possibly have access to the library, no matter how large. Within Rome, however, Greek texts including those such as the Hippocratic corpus may have been transcribed into Latin at least partially by this time and the students of the healing arts could emigrate to the city and subscribe their services to beneficent patrons or to public duty and further their education. Galen documents that three main sects were present in Rome by the start of the second century AD: Rationalists, Empiricists, and Methodists (Caldwell 2018). The Rationalists were the most directly influenced by the Hippocratic corpus and the other groups adapted and contested with the philosophies found within that medical school, demonstrating that medical science had entered Roman intellectual society by Galen's time. Empiricists, unlike the Rationalists, cared less about the origin of disease and more about the treatment and their thoughts influenced and helped refine treatment plans for diseases. Methodists descended from the Asclepiadean school and had a fluid and fragmented set of philosophies, but they demonstrate the generation of medical sects from within Rome itself, not from the importing and adapting of Greek schools (Nutton 2004, pp. 192-200).

Essentially, there was a symbiotic relationship between the immigration of Hellenistic physicians and the flourishing of Roman public health. The evidence suggests

that there was no strict causation regarding whether the environment led to the new public health paradigm or if the individuals led to the fostering of such an environment. Perhaps the most effective distilling of the question "why did the public physicians become more present in Rome during the late Republic and early Empire" was simply that as Rome expanded and integrated more land and more populations, the cosmopolitan identity called out with a question regarding how the health of its people could be improved, and the already developed Hellenistic model of public physicians answered the call. This is all to say that certainly the main underlying rationale was certainly the modification of traditional values to allow for foreign influence to address the practicality of preserving the health of a new Rome.

Medical Specialties

Physicians being adept or thoroughly trained in a certain field while still being familiar with other forms of practice is certainly not a new development. Nor was it a novel idea brought in by the increasing Hellenization of medicine during the 1st century AD. In fact, one of the most notable physicians of early Rome, Asclepiades, developed hydrotherapy as an innovative and popular treatment to the ailments of the Roman citizens that carried on from the 1st century BC onwards (Israelowich 2015, p. 20). What Asclepiades demonstrates is the basis of the development of specializations – a physician would begin to develop treatments he thought would lead to a result, and over the years of testing his theories on debatably unfortunate patients or cadavers, would at best be hailed as an innovator or at worst be lamented as a quack. Therefore, the question behind

specializations that connects to the practicality of public health is easy to determine – was there a need for the diversity or did the diversity arise from other factors?

Military physicians have been discussed in a previous chapter and surgeons were briefly mentioned, but both categories of physicians demonstrate that there was certainly a presence of different sets of expectations for healers based on what they claimed to focus on. Another example would be Pedanius Dioscorides, who began his training alongside the healing corps of the army but took the opportunity to hone a different sort of craft – herbal medicine. What is notable about this is not only does it show that an individual could switch disciplines, but also provides glimpses into the organic integration of newer medical practices into nascent societal tradition. Herbalists are known to have existed as a form of "virtuous healer" as the aristocratic Roman *patres* would describe, and so Dioscorides seems to have had some knowledge of this Roman tradition and brought a Hellenistic touch to it, even if unconsciously. Certainly Dioscorides based much of his work on knowledge already in circulation, but since this shift in public medicine involved improvements in record-keeping and dissemination of knowledge, his "[instructions] on collecting, using, and storing drugs from vegetable, animal, and mineral sources" brought the art of herbal healing from relative inorganization to codification (Osbaldeston and Wood *Dioscorides: De Materia Medica* 2000, p. xxii). This represents a method to separate a true specialization from interest – a true specialized discipline even in Roman medicine involves enough participants, a way to increase the longevity and transmission of the discipline, and sufficient innovation to make an impact. To make this distinction clear, it is easy to compare a medical specialty such as surgery to another common form of healing – magic. While surgery and magic

both may have multiple individuals practice it and while both may have made impacts on individuals and populaces, writings on surgery involve clear instructions regarding causation and effect and the potential to replicate the experiment or procedure through time.[2] Ulpian must have used a similar distinction for he states simply that while it is acceptable to have doctors who claim to heal only a certain part of the body, those who use incantations, spells, or exorcisms are certainly not doctors.[3]

Understandably, the variety of medical specialties was limited to two primary factors – the need to treat a certain condition and the actual ability for a procedure to have a degree of success rather than being an elaborate method of butchery. This is why surgery was such a progressive and popular specialty – the need was great because of injuries sustained by soldiers, laborers, slaves, and unlucky individuals. Furthermore, if a wound or injury required only basic "traumatic care", plenty of medications were known about and recorded by herbalists that had antiseptic properties of varying degrees (Jackson 1988, p. 68).[4] Aside from surgery, ophthalmology was another popular and effective medical field with military and civilian populations seeking services. The procedures for conditions such as cataracts were known even to Hippocrates and so there would have been enough familiarity with the anatomy of the eye and equipment in circulation. Ophthalmology also demonstrates another rule behind the formation of

[2] Galen is known to have had examples of anatomical functions derived from practice, such as how cutting the laryngeal nerves of animals and preventing vocalization showed a brain-voice connection. Jackson 1988, p. 62

[3] Found in Prioreschi, *A History of Medicine*. P. 594. Prioreschi's translation of *Digest* 50, 13, 1 – Latin text from Darrel W. Amundsen, "The Liability of the Physician in Roman Law", *International Symposium on Society, Medicine, and Law, Jerusalem, 1972,* Amsterdam, Elsevier, 1973, Pp. 17-31.

[4] For examples of the herbalists' perspectives, see Osbaldeston and Wood, *De Materia Medica* entries on turpentine (Book 1:90), pitch pine (Book 1:97), and for effects of wines (Book 5:11)

specialties as aside from acceptable survival rates and enough demand, it also served a practical purpose as witnessed within the need for eye surgery within the military. During campaigns, soldiers relied on visual cues such as gestures by commanders, location of the standard, and the need to aim projectile and melee weapons by sight. Therefore, eye injuries necessitated experienced physicians to treat them and so there is a recorded history of eye surgeries and procedures within the military *valetudinaria* (Belfiglio 2019, p. 63). Additionally, similarly to the relationship between herbal pharmaceuticals and surgery, herbal agents existed to soothe the eye after an invasive procedure but also to allay the symptoms caused by progressive diseases such as macular degeneration (Belfiglio 2019, pp. 64-65). Whereas herbalists pursued recordkeeping of existing knowledge and while surgery and ophthalmology represent a specialization after-the-fact, where a generally trained physician or medicus delved into a certain field more than his peers, there are those medical professionals who were specialized to begin with and continued to formalize the tradition in a remarkably significant way – the female doctors.

Midwives, Obstetricians, and Gynecologists

Easily among the most ancient medical professions both in Roman history and in human history, the midwife has played an integral role in the continuation of lineages, homebuilding, and societal proliferation. These three virtues of course resonated with the Romans and the midwife was easily a common denominator among the aristocrats and the plebeians capable of requesting their services. Around the same time that the role of physicians became more integrated in the Roman public health identity, midwives began a transformation from important but usually informal roles to more organized and

professional individuals. A significant thread that connects earlier practitioners to later practitioners is the gender of the individuals – female in nearly all cases. This detail is consistent in all pieces of evidence that will be discussed further in this chapter. Great discretion must be made to separate the root midwives from the diversifying female physicians and later midwives, the latter two groups which will be considered *medicae* for purposes of ease in this discussion. Also, although *medicae* were being trained more aptly during the late republic to the Principate, the general rule that modern labels cannot properly align with foreign cultures of antiquity and that reputation superseded any sort of "certification" in the modern sense must be kept at the forefront (Cilliers and Reteif 2006, p. 168).

First, it is necessary to discuss the possible origins of *medicae*. Evidence exists that suggests that they were the natural progression of the midwives already present during pre-Hellenistic medicine Rome, such as the existence of tombstones dedicated to female physicians by the 1st century AD.

Figure 3: Tombstone of a Female Physician. 1st Century AD, Metz. CIL 13.4334. Inscription reads: INI FIL MEDICA (A doctor, Daughter of Iunius) [5]

This tombstone suggests that *medicae* were not a burgeoning aspect of society, but an established class of individuals by the first century. There is no definite evidence that women such as the physician displayed above were descended from midwives, but the boundaries between the roles of midwives and true female physicians had begun to dissolve, especially in fields such as gynecology. Theodorus Priscanius and Galen both dedicated books related to gynecology and the anatomy of the uterus to midwives, demonstrating that at least the educational expectations for midwives had taken a distinctly more scientific route than earlier records (Jackson 1988, p. 87). Additionally,

[5] Image found initially in Jackson, *Doctors and Diseases*. P. 87. Further analysis comes from Raia and Sebesta, "The World of Work." *FeminaeRominae.org*

gynecology as a science was well-established and the obstetrical techniques of the time were remarkably effective on account of the thorough understanding of female anatomy. At the least, female physicians with high probability could be expected to treat disorders and disease specific to women, and the intimate relationship midwives already had with the women of a household would easily translate into becoming the foundation for the primary healthcare system for the women of Rome.

Second, the question arises as to what exactly the *medicae* practiced. A safe hypothesis is that female physicians practiced what would in modern times be considered obstetrics and gynecology, and the presence of texts dedicated to the female physicians corroborates this. Furthermore, the most common set of treatments for women's diseases involved dietic changes (Jackson 1988, p. 91). Inscriptional evidence of a female physician preparing either a topical solution or an ingestible solution in a pharmacy or workshop also shows that the way in which a male physician would prepare remedies for his patients extended to women by the Principate.

Figure 4: Medicae in a pharmacy or shop. Roman Gaul, 2nd Century AD. Epinal, France; Musee d'art ancien et contemporain. [6]

Aside from evidence that the *medicae* had similar workplaces to their male counterparts, the writings by contemporary physicians regarding the characteristics of a great midwife hearken back to the characteristics of a successful surgeon. A midwife must be: "well versed in theory" and have education in "all branches of therapy" (Jackson 1988, p. 97).[7] The need for a midwife to have such characteristics also seems to incorporate aspects of good public health practices, namely that if needed, a midwife could be summoned by the government with confidence in her skill if she had such characteristics and good reviews from her patrons (Israelowich 2015, p. 75). Midwives had a high degree of professionalism that rivaled that of their male counterparts that also

[6] Image from Raia and Sebesta, "The World of Work." FeminaeRominae.org

[7] Direct citation from the ancient source *Gynaecology I,* 3-4; translated by O. Temkin

showed itself in a distinctly bureaucratic measure. The reception of a newborn by the *paterfamilias* was a critical symbolic gesture confirming the legitimacy of the child, important for determining social and economic status for both men and women and further, military-political opportunities for a male heir. The midwife was responsible for preparing a formal report of this reception, and so demonstrated, much like male physicians evaluating potential military recruits, the recognition of medical duty in the structure of the public sphere (Israelowich 2015, p. 76).

Since the duties of midwives and *medicae* were similar, it is only logical that their extra-career pursuits would be similar as well. Much as how male physicians would experiment, write, and participate in public health governance, there are records of *medicae* participating in similar pursuits, aside from governance. Unfortunately, the only surviving work written by a midwife-*medicae* is *On the Suffering of Mothers as Women*, the author being Metrodora (Cilliers and Reteif 2006, p. 173). Nevertheless, the content of the text encompasses what was expected of female physicians at the time – a limited but detailed medical guide to the female urogenital system alongside both pro-fertility and contraceptive medications. In fact, the rationale necessitating the differentiation from female physicians from the male physicians was simply that women, due to the Roman perspectives on modesty, preferred if not outright required that only other women would provide more intimate sorts of medical care. This being the niche, certainly there would also have been a catalyst that encouraged capable females from going beyond the normal repertoire of careers and the presence of family practices lends itself as a possible answer in the search of said catalyst. One inscription from Ostia shows Scribonia Attike performing midwife duties alongside the surgical practices carried out by her husband,

M. Ulpius Amerinus (Cilliers and Reteif 2006, p. 175). The advantage found here is twofold: one, combining traditionally male practices with female practice allowed for the family to access a far greater number of customers. If a man came to Amerinus with the need to undergo surgery and left alive and for the better, there is a chance that he would recommend his wife to attend the *medica* of the same location. Second, since medical education in Rome was dependent on the same disciple – patron relationship, then an interested wife of a physician would have easy access to medical training alongside the innate instinct for female medicine. This definitely embodies the practical aspect of medicine within Roman society as not only does it provide the ability for all members of the household to be cared for, but also that the variances in medical disciplines between the two groups cooperated with the traditional gender roles. The male physician practiced within the military or in treating conditions that interfered with productive citizenry while the female physician ensured that future generations of Romans would be properly brought into the world.

Conclusion

The rise of the Roman public physician was a question and an answer of the same origin. Growth in population and changing dynamics of the urban landscape begged why and how Romans would be able to access healthcare that would allow them to continue to be productive and those same dynamics provided the factors that ultimately resulted in physicians growing in popularity. Legislation and socio-economic changes provided the seeds which implanted into the fertile but barren field of Roman public medicine and a virtual menagerie of specializations erupted. Realistically, this changing landscape of

public health had less to do with innovation rather than adaptation. Greek physicians had enjoyed a welcoming atmosphere in the eastern Mediterranean to hone their crafts and the clinical sciences but the field in practice was crowded and competitive. Meanwhile, Rome had expanded its borders considerably and its mentality less so, but this was enough for the Greek physicians to notice the vacancy and gladly fill it. Once within the Roman sphere, Greek physicians perused libraries, honed their science, and disseminated knowledge among a new generation of physicians that resulted in the seemingly daily development of new concentrations. Although some practices, such as surgery and ophthalmology were new in the sense that they required an import of foreign Hellenistic principles, pharmacy derived from herbs, and gynecology derived from midwifery demonstrated that medicine as a science was not foreign from Roman ideals or tradition.

Determining to what extent practicality influenced the Roman public health system requires a different lens than medical practice within the house or within the military. In both these scenarios, the type of practice was itself a practical response to an issue. For example, since a household did not always have access to a physician, the *paterfamilias* and midwives would have had to act as proxies even if the result was not as ideal as visiting a physician. Within the army, specialties had to be sieved to find which would be most applicable in a military scenario and the logistics behind doctor's pay and duties had to be carefully determined. However, the public field of medicine is broader than both these environments and so a centralized doctrine of medical practicality would be unsuitable. Instead, solutions must arise independently at first and then fuse to encompass the broader demand. To be clear, in the Roman public, the demand of healthcare was greater than the capability of nascent practitioners. Simultaneously, the

external factor of Roman expansion during the same time allowed for increased Hellenization with its own set of advantages and disadvantages. Finally, there was also a natural development of traditional practices into careers. The Hellenization and transformation of careers rose independently but worked together to answer the same demand, a remarkably different approach than the compromised but practical practice found within the home and military. In terms of an analogy, medical practicality within the home and army had a vertical demand and satisfaction relationship whereas public health had a horizontal relationship. Ramifications of this horizontal relationship would dominate regarding medical centers. Religious, military, and civic monuments and institutions would become concatenated into a web of healthcare centers that swung Roman medicine into the realm of a system that would be familiar in a modern setting, leading to an even more significant display of clinical practice as being practically Roman for practical Romans.

CHAPTER FIVE

Physicians in the Pipes: Water Culture and Public Health in Rome

Introduction

Water culture in Ancient Rome should be considered with significant importance in any conversation regarding the practicality of public health throughout the Republican and Early Imperial periods. The reason is simple – water quality has direct correlations with the quality of life of the citizens. Water supplies were controlled so that there would be an availability for both domestic use and economic activity. Essentially, the Romans understood that water was a critical resource for the functioning of the state, and if the water flowed healthy and properly, the citizenry would follow suit. Aqueducts provided clean water for consumption and sanitation and the quality of water was as much a component taken in mind as were the mechanics behind its allocation and management. Therefore, the discussion of water culture requires the coverage of three main categories, each contributing to the overall degree of practicality of aqueducts and other such monuments in managing the welfare of the citizenry. The first will address how water quality was determined and why this was an important component for potability and other usage. The second will address how water was distributed; distribution is a continuation of the water quality discussion because even if the water source in question was not deemed potable, it could be used for economic or agricultural reasons. Finally, the discussion will move to the effect of water culture on the state; how the "physicians in the pipe" feature came to be and how the health of the citizenry was affected.

Water Quality

Suffice to say that water quality in Rome was the envy of the ancient world. Many references exist to laud the availability of clean water throughout the city, such as Galen exclaiming that the water of the aqueducts was not "foul, mineralized, turbid, hard, or cold" (Ashby 1935, p. 10). Clearly this discretion in supply must have originated from a series of procedures and techniques honed through repetition and practice. Before the quality of the water itself can even be determined, however, the location of a sufficient source was priority. Vitruvius provides an example for the location of a simple spring or groundwater source:

> *Earum autem erit facilior, si erunt fontes aperti et fluentes. Sin autem non profluent, quaerenda ubi terra sunt capita et colligenda* (Vitruvius *De Architectura*, Liber VIII 1.1)
>
> Therefore, this will be easily done, if the springs are open to air and flowing. However if they do not flow above ground, where their sources are underground must be sought and collected.

The Romans preferred open and easily accessible springs or groundwater sources for the same reason modern civilizations use the same for consumption – the water was usually non-saline and had lower levels of turbidity. Vitruvius explains how geology and ecology of the source correlates to the quality of water. The dependence of water quality on soil type is a valid measure that, in modern ecological science, certainly holds water – clay-rich soil is poorly saturated with water, sandy soil retains water poorly, and exceptionally loamy soil contributes to turbidity. Gravel-rich locations handle these issues well because the Romans lacked abilities to retain the water from the source and distribute it into aqueducts simultaneously; in other words, there needed to be a continuous uptake of clean, easily flowing water (Evans 2013, p. 287). Although this was certainly a limitation,

it was also an advantage in the sense that the constant flow of clean water did not have to contend with the issue of low flow during parts of the day and the constant flow also reduced the chance of pathogens breeding in stagnant water. Moving water was preferred to such an extent that Roman religious practices required moving water rather than stagnant (Rogers 2018, p. 8). The movement of water was considered to be an important factor in removing impurities from it; impurities that the Romans knew well to have physiological significance.

Beyond the judgment of the soil for the physical qualities of water, the physiological qualities could be determined by both observational and experimental means. Observational means included the practice of seeing how the animals who drank from the source appeared – if they were well in limb and gait, then the water was considered to be safe for humans to also drink from (Vitruvius *De Archetectura*, VIII 4.1). Chemicals dissolved or suspended in the water contribute to the health and welfare of whatever animal drinks from it, so this observational process was definitely sound in judging the general qualities, but was also limited in determining exactly what unique quality was present in this water and not another. For a more focused analysis, Vitruvius mentions that the filling of a brass vessel with water should not lead to the discoloration of the vessel if the fate of the water is to be drunk. Sulfur dioxide is a common reason for the tarnishing of brass, and it is decently soluble in water; therefore, if the brass is discolored so easily by the water being tested, then it can be deduced that there is an over-abundance of sulfur dioxide or another agent that would be harmful to humans if consumed. Nevertheless, in a time before spectroscopy of chemicals, the taste of water was an important measure of quality. Taste buds themselves are arranged so that

depending on what the main flavor is, the presence of a certain component can be elucidated. For example, bitter tastes correlate to toxins and alcohols, sour tastes to the presence of acids, and salty taste to the presence of sodium. Seneca mentions, regarding water sources:

> *Aliae dulces sunt, aliae uarie asperae; quippe interueniunt salsae amaraeque aut medicatae, ex quibus sulphuratas dicimus, ferratas, aluminosas: indicat uim sapor* (Seneca *Naturales Quaestiones*, Liber III 2.1).
>
> Some are sweet, others have various pungent tastes; among these are salty, bitter or medicinal, and of [medicinal] we may speak of sulfurous, iron-rich, and aluminum-rich waters: the taste shows the quality.

The reason for a brave individual to determine the taste of water was simple – even if the source of the spring was flowing and the wildlife that drank from it were of secure physiology, it says nothing about whether a human would find the water itself palatable. An anecdotal explanation would be as follows: in modern public water supplies, there are times when the chemical components of the water added during treatment may be a bit much. This is not enough to cause harm, necessarily, but the water itself becomes pungent and distasteful and procedures are undertaken to return the water to a more acceptable state. Therefore, the Roman fixation with the taste of water as a determinant of its quality has less to do with a direct physiological question and more with a need to have public approval and trust that the water is safe and healthy from its own qualities and not based on just the statement of the government.

Water culture in Rome encourages the fixation to aqueducts because the skeletons of the monuments still exist and there are plenty of classical and modern literary sources referring to the politics, physics, and general studies thereof, but the more simple water-

collecting structures cannot be neglected. Wells fall under the category of underground water sources for determination of quality – soil type is the primary variable and it is most likely with the experience of community-based wells that the Romans developed the system for underground source evaluation. Even within the city, apartment blocks and common locations around the city had wells to augment the water supply brought in later by aqueducts (Hodge 2002, p. 57). Wells were also commonly used for irrigation when a stream was unavailable for the same purpose, and this separation of drinking wells from those used for irrigation suggests that a similar categorization occurred. Although the society regarded wells as beneficial and were a traditional and tested way to provide water, Seneca warns about underground water supplies that are too deep with a colorful but questionable example:

> *Sed ut ad propositum revertar, accipe argumentum magnam vim aquarum in subterraneis occuli, fertilem foedorum situ piscium: si quando erupit, effert secum inmensam animalium turbam, horridam aspici et turpem ac noxiam gustu* (Seneca *Naturales Quaestiones*, Liber III 19.1).
>
> But so that I may turn to my proposition, listen to the argument that a great source of water is hidden underground, fertile with nasty and noxious fish; if this water bursts out, it brings an immense throng of animals, horrid to look at, disgusting, and poisonous to eat.

This hidden danger of fish would negate the observational evaluation of water – if the fish were of this quality, then the underground supply was poor for consumption. Nevertheless, because animals lived in that water and seemed to be thriving within it, even if the water is noxious to drink it could still be used for irrigation of crops.

Wells were limited in the same way that spring sources were, but there was a way to bypass the need to evaluate water after the fact simply by having the source be unquestionably clean. Rainwater is touted by plenty of authors, including Vitruvius:

> *itaque quae ex imbribus aqua colligitur salubriores habet virtutes, quod eligitur ex omnibus fontibus levissimis subtilibusque tenuitatibus* (Vitruvius *De Architectura*, Liber VIII 2.1)
>
> therefore, water collected out of the sky has the healthiest qualities, because it is holding of the most light and subtle particles of all springs

This statement is agreed to by Seneca indirectly as he explains how water gains quality from its environment but if it is from the sky, then its qualities arise from its transformation from moisture to precipitation, insinuated to be a process at risk of less corruption (Seneca *Naturales Quaestiones*, Liber III 9.2). Additionally, rainwater catches can be stored within the cisterns of houses and if the cisterns are kept well-maintained, then the water quality within them can remain safe enough to drink for an extended period of time. The Roman domus is the best example of a building using rainwater catches – the atrium was open-air, and the incoming precipitation would pool in the *impluvium*, a pool connected to the domestic cistern. The advantage of rainwater was simple – events that would change the quality or quantity of groundwater such as a landslide or over-extraction was less common if the source was atmospheric. Suffice to say that events such as droughts would affect both rain and groundwater, but at that point more drastic alternatives would be needed. Furthermore, rainwater holds less suspended particles, reducing the chances for illness to befall the drinker due to pollution.

Limitations certainly existed with rainwater catches including the actual need for rainfall to be effective. These structures, then, were accessory in design in the sense that while rainwater would have certainly be used if available, the majority of the time, another source such as a well was probably utilized. Archaeological evidence provides support to this indirectly – by 79 AD, it seems that many *impluvia* were resigned to

ornamental purposes, even if few retained their water-collecting functionalities (Hodge 2002, p. 58). Aqueducts simply became too ubiquitous and convenient in use for *impluvia* to continue as a necessity. In more arid regions of the state and empire, cisterns continued to be used because the location of them underground provided heat insulation to the water supply, allowing for cool and fresh water to be on hand in case an aqueduct was not present or if the water of the aqueduct was not cool or refreshing enough.

Aqueduct Distribution, Upkeep, and the Fate of Water

Aqueducts were the dominant and most efficient form of widespread water distribution in Rome for most of the civilization's span. There was an inherent trust and belief in running water being salubrious and luckily, the method by which hydraulics worked within the means the Romans could employ was through constant flow. This constant flow was also beneficial because a laxer attitude could be adopted towards the mechanical structure of aqueducts. Therefore, the first hurdle to surmount involves the process of water distribution of the aqueducts – what exactly does the term "constant flow" mean?

Constant flow began at an appropriate source, as described earlier in the chosing of a flowing source of water. Topography was the main factor that determined the flow rate, velocity, span, and destination of the aqueduct – put simply, if the source was lower than the destination, the water supply could not reach that destination. Therefore, in the city of Rome itself, various aqueducts were constructed over time and each had a

different elevation. The elevation difference dictated where the water would flow – Frontinus, the curator of waters of the later 1st century AD, said:

> *Omnes aquae diversa in urbem libra perveniunt. Inde fluunt quaedam altioribus locis et quaedam erigi in eminentiora non possunt...(*Frontinus *De Aquis,* Liber I 18)
>
> All aqueducts reach into the city at different heights. Whence some flow into the higher grounds and others cannot rise to the higher places

When an aqueduct was constructed, it was consigned to a location. Most of the length of the aqueduct was in the form of surface channels, following the contours of the land and the famous arches now correlated to aqueducts were only a smaller component of the overall structure (Hodge 2002, p. 93). These arches were utilized when the water supply had to cross a valley or had to be changed afterwards to suit a change in elevation of the destination. Arches also functioned as junctions for minor aqueducts and even as catch basins. Catch basins were important in equalizing grade differences for the various aqueducts and supporting water supplies during periods of lowered flow. Nevertheless, the issue with functioning aqueducts was that since the water quality differed from source to source, if an aqueduct with a notably poorer supply shared a catch basin with a slacking conduit of a lower elevation, then the poor quality would be spread to the lower-elevated aqueducts (Frontinus *De Aquis*, Liber II 92). To alleviate this issue, aqueducts within the city of remarkable supply were kept separate from the others and usually, the lowest-elevated aqueducts were consigned to water gardens and irrigation-intensive farms.

Repairs were a major commitment of the water works office and the impact of the need to repair governed the distribution of the aqueducts themselves. The section of the

flow immediately after the source was the conduit proper, and the conduits, for the most part, were large earthen "pipes" through which the water would flow. These conduits were large not only to facilitate the necessary drainage but also because repairs needed to be done mechanically by workers sent into the actual pipework. Manholes were distributed regularly throughout the length of the conduits to facilitate this (Hodge 2002, pp. 98-99). Surprisingly, the main repair issue within these conduits were not breaks or leaks but entrustments. Breaks and leaks were less common because of the construction of the aqueduct – there was usually an underground outer shell of masonry in the lumen of which was two to three layers of cement (Ashby 1935, pp. 44-45). The cement formed a seal and, much to the approval of Vitruvius, was preferred to using lead tubing since lead was thought to have some toxic qualities even in that time. The encrustation itself was a combination of suspended particles such as calcium carbonate and became a problem in the conduits supplied by poorer-quality waters or waters with a slower velocity of flow. The *Anio Vetus* was noted for its tendency to clog up the pipework with this entrustment and sometimes became so severe that water flow was constricted to 2/3 of normal rate (Ashby 1935, p. 44 and Hodge 2002, p. 99). Importantly, the encrustations were another method by which potentially harmful waters were avoided from consumption – if the supply required consistent maintenance, then the waterworks may have begun to see the water of that supply as being insalubrious. Indirectly, Seneca supports this by comparing water supply to the human body's circulatory system and since clogs were indications of poor health, then egregious encrustations were similarly indicators of poor water health.

Whereas the immediate conduit did not require much upkeep, the various pipes and ancillary structures of the aqueduct were considered as more finicky and demanding of repairs by Vitruvius. The reason for this is both due to the simple phenomena wherein a pipe with a smaller lumen fills with sediment more often and also because of the nature of Roman construction itself. The situation within the pipes is logically simple – encrustations and internal damage of large conduits would need to be severe to hamper the flow to a noticeable degree, but smaller pipes needed fewer obstructions to have a high magnitude of effect. Roman construction had an internal advantage and disadvantage regarding aqueduct flow – there was little concern with the velocity of the flowing water. This can be seen in the presence of right-angle bends in above ground aqueducts; the Romans certainly had the capacity to build more gradual curves when the topography necessitated it, but the abundance of T junctions suggests otherwise (Hodge 2002, pp. 118-119).

The presence of T junctions may seem like an unnecessary fact and unconnected to the relationship between construction and the need for repairs, but it explains both the cause and effect of the upkeep. To explain this phenomenon and why the Romans did not consider the effect with great care, a digression needs to be made into physics. In classical physics, there is an assumption that bodies move with an internal frame of reference, in other words, with no acceleration and with constant velocity. Water flowing down a ramp does not have an internal frame of reference – it is influenced by gravitational acceleration with a modification based on the steepness of the gradient. This results in the water having a certain kinetic energy that is transferred to the walls of the aqueduct. Wherever there is a sharper turn, since the change in direction is so abrupt, the

water will retain its kinetic energy when it hits the turn, causing damage to the wall over time. Now then, why would the Romans not adjust their practices to avoid this? The answer comes from an "ends justify the means perspective" – the aqueducts, unlike modern systems, were not meant to have a defined flow. The velocity of the water was not meant to be consistent, rather the Romans were simply concerned that the water was flowing when needed, especially in the summer months (Frontinus *De Aquis*, Liber II 122). The rapid directional changes would retain a high water velocity when multiple sources were joining, and when the water volume was sufficient to be put to the main causeway of the aqueduct, there was a decrease in the number of junctions. Strategically, this made it so that there was a constant volume of water reaching the citizens and the repair endeavors would be easily localized to the section of aqueduct between the source conduit and the main causeway.

The terminal of aqueducts is among the most important considerations when it comes to water and human health in the Roman state. First, there is a tremendous breakdown of the various pipes found in the public water system.[1] The variance in pipe sizes suggests that the inflow was divided up into various outflow volumes within the urban system itself with the general trend that smaller diameters would flow into private residences, moderate diameters into public water use, and larger diameters as continuing the inflow to another district within the city. Urban pipe-works were subject to a great deal of perturbation by criminals and middlemen and the presence thereof was a dominant reason for Frontinus writing down his experiences as curator of the waters but

[1] The Roman piping system is much too complicated to describe in detail within this paper. Additionally, the actual measurements of the pipes are out of scope of this chapter. Frontinus in *De Aquis*. Liber I 37-63 provides the Roman measurements of the pipes and Hodge in *Roman Aqueducts*. P. 297 has the Roman values adjusted to centimeters.

it also influenced the waterworks department to adopt ingenious ways to ensure the water volume was of acceptable amounts to do a public good. In addition to ensuring proper volume, the urban inflow was subject to the last bits of checking of overall quality.

In order to ensure that the water was properly filtered, the inflow was first subjected to a series of settling tanks; the velocity within the tanks was less than from the causeway and this allowed for heavier components such as pebbles and large-grain sand to escape the water column. Frontinus states that the *Anio Novus et Claudia a piscinis in altiores arcus recipiuntur*, "that the New Anio and the Aqua Claudia are received on a high arch from settling-tanks" (Frontinus *De Aquis*, Liber I 20). Therefore, these two aqueducts required an extra section of settling before continuing to deposit their waters into the *castellum*, the terminal segment. Evidence shows that the *Anio Novus* has abundant deposits in its settling tanks near Villa Bertone in Capanelle and knowledge of the abundant sediment in the water would explain why this extra settling had to occur in the urban segment as well (Hodge 2002, p. 273). After enough had settled out of the water column, the smaller particulates went through a filtration process – the simplest way this was done was by having slower flowing water pass across a bed of sand; nevertheless for higher volume aqueducts, the velocity would still be too high for such a slow process and alternatives had to be developed (Hodge 2002, p. 275). Archaeology at Ampurias (Empuries) uncovered a circular series of amphorae filled with charcoal and sand that connected to the terminal end of an aqueduct's inflow and later on into a cistern (Hodge 2002, p. 275). The circular series of filters would have slowed down the velocity of water to allow for filtering and the presence of a public cistern at the end suggests that the aqueduct was not of considerable volume as the Roman urban aqueducts had. The

evidence for this comes in the lack of a *castellum* at the end of the filtration system – the reduction in velocity needed to be compensated for with either an increase in velocity or volume so that the exit pipes had enough of a flow through them to be carried forth to the final destinations.

The Castellum Divisiorum and the Uses of Water

The last step of the aqueduct process and arguably the most critical to ensure proper distribution of water came in the form of the *castellum divisiorum*. The inflow was collected in a large basin; the inflow would have the largest diameter and came into the *castellum* from a higher elevation of the various settling tanks. The water, therefore, would accelerate immediately before entering a container of larger volume and immediately reduce its velocity. From here, the water would then be siphoned out via channels that started off widest at the basin and narrowed as they progressed to their source. The reduction of the lumen circumference between the basin and these channels then re-accelerated the water flow and protected against the disadvantages of stagnant water. Generally, the *castellum* was tripartite – the exact configuration can change in the sense of which channel has what fate but in nearly all cases, the channels fed public fountains, baths, and private residences (Hodge 2002, p. 281).

The dividing of the water into these categories shows that there was an assumption for what the most important uses of water was in Roman society. The public fountains allowed the general populace to access water for drinking and for collecting so that they had a supply at their homes; the baths having a steady supply ensured their

operation as a social space and as a method for improving the physical and mental health of the citizens through cleansing; finally, the provision to the private houses of the rich placated those in power and indebted them to the upkeep of the waterworks for their own sakes (Vitruvius *De Archetectura*, Liber VII 6.2). Interestingly, the *castellum* at Pompeii alters this Vitruvian division system wherein there is an extra layer of division before the channels themselves. Vitruvius says that to maximize supply when there is an overflow, the middle one that is set lower than the others gains an increased supply (Vitruvius *De Archetectura,* Liber VII 6.1). This middle one was almost always the public fountain channel and the reasoning holds water – the public fountains would serve the most people and public fountains follow the principle of constant discharge while baths have a defined capacity. Pompeii, however, demonstrated an even more pro-public construction: there were gates that could divert flow in the *castellum* so that private houses and baths could have their flows constricted in advance so that the public fountains received an abundant supply (Adam and Varene 2008). Essentially, the designer of the Pompeiian *castellum* recognized the private water supplies and the supplies for theaters and baths as inferior to the public supply. Although it would be impossible to define why the Pompeiian system was designed in this way, it may have been for egalitarian or economically beneficial reasons. Nevertheless, the division at the *castellum* clearly shows that there was a triaging of the water supply based on need in most Roman settlements.

Water Consumption and Implications on Culture

Suffice to say that the system of constant flow with rare exceptions for a retention and distribution system of public water supply resulted in the Romans consuming much more water per capita than by modern civilizations. The high level of consumption insinuates that there was a need beyond simple hydration that the Romans sought and now it is time to address the practicality of this need. Modern archaeological evidence shows that two water-dependent features dominated the urban landscape of Rome: the baths and the *laci*, basins of freshwater for either religious or public use (Orengo and Alaix 2013). This explains the prioritization of public fountains in cities such as Pompeii – in terms of distribution by use, a *lacus* would fall under the category of public fountain while baths dominated in their own category. Without doubt the Romans certainly enjoyed their bathing rituals and their religious rites and so the heavy use of water in these two is to no surprise, but the question is what practical use did these facilities have?

Neither baths or religious fountains have a definite physiological benefit as the presence of clean drinking water does but certainly both have a presence in the general improvement of wellness. In fact, pysicians such as Galen even recommended against visiting baths with unhealed wounds because there was a danger of further infection:

> *Balneum quoque, dum parum vulnus purum est, inter res infestissimas est: nam id et umidum et sordidum reddit, ex quibus ad cancrum transitus esse consuevit* (Celsus *De Medicina*, Liber V 26).
>
> Bathing too, while the wound is not pure enough, is among the worst things [to do]: for it makes the wound wet and sordid, and from which there is a tendency for a disease [gangrene] to occur.

So bathing was at times a disadvantage, but there was a considerable psychologically beneficial aspect found within them. For one, baths allowed for a mingling between the disparate populations within Rome and facilitated social well-being (Deming 2020). Public facilitation is certainly a goal of public healthcare – if the people can feel well and be encouraged to socialize instead of cloistering themselves within homes and gardens, a public good has been done. Social wellness recently has been accepted as a defining factor of wellness that correlates with improved personal health (Stoewen 2017). Religion would govern a similar role in terms of wellness especially when considering the privately funded fountains of the wealthy; while privately funded, the spectacular displays would draw in crowds and serve for entertainment and devout collective worship (Rogers 2018, pp. 53-54).

Conclusion

Water culture in Rome served as a practical public health initiative. The aqueducts provided appropriate water supplies for different tasks because of stringent water quality measures, advanced construction, and well-thought distribution systems. Some of the most popular functions such as baths and public fountains resulted in implicit benefits to the populace through social facilitation. Criticisms can be made regarding practicality in the sense that the constant flow system was not ideal for water conservation and that the aqueducts were subject to criminal enterprise, but in consideration for impact per capita, the aqueduct system was unparalleled in bringing good to the greatest number of citizens.

CHAPTER SIX

Concluding Remarks

Rome embodied practical medicine in numerous fields of their civilization and properly devised solutions to various common ailments through adaptation or innovation. The main categories of civilization that the Romans presented practical health solutions in and those that crystalized and continued to influence further development were the military, the domestic physicians, and public water supplies. The reason these fields were so effective has to do with their congruency to the needs – the main ailments the Romans contended with involved vector-borne illnesses, trauma, the burdens of crowding, and food or waterborne illnesses. These conditions are prevalent in the 21st century as well and so it is easy to prime the mind to consider the ancient efficacy to how they were addressed within the means accessible to the Romans.

Military medical developments such as the bi-directional relationship between the army and surgeons and the specialization of the corps of *medici* helped address the traumatic injuries and the burdens of crowding. Battlefields provided a constant supply of soldiers seeking care and so application of surgical theories and techniques upon these patients allowed for refinement of the craft. Due to this refinement, the army directly contributed to a growth in knowledge of the human anatomy and the studies of wounds. Furthermore, the decision to make military physicians a unique form of *immunes* resulted in an improvement in military bureaucracy, especially in choosing recruits. Additionally, the ability of the Roman army to retain and recuperate soldiers instead of having to train

new recruits resulted in a more stable soldier population, improved loyalty, and demonstrated practical use of military human resources.

Domestic specializations of doctors and the symbiosis of imported Hellenistic traditions with nascent Roman medicine resulted in the improvement in quality of life for citizens. The practicality of this was better management of the disparate medical conditions in a quickly growing populace and the accessibility of a wider range of learned physicians. Instead of having to depend on just the *paterfamilias* to dole out treatment even if he was inexperienced, the urban Roman could be attended to by a reputable doctor if they so wished. The conservative members of society were also appeased by the presence of Roman herbalist tradition in this new field of study and acted as a buffer so that medicine was practically accessible, but not thoroughly corrupted and mutated by Greek ideals.

Although physicians most often came in the form of humans, the aqueducts demonstrated that physicians of stone and flowing water could be equally effective in addressing ailments. Flowing water most directly contended with vector-borne illnesses and gastrointestinal infections, and because the human resource aspect was absent when the "physician" was a constant structure, aqueducts were superior in their reach and impact on public health. Due to the reach and impact itself, aqueducts could be considered practical in terms of the definition set forth in the investigation – however, the additional quality of aqueducts having influenced modern water practices augments its position even further. Aqueducts also have an impressive record of ancient and modern literature unified by the disciplines of engineering and hydraulics.

Roman medicine is not limited to these three prongs – these are examples of the efficiency, longevity, and sensibility of Roman solutions to health issues. What is most remarkable is that the Romans were not concerned with bleeding-edge technology or innovation with seemingly miraculous origins; rather, Roman medicine was practical because it was a simplification, purification, and refinement of existing techniques. Political, social, technological, and intellectual shifts coalesced at an ideal time and the Romans, primordial farmers, understood the seasonality of their ascension to a more civilized state.

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