Conceptions of Disease Contagion in Ancient Literature

By

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Abstract

The “seeds of disease” theory that emerged in Europe during the Renaissance period was not an entirely novel concept at the time. Humans were aware of the contagious properties of certain afflictions long before it was possible for them to observe the microorganisms responsible for disease transmission, and ancient authors had already speculated about the existence of imperceptible creatures as a cause of illness. This thesis will show that through ancient literary works of every type permeates the recognition of disease contagion not only between humans, but also between animals of the same species, animals of different species and between humans and animals. Chapter One will examine cases of intra-species infection, beginning with those that do not specify precisely the manner in which the illness in question is passed from one being to another. Instances in which particular factors are noted as contributing to the spread of disease will also be presented, followed by examples highlighting the recognition of intra-species infection in animals. Chapter Two will address the three varieties of inter-species infection of which ancient people were evidently aware: zoonosis, anthroponosis, and xenoosis. Chapter Three will explore the prevalent belief among the ancients that uninterred corpses incited pestilences. Chapter Four will discuss ancient views concerning the contamination of drinking water, as well as cases of deliberate infection with disease—ancient precursors to bioterrorism. Chapter Five will feature numerous theories of ancient authors regarding the presence of disease-causing microorganisms in the air. A variety of literary evidence will be examined throughout this paper and will prove that there was indeed a pervasive knowledge of disease contagion in the ancient world.
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Introduction

It is in the fifth-century BC historian Thucydides’ contemporary account of the Plague of Athens that an indisputable recognition of an epidemic disease’s capacity to spread through direct contact is “first and most fully expounded,”\(^1\) although the concept of disease contagion through physical interaction seems to have been recognized by many societies long before.\(^2\)

Yet a cursory review of the history of our understanding of this phenomenon often indicates that it began with Girolamo Fracastoro, the fifteenth- and sixteenth-century Italian physician who proposed his “seeds of disease” theory to explain the transmission of illness. This, however, is patently untrue; for although Fracastoro advanced an explanation for the spreading of communicable diseases that would pave the way for the eventual universal acceptance of germ theory, he was certainly not the first person to suggest that minute organisms were responsible for this phenomenon.\(^3\)

Too often glossed over in history books are the very relevant and, at times, surprisingly astute notions of ancient peoples on this subject\(^4\)—particularly those of the Greeks and Romans, which are the focus of this paper.

\(^{1}\) Winslow 85
\(^{2}\) Varlik 133
\(^{3}\) Nutton (1983: 23) cites the 1917 article “The Scientific Position of Girolamo Fracastoro” in The Annals of Medical History in which the authors point out that in his work On Contagion, Fracastoro does not state expressly that he is presenting original and revolutionary material; however, Nutton adds that the general impression made by Fracastoro in this work is that these “seeds of disease” were entirely his own invention, and that his application of the theory to disease contagion was also novel. He calls Fracastoro’s practice of failing to acknowledge the work of his predecessors “the art of judicious silence,” and writes that “by not making explicit [his] debts to others, [Fracastoro] gained credit for [himself] at the expense of the dead or less astute.”

\(^{4}\) In Eras in Epidemiology, Susser and Stein (73) reduce the ancients’ knowledge on the subject of contagion to two short phrases, crediting them with only a “vague form” of familiarity with transmissible diseases, as well as the recognition of and “call for measures to contain the spread of disease.” The authors then closely examine Renaissance theories of disease transmission without paying the same courtesy to ancient ideas.
Nevertheless, one must draw a distinction between recognition and understanding. I do not contend that any ancient peoples had a clear comprehension of the mechanics of the process of disease transmission. They were never fully able to gain the understanding of this process that we have today (and indeed no one was entirely able to do so until the invention of the microscope, when the existence of microorganisms could be proven), but it is indisputable that the ancients had knowledge of the communicability of diseases through physical contact—there is ample evidence throughout the literature of the time between the fifth century BC and the fifth century AD to support this.

With said evidence found in ancient literature, this paper shall show not only that there was an irrefutable recognition of disease contagion nearly two millennia before Fracastoro, but that there were also several ancient authors whose descriptions of the phenomenon are strikingly similar to that of the Italian physician and modern scientific explanations. To prove this, I shall first present passages in which there is recognition of what I refer to as “general contagion” in humans (i.e. examples that cannot be placed under the banner of any of the other types of contagion I outline), followed by those in which the author mentions certain factors contributing to the proliferation of a sickness, namely urban crowding and the care of ailing patients. I shall also give examples of the knowledge of disease contagion in animals, as well as the communication of illness between animals and humans, and animals of different species.

Following the section concerning animals I shall examine the very common ancient belief that decomposing human, animal and even insect remains were responsible for inciting plagues, and I shall present what evidence I have found for an awareness that tainted water
could infect one with illness as well. Further discussion of air contamination (also known as “miasma theory”) shall follow, as well as passages in which the author refers to tiny creatures in the air that cause illness in humans once they are aspirated (often called animalculae). The last excerpts I look at will be instances in which diseases are incited or spread intentionally, in the manner of biological warfare.

After examining all of the evidence that I have put forth, it shall be abundantly clear to my reader that the ancient Greeks and Romans did indeed have an unmistakable awareness of the ability of a disease to be spread through contact.
Chapter 1
Intra-Species Infection

1.1 General Contagion in Humans

The contagion of disease may be reduced to two simple categories: intra- and inter-species. Respectively, they are the transmission of illnesses between members of the same species, and that between members of differing species. Throughout the literature of the ancient Greeks and Romans are peppered many passages suggesting the people’s awareness of both types of disease contagion. These excerpts may be found in all manner of writings: historical, agricultural and architectural treatises, poetry, tragedy and so on. Oddly enough, few of these references are within the pages of medical works.\(^5\)

Thucydides makes numerous references to plague\(^6\) in his account of the Peloponnesian War, many of which hint at an awareness of contagion. He writes of a group of Athenian soldiers under the general Hagnon passing their disease on to others in the soldiery:

\[
\text{ἐπιγενομένη γὰρ ἡ νόσος ἐνταῦθα δὴ πάνυ ἐπίσεσε τοὺς Ἀθηναίους, φθείρουσα τὴν στρατιάν, ὡςτε καὶ τοὺς προτέρους στρατιώτας νοσήσαι τῶν Ἀθηναίων ἀπὸ τῆς ἠγνωνι στρατιάς, ἐν τῷ πρὸ τοῦ χρόνῳ ύγιαίνοντας.}
\]

\(^5\) Nutton (1995: 54) comments on this curiosity: “Lay authors (and veterinarians) also talked a good deal about contagion (particularly of plague...) and the need to separate affected persons or animals. Galen and other writers in the Hippocratic tradition, on the other hand, say nothing at all about contagion. This omission can hardly have been accidental, and reflects their preference for explanations and treatments that concentrated on individual susceptibility to potentially harmful environmental changes.”

\(^6\) NB: A distinction must be made between the disease caused by the bacterium *Yersinia pestis* (commonly known as “plague”) and the general term plague, which denotes a non-specific illness, usually of a contagious nature (Aberth 19). While some of the plagues discussed in this paper may well have been the work of *Yersinia pestis*, I shall be using the term “plague” in its abstract sense only.
...for the plague broke out and sorely distressed the Athenians there, playing such havoc in the army that even the Athenian soldiers of the first expedition, who had hitherto been in good health, caught the infection from Hagnon’s troops.  

The verb Thucydides uses to indicate the infection of the Athenian soldiers (νοσέω) reveals nothing about the manner in which he believes that the illness is passed on, but it does show his understanding that a sick person can, by coming into the presence of one previously healthy, cause that person to become ill with the same ailment.

Thucydides’ description of this particular plague shall be revisited several times in this paper, in due course (as shall a number of other references by different authors, as some are relevant to discussions of multiple types of contagion).

In his encyclopaedic opus Natural History, the first-century AD author Pliny the Elder addresses a contagious skin condition called “lichen” which he describes as beginning at the chin and spreading through the interior of the mouth, over the entire face (excepting the eyes) before going down the neck, chest and arms to the hands, covering the person affected with eruptions which he terms “furfuraceous” (from the Latin word furfur, meaning bran). He also comments on the disease’s propensity to affect members of the upper-class:

\[ \text{nec sensere id malum feminae aut servitia plebesque humilis aut media, sed proceres veloci transitu osculi}^{8} \text{ maxime...} \]

The disease, however, did not attack either females or slaves, nor yet the lower orders, or, indeed, the middle classes, but only the nobles, being communicated even by the momentary contact requisite for the act of salutation.  

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7 Thucydides, History of the Peloponnesian War II.58, Trans. Charles Forster Smith
8 Irrelevant but amusing is the translator’s prudish note on the word osculi: “Oscoli, kissing; a nauseous and silly practice, still adhered to, between bearded men even, in many parts of Europe.”
There is here a clear recognition of the transmission of the illness, as the author specifies the manner in which the disease is passed from one person to another—through physical contact (*osculum*), even that which is brief (*velox*).

Another description of a skin condition in which the author’s familiarity with contagion is apparent is that of first-century AD physician Aretaeus of Cappadocia, who gives a description of elephantiasis, and its typical course of infection. He states that it attacks not only the body’s exterior but its interior as well, possessing the whole person. He comments on the communicability of the affliction:

δέος δὲ ἡμυβιοῦν τε καὶ ἐμνιακατὰθαι, οὐ μεῖον ἢ λοιμῷ. ἀναπνοῆς γὰρ ἐς μετάδοσιν ῥηϊδῆ βαφῆ.

Moreover, there is a danger in living or associating with it no less than with the plague, for the infection is thereby communicated by the respiration.\(^9\)

As with the Pliny reference above we are afforded a glimpse into the ancients’ perceptions of the transmission of disease, which the author indicates with the word *μετάδοσις*, “the giving of a share of something” (in this case, disease). While more telling than many, this excerpt’s implications are not entirely apparent. Are there particles present in the exhalations of the infected, or is every bit of the air itself unhealthy and liable to infect another? One may only speculate as to what mode of transmission Aretaeus might have had in mind.

\(^9\) Pliny, *Natural History* XXVI.iii, Trans. John Bostock, H. T. Riley
\(^{10}\) Aretaeus, *De curatione diuturnorum morborum libri duo* II.xiii, Trans. Francis Adams
In the second book of *On the Causes and Symptoms of Chronic Disease (De causis et signis acutorum morborum)* the same author shares what the fear of infection with elephantiasis drove many people of his time to do:

δέος καὶ ἀμφὶ μεταδόσιος τοῦ κακοῦ. πολλοὶ γοῦν ἐπ᾽ ἐρημής καὶ ἐς ὄρεα τοὺς φυλτάτους ἔξεβεσαν, οἱ μὲν ἐς χρόνον ἐπαρήγοντες τῷ λιμῷ, οἱ δὲ ἥκιστα, ὡς σφέας ἐθέλοντες ἐκθανεῖν.

There is danger, also, from the communication of the ailment [elephantiasis]. Many, therefore, have exposed their most beloved relatives in the wilderness, and on the mountains, some with the intention of administering to their hunger, but others not so, as wishing them to die.\(^{11}\)

What is thought of today as being an unthinkably cruel and inhumane precaution to avoid acquiring a chronic illness, this certainly speaks to the date of the excerpt— it was written in a time when falling ill from any number of ailments could quite easily lead to death. The extreme nature of this particular prophylactic measure is also indicative of a well-established awareness of the communicability of disease; for if people thought that a disease or illness would not be passed on through contact, surely exposure of their most cherished family members— Aretaeus uses the superlative form of φίλος— would not be practised.

The Pseudo-Aristotelian work *Problems*, in which the author both poses and answers questions regarding the human body and natural phenomena, mentions the concept of contagion several times as well. The first reference concerns the infectious properties of plague:

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\(^{11}\) Aretaeus, *De causis et signis acutorum morborum* II.xiii, Trans. Francis Adams
Διὰ τί ποτε ὁ λοιμὸς μόνη τῶν νόσων μάλιστα τοὺς πλησιάζοντας τοὺς θεραπευομένους προσαναπίμπλησιν;

Why does the plague alone among diseases particularly infect those who come close to people being treated for it?12

The verb the author uses to indicate the transmission of the disease is a compound of ἀναπίμπλημι, “to fill full of a thing,” especially with the notion of defiling, and thus in the passive, “to be infected.” He goes on to assert that plague is something from which all of mankind suffers, and that perhaps because of this ubiquity it is communicated easily to those who are already weakened by poor health.

Several books later, Pseudo-Aristotle wonders why some conditions that humans experience can be passed on to someone else and others cannot:

Διὰ τί ἀπὸ μὲν νόσων ἐνίων νοσοῦσιν οἱ πλησιάζοντες, ἀπὸ δὲ ύγιείας οὐδεὶς ύγιάζεται;

Why do those who get too close become infected by certain diseases, whereas no one becomes healthy from contact with health?13

Found in the book concerning problems arising from sympathy, this question (though ambiguous due to the use of the verb νοσέω) displays the author’s basic understanding that disease may be transmitted from a sick person to one who is healthy.

Four questions later in the same book the philosopher mentions the contagious properties of specific afflictions:

12 Aristotle, Problems I.7, Trans. Robert Mayhew
13 Ibid. VII.4
Διὰ τι ἀπὸ φθίνεις καὶ ὀφθαλμίας καὶ ψώρας οἱ πλησιάζοντες ἀλίσκονται, ἀπὸ δὲ ὑδρωποὺς καὶ πυρετῶν καὶ ἀποπληξίας οὐχ ἀλίσκονται, σοῦδὲ τῶν ἄλλων;

Why do those who come in contact with consumption, eye disease, and scurvy get infected, but they do not get infected from dropsy, fevers, apoplexy and others?^{14}

Although this question is not accompanied by much of an explanation of the mechanics of the process of disease transmission (other than his use of a participle of the verb πλησιάζω, “to be near”), it is evident that in this quotation the author displays a knowledge of contagion, most probably drawn from observation.^{15} Also, the fact that the author questions the communicability of certain illnesses (i.e. why some are passed on and some are not) indicates at least some awareness that every illness does not share the same pathology.

There are indications of the recognition of contagion in a passage within a funeral oration for Bishop of Constantinople John Chrysostom, which was delivered shortly after the bishop’s death in 407 AD.^{16} The excerpt in question details Chrysostom’s treatment of those suffering from leprosy, and from the account given, one may infer the author’s knowledge that the disease may be transmitted from one person to another:

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^{14} Aristotle, Problems VII.8, Trans. Robert Mayhew

^{15} Though an antiquated work, A Brief History of Epidemic and Pestilential Diseases by Webster (9) contains the author’s incisive opinion that “the ancients derived most of their knowledge and science from personal observation, as they had very few books and little aid from the improvements of their predecessors.”

^{16} Barnes and Bevan xi (see Cosmas)

^{17} The “sacred disease” refers most often to epilepsy, but here is thought to denote leprosy (Barnes and Bevan 74 [see Cosmas]).
This disease, I think, acquired its name from the fact that it surpasses every human misfortune and suffering. For it is truly a most grievous disease, a disease both pitied and hated, a disease that drives even a soul of steel to pity, but that scares away even the most philanthropic soul whenever it is necessary to touch the body of the invalid, a disease that dissolves the tie of kinship and overturns the bond of friendship, a disease that deprives those in its thrall of both pleasure from life and the release that comes from death, by making life distasteful and prolonging death, a disease that needs many to care for it, but at the same time is deprived of all. For, in addition to the other evils, the Devil who hates mankind has sown in everyone suspicion against his afflicted brothers, so that they think that the disease is a sort of reptile which is transmitted to those who enter the presence of those who have it, with the result that in unison all the human beings who inhabit the earth, both in cities and villages, have forbidden sufferers to set foot in their houses, marketplaces, baths or cities. And if anyone has an infected child, these arrangements apply to the child of his flesh as long as he lives; if anyone has a brother, a friend or a member of his household <who is infected>, he imposes these rules on him together with everyone else as soon as the disease has begun, and the assumption that one will also
catch the disease extinguishes even the flame of affection which nature has lit.\textsuperscript{18, 19} 

The author Cosmas relates that even the most charitable individuals had limits to their interactions with lepers, and in so doing reveals the manner in which the disease was believed to have spread: through touch (\textit{ψαῦσις}). He also suggests that the disease can be transmitted to anyone who enters the presence of a person already suffering from it, which could imply infection by miasma, that by direct physical contact, or both. Definitions of neither \textit{μεταβαίνω} nor \textit{συγγίγνομαι} provide insight into the mode of transmission; nevertheless, the author has stated previously that at least some of his contemporaries believe this affliction to be propagated through bodily contact with sufferers.\textsuperscript{20}

\textbf{1.2 Urban Populations and Contagion}

Upon the examination of ancient works which either mention directly the spread of disease among humans or suggest some awareness of the process of contagion, one finds several recurring phenomena cited by the authors as major factors contributing to the rampancy of human-to-human infection. One such factor mentioned in the works of many authors is over-crowding in urban areas. In ancient times, congested cities often precipitated

\begin{flushleft}
\textsuperscript{18} Cosmas, \textit{Funerary Speech for John Chrysostom}, 61  
\textsuperscript{19} This passage was brought to my attention during my ultimate days of editing but was too interesting to omit. Conceptions of leprosy and fear of infection would be a suitable area for further exploration, were I to continue writing this paper.  
\textsuperscript{20} This belief is not incorrect. Grmek (152) writes that although the manner in which leprosy transmits is still not entirely understood, it is known that a single exposure to the microbe that causes the disease will not infect a person; “contamination” of an individual occurs with both prolonged and continual exposure to sufferers, and even under such circumstances, only some people will become infected with the disease. 
\end{flushleft}
plagues largely because of the sanitary conditions therein; with sewage\textsuperscript{21} (and often corpses) strewn about the streets, and vermin, fleas and lice all around, “every city dweller was inevitably exposed to infection every day of his life.”\textsuperscript{22}

Bollet refers to the diseases affecting urban peoples as “crowd diseases,” and explains that large congregations of people allow for the transmission and perpetuation of agents of contagious illnesses because there are always enough of those vulnerable to infection (“nonimmune [sic] people”) to prevent the disease from dying out.\textsuperscript{23} Barnes (citing Cockburn 1963) calls such illnesses “density-dependent diseases,” agreeing that the microbe’s survival relies upon a regular supply of new and susceptible victims before the “cycle of infection” is arrested.\textsuperscript{24}

During war times when citizens feared a siege on a city or an attack on defenseless rural areas, people from the countryside would take refuge within the walls of a city.\textsuperscript{25} With them they would bring whatever diseases and illnesses they were already carrying, and they would pass them on to the city-dwellers. The regular exposure of farmers to their livestock saw them at greater risk of infection with zoonoses (diseases that are passed from animals to humans) than urban citizens, and thus some of the pathogens carried into the city by farmers might be altogether new to the urbanites. The sudden influx of people in the city meant close quarters and therefore close contact with others, as well as an increase in the amount of excrement and

\textsuperscript{21} Quoting a twentieth-century treatise on environmental sanitation, Scobie (407) points out that the inability to dispose of human waste properly is a serious threat to people living in an area with inadequate sewage infrastructure because “very large numbers of different disease producing organisms can be found in the fecal discharges of ill and apparently healthy persons.” He also asserts that there is “abundant evidence” that Roman streets were used as toilets as well as disposal sites for chamber pots (417).
\textsuperscript{22} Burnet 14
\textsuperscript{23} Bollet 3
\textsuperscript{24} Barnes 189
\textsuperscript{25} Longrigg 21
garbage generated—and in the ancient world, disposal of household and human waste was typically not more than the heaving of a vessel’s contents into the streets. Time and time again in human history, an area’s over-population has provided the perfect environment for the proliferation of disease; indeed a large city might be considered a proverbial petri dish.

In Thucydides’ narrative of the Plague of Athens, he comments on the effect of the sudden population increase on the people of the city:

ἐπίέσει δ’ αὐτούς μᾶλλον πρὸς τῷ ὑπάρχοντι πόνω καὶ ἡ ἐμφάνισις ἐκ τῶν ἁγρῶν ἐς τὸ ἁστυ, καὶ οὐκ ἦσσον τοὺς ἐπελθόντας. οἰκίων γὰρ οὐξ ὑπαρχοῦσῶν, ἄλλ᾽ ἐν καλύβαις πνιγηρᾶς ὡρὰ ἐτους διαιτωμένων ὁ φθόρος ἐγίγνετο οὐδενὶ κόσμῳ...

But in addition to the trouble under which they already laboured, the Athenians suffered further hardship owing to the crowding into the city of the people from the country districts; and this affected the new arrivals especially. For since no houses were available for them and they had to live in huts that were stifling in the hot season, they perished in wild disorder.26

The account of the illness that the author provides is detailed and graphic, beginning with a description of the onset of symptoms and continuing with the illness’ entire typical course, which most often resulted in death (but did not in the case of Thucydides himself; the author tells that he was infected with this plague and survived).

In his great didactic poem On the Nature of Things, the first-century BC Roman poet Lucretius Carus also gives a detailed account of the Plague of Athens, which is based upon that of Thucydides. He reports that every person in the city was either infected with the plague or

26 Thucydides, History of the Peloponnesian War II.liii.1-2, Trans. Charles Forster Smith
mourning the loss of a loved one who had already died from it. The people in the country were not spared this fate either:

nec minimam partem ex agris maeror is in urbem confluxit, languens quem contulit agricolarum copia conveniens ex omni morbida parte. omnia conplebant loca tectaque quo magis aestu, confertos ita acervatim mors accumulabat.

And in no small degree that affliction streamed from the fields into the city, brought by the drooping crowd of diseased countrymen coming together from every quarter. They would fill all places, all houses; and so all the more, packed in stifling heat, death piled them up in heaps.  

Again an author relates that with the migration of people from rural areas to the city, the transmission of illness is a serious problem, particularly when said migration results in over-crowding.

Plutarch’s Life of Pericles also contains an account of the Plague of Athens, but he seems far less concerned with the symptoms and characteristics of the illness than were Thucydides and Lucretius. Nonetheless, the first- and second-century AD historian does mention the calamitous effect of the city’s over-population on the plague, and what people believed to be Pericles’ role in precipitating the disaster:

νῦν δὲ πρῶτον μὲν ἡ λοιμώδης ἐνέπεσε φθορά καὶ κατενεμήθη τὴν ἁκμάζουσαν ἡλικίαν καὶ δύναμιν ὑφ᾽ ὣς καὶ τὰ σώματα κακούμενοι καὶ τὰς ψυχὰς παντάπασιν ἠγριώθησαν πρὸς τὸν Περικλέα, καὶ καθάπερ ἰατρὸν ἢ πατέρα τῇ νόσῳ παραφρονήσαντες ἀδικεῖν ἐπεχείρησαν, ἀναισθηθέντες ὑπὸ τῶν ἐχθρῶν ὡς τὴν μὲν νόσον ὧ τοῦ χωρίτικοῦ πλῆθους εἰς τὸ ἄστυ συμφόρησις ἀπεργάζεται, θέρους ὡρα πολλῶν ὁμοί χύδην ἐν

οἰκήμασι μικροῖς καὶ σκηνώμασι πνιγηροῖς ἡναγκασμένων διαιτᾶθαι δίαιταν ὁίκουρόν καὶ ἀργὴν ἀντὶ καθαρᾶς καὶ ἀναπέπταμένης τῆς πρότερον, τούτου δ᾽ αἵτιος ὁ τῶ πολέμῳ τὸν ἀπὸ τῆς χώρας ὁχλὸν εἰς τὰ τείχη κατασχέαμενος καὶ πρὸς οὐδὲν ἀνθρώποις τοσούτοις χρώμενος, ἀλλ᾽ ἐὼς ὡσπερ βοσκήματα καθειργμένους ἀνατύπωσανος φθορᾶς ἀπ᾽ ἀλλήλων, καὶ μηδεμίαν μεταβολὴν μηδ᾽ ἀναψυχὴν ἐκπορίζων.

As it was, in the first place, a pestilential destruction fell upon them and devoured clean the prime of their youth and power. It weakened them in body and in spirit, and made them altogether wild against Pericles, so that, for all the world as the mad will attack a physician or a father, so they, in the delirium of the plague, attempted to do him harm, persuaded thereto by his enemies. These urged that the plague was caused by the crowding of the rustic multitudes together into the city, where, in the summer season, many were huddled together in small dwellings and stifling barracks, and compelled to lead a stay-at-home and inactive life, instead of being in the pure and open air of heaven as they were wont. They said that Pericles was responsible for this, who, because of the war, had poured the rabble from the country into the walled city and then gave that mass of men no employment whatever, but suffered them, thus penned up like cattle, to fill one another full of corruption, and provided them no change or respite.28

Lucretius’ version of these events makes no mention of Pericles, but that of Thucydides does. He writes that after the Peloponnesians’ second invasion of Athenian territory, the people turned against Pericles, resenting him for having persuaded them to engage in war, and holding him responsible for the other misfortunes that had occurred as a result.29 Where the contemporary author believes that Pericles is at fault chiefly for the war and only indirectly for the plague, Plutarch lays the blame for the pestilence directly on the Athenian general—perhaps a conclusion clarified by centuries of hindsight.

28 Plutarch, Pericles 34, Trans. Bernadotte Perrin
29 Thucydides, History of the Peloponnesian War II.lix
The first-century BC work *Historical Library* by Diodorus Siculus also contains an account of the plague that seized Athens during the Peloponnesian War at the time of the Lacedaemonians’ and Peloponnesians’ second invasion of Attica. It cites the cramped quarters in the city as a major contributor to the proliferation of the plague:

οἱ δ´ Ἀθηναῖοι παρατάξασθαι μὲν οὐκ ἔτολμοι, συνεχόμενοι δ´ ἐντὸς τῶν τειχῶν ἐνέπεσον εἰς λοιμικὴν περίστασιν’ πολλοῦ γὰρ πλήθους καὶ παντοδαποῦ συνερρυηκότος εἰς τὴν πόλιν διὰ τὴν στενοχωρίαν ἐυλόγως εἰς νόσους ἐνέπτοτον, ἔλκοντες ἁέρα διεφθαρμένον.

As for the Athenians, they could not venture to meet them in a pitched battle, and being confined as they were within the walls, found themselves involved in an emergency caused by a plague; for since a vast multitude of people of every description had streamed together into the city, there was good reason for their falling victim to diseases as they did, because of the cramped quarters, breathing air which had become polluted.30

It is evident that this example is alluding to infection via miasma (an imprecisely-defined contamination of the air often thought to be a result of the decay of organic matter and believed to cause illness31), but the origin of the pollution is not specified explicitly. Were the people flocking to the city previously infected with the plague and did they simply bring it into Athens or was the disease already there? Did it become epidemic due to the over-crowding alone or were there other factors involved in its propagation? Was the miasma created by the worsened sanitary conditions that were a consequence of the sudden over-population in Athens, or was the air polluted by the exhalations of those previously suffering from the plague?

There is only so much information from an ancient work that one may glean; these additional questions posed by the modern reader regarding the nature of the ancients’ understanding of disease contagion can never truly be answered, so one must surmise what one can, while avoiding over-inference and arbitrary assumption.

In his account of the Siege of Amida in *Rerum gestarum*, Greek-born fourth-century AD historian of the Roman Empire Ammianus Marcellinus writes of a plague being brought on by unburied corpses lying about and reports two factors that led to additional deaths during that time before rains brought health back to the people:

> Hac exitiali peste quassatis, paucis intemperantia aestuum consumptis, quos multitudo augeb at, tandem nocte quae diem consecuta est decimum, exigu is imbribus disiecto concreto spiritu et crassato...

> After we had been exhausted by this destructive plague and a few had succumbed to the excessive heat and still more from the crowded conditions, at last on the night following the tenth day the thick and gross exhalations were dispelled by light showers...  

This example seems to be alluding to miasmal infection as well, particularly because of the author’s use of the words *spiritus* and *aestus*—I imagine he means to indicate the exhaled breaths of plague victims as well as effluvia generated by the heat. Precisely what Ammianus intends to convey with *quos multitudo augeb at* is ambiguous. This could mean either that the crowded conditions produced a larger or more concentrated cloud of unhealthy air, or that because so many people were within a confined area, the illness was more easily passed along through direct physical contact. Since the rest of the excerpt points quite clearly to miasma,

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32 Ammianus, *Rerum gestarum* XIX.iv.8, Trans. John C. Rolfe
one could argue that the author means that the multitudes infect each other through the same means, but one could make a case for direct contact just as easily.

First-centuries BC and AD Roman historian Titus Livius also addresses the phenomenon of plagues arising in over-crowded cities during times of war, in his *History of Rome*. In a passage detailing the aftermath of the successful invasion of Sabine territory by the Romans under King Servius Tullius, Livy tells of a pestilence that seized Rome:

> unde cum pigritia militandi oreretur, nulla tamen ab armis quies dabatur a bellicoso rege, salubriora etiam credente militiae quam domi iuvenum corpora esse, donec ipse quoque longinquus morbo est implicitus.

Not long after a pestilence caused great distress, and made men indisposed for the hardships of military service. The warlike king, however, allowed no respite from arms; he thought, too, that it was more healthy for the soldiery in the field than at home.33

Here we see the king recognizing that to house his troops within the city is to expose them to disease;34 however, he does not mention the manner in which the men might become infected— by miasma? By direct physical contact? Travelling also had its risks, for exposure to a neighbouring army or settlement could also result in infection with some disease or other.

There are many references in ancient literature indicating that illnesses spread most quickly in urban centres, and for the most part, each is very much like every other; however, in another passage of Livy's *History of Rome*, the author provides what, upon first examination,

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34 Webster (31) mentions this reference in his *A Brief History of Epidemic and Pestilential Diseases*, saying that it seems Rome was “most subject to pestilence in time of peace, when the soldiers were [at home], augmenting the population of the city, and indulging in ease and luxury.”
seems an anomalous account of a plague’s effect on a city and its surrounding area during the
Roman siege and capture of Syracuse in the last quarter of the third-century BC:

accessit et ab pestilentia commune malum, quod facile utrorumque animos averteret a belli consiliis. nam tempore autumni et locis natura gravibus, multo tamen magis extra urbem quam in urbe, intoleranda vis aestus per utraque castra omnium ferme corpora movit.

For as the season of the year was autumn, and the situation naturally unwholesome, though this was much more the case without than within the city, the intolerable intensity of the heat had an effect upon the constitution of almost every man in both the camps.³⁵

The phrase following this excerpt explains that when the pestilence first visited the area, the majority of those dying perished as a result of the season and the natural insalubrity of the region and it was only later that the illness was spread through physical contact.

Normally the population density outside a city would not be as great as inside; however, the soldiers were being housed in castra (military camps), which were essentially small cities unto themselves (i.e. the soldiers would have been in fairly close quarters). What seems like an atypical pattern of infection reported by Livy is in fact analogous to the aforementioned examples of disease transmission within a city.

1.3 Patient Care and Contagion

Instances of infection of those tending to the sick are also fairly numerous in ancient Greek and Roman literature, one of the earliest examples being found in Thucydides’ History of

³⁵ Livy, The History of Rome XXV.xxvi.7, Trans. D. Spillan and Cyrus Evans
the Peloponnesian War. He recounts the summer invasion of Attica by the Peloponnesians and their allies a short time after which the terrible Plague of Athens began. Thucydides recalls that the physicians were unable to cure the illness, and that because they had frequent and prolonged contact with those ailing from it, they themselves became infected and died:

οὔτε γὰρ ιατροὶ ἥρκουν τὸ πρῶτον θεραπεύοντες ἄγνοια, ἀλλὰ αὐτοὶ μᾶλλον ἐθνησκον ὡσ καὶ μᾶλλον προσήσαν, οὔτε ἄλλῃ ἀνθρωπεῖα τέχνῃ οὐδεμία·

For neither were physicians able to cope with the disease, since they at first had to treat it without knowing its nature, the mortality among them being greatest because they were most exposed to it, nor did any other human art avail.\(^{36}\)

Several chapters later, Thucydides articulates just how much the spreading of the plague to caretakers of the sick affected the people of Athens:

καὶ ὅτι ἔτερος ἄφ᾽ ἑτέρου θεραπείας ἀναπιμπλάμενοι ὠσπερ τὰ πρόβατα ἑθνησκον· καὶ τὸν πλεῖστον φθόρον τοῦτο ἐνεποίει.

There was the awful spectacle of men dying like sheep, through having caught the infection in nursing each other. This caused the greatest mortality.\(^{37}\)

Again we see the verb ἀναπιμπλημι used to indicate infection, which in this example, is carried out by the healthy people tending to those already suffering—θεραπείας is the instrument through which they are infected and ἑτέρου is the person by whom it is done.

\(^{36}\) Thucydides, *History of the Peloponnesian War* II.xlvii.4, Trans. Charles Forster Smith

\(^{37}\) Ibid. II.li.4, Trans. Richard Crawley
Clearly Thucydides recognizes that those caring for the sick become infected themselves because of their ailing patients.\(^{38}\)

The first-centuries BC and AD Greek-born historian Dionysius of Halicarnassus reports the same phenomenon occurring in Rome during a plague in the 82\(^{nd}\) Olympiad:

οἱ γὰρ ἐπικουρεῖν ταῖς ἔτέρων βουλόμενοι συμφοραῖς ἀπτόμενοι τε καματηρῶν σωμάτων καὶ συνδιαίτωμενοι τὰς αὐτὰς ἐκείνος νόσους μετελάμβανον, ὡσπον πολλὰς οἰκίας ἐξερημωθῆναι δι᾽ ἀπορίαν τῶν ἐπιμελησομένων.

For those who were willing to relieve the calamities of others, by touching the bodies of the diseased and continuing with them, contracted the same diseases, with the result that many entire households perished for want of people to attend the sick.\(^{39}\)

This reference does not merely suggest the transmission of disease through physical contact; rather, it states explicitly that those willing to tend the ailing are touching (present participle of ἀπτω) their diseased bodies and as a result acquire the illness themselves (imperfect form of μεταλαμβάνω with that which is received in the accusative—νόσος).

Although more a catalogue of mythology than an historical treatise, Publius Ovidius Naso’s early first-century AD poem *Metamorphoses* contains an account of a plague within which one finds several references and allusions to contagion. The account is related by Aeacus, son of Zeus and Aegina, who explains that the plague in question has been sent to the island of Aegina by the goddess Juno, who resents the inhabitants of the island because it had been named after her rival. The narrator describes hot winds from the south bringing

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\(^{38}\) In the same chapter, Thucydides also reveals knowledge of acquired immunity, which Longrigg (34-25) judiciously insists (along with Thucydides’ awareness of contagion) must not be mistaken for a complete understanding of the phenomenon.

\(^{39}\) Dionysius, *Roman Antiquities* X.liii.2, Trans. Earnest Cary
pestilential air to the area, and thousands of snakes polluting rivers with their poison (venenum). The sickness then spreads to dogs, birds, animals (both domesticated and wild), and farmers. Ovid says that the pestilence also comes to infiltrate the city and he speaks of the futility of medical treatment for those infected, and how its practice condemns physicians to death:

Nec moderator adest, inque ipsos saeva medentes erumpit clades, obsuntque auctoribus artes: quo propior quisque est servitque fidelius aegro, in partem leti citius venit. Utque salutis spes abiit finemque vident in funere morbi, indulgent animis et nulla, quid utile, cura est: utile enim nihil est.

The Surgians and Phisitions too were in the selfsame plight. Their curelesse cunning hurt themselves. The nerer any man Approcheth his diseased friend, and doth the best he can To succor him most faithfully, the sooner did he catch His bane. All hope of health was gone. No easment nor dispatch Of this disease except in death and buriall did they finde.

This account of a plague and its course of infection differs from many others found in ancient literature (and those mentioned previously) in that it is the stuff of legends; i.e. it is based on neither the first-hand observation of patients carried out by this author nor on that of another, and thus may be said to speak to the Roman people’s general understanding of the phenomenon of disease contagion at the time.

Although a somewhat edifying passage, Ovid’s choice of words here does little to inform us of the process of disease transmission taking place. Using the verb venire he writes that by

40 As evidenced by the archaic spellings, this translation dates to 1567. While there are countless translations of this work I could have used here, Golding’s sixteenth-century English charmed me and I wished to include it.

41 Ovid, Metamorphoses VII.561-567, Trans. Arthur Golding
ministering to an ailing friend, a person’s share of the illness (partem leti) would come to him or her all the more swiftly.

Also containing a reference to the incidence of caretakers being infected with their patients’ afflictions is the section of History of Rome which discusses the 214-212 BC siege and capture of Syracuse by the Romans, in which Livy tells of a pestilence affecting both sides of the conflict. He claims that initially the people succumbing to the sickness had become ill due to the unhealthy locale and autumn climate, and that later the illness spread by contact, specifically to those nursing the infected. Livy writes that because of this, the sick met their end in one of two ways:

postea curatio ipsa et contactus aegrorum volgabat morbos, ut aut neglecti desertique qui incidissent morerentur aut adsidentes curantesque eadem vi morbi repletos secum traherent...

Later, the nursing of the sick and contact with them spread the disease, so that either those who had caught it died neglected and abandoned, or else they carried off with them those who were waiting on them and nursing them, and who had become infected.  

In this passage the author exhibits a distinct knowledge that it is physical contact which facilitates the transmission of illness from person to person— he uses a participle of the verb contingere, which comes from tangere, “to touch.”

Within his account of the Plague of Athens in On the Nature of Things, Lucretius also uses a word derived from tangere to refer to the proliferation of the plague at the hands of those caring for infected family members:

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42 Livy, The History of Rome XXV.xvi.7, Trans. Rev. Canon Roberts (slightly altered)
qui fuerant autem praesto, contagibus\textsuperscript{43} ibant atque labore, pudor quem tum coge bat obire blandaque lassorum vox mixta voce querellae. optimus hoc leti genus ergo quisque subibat.

But who had stayed at hand would perish there
By that contact and the toil which then
A sense of honour and the pleading voice
Of weary watchers, mixed with voice of wail
Of dying folk, forced them to undergo.
This kind of death each nobler soul would meet.\textsuperscript{44}

He too writes of those who left their loved ones for fear of falling victim to the pestilence themselves, saying that even they did not escape infection, and that they eventually met their deaths, “themselves deserted and forlorn of help”\textsuperscript{45} (desertos, opis expertis, incuria mactans).

A comparatively recent reference to caretakers of those stricken with illness becoming infected themselves is by Eusebius of Caesarea, the third- and fourth-century AD Roman historian, who was a Christian. He cites the Festal Epistles written by Dionysius of Alexandria, which rather glorify the people who became infected as they tended those who were already suffering from a plague in Alexandria:

\begin{quote}
oi γοῦν πλείστοι τῶν ἄδελφῶν ἡμῶν δὶ ύπερβάλλουσαν ἀγάπην καὶ φιλαδελφίαν ἀφειδοῦντες ἑαυτῶν καὶ ἀλλήλων ἐχόμενοι, ἐπισκοποῦντες ἀφυλάκτως τοὺς νοσοῦντας, λυπαρῶς ύπηρετοῦμενοι, θεραπεύοντες ἐν Χριστῷ, συναπηλλάττοντο ἐκεῖνοις ἀσμενότατα, τοῦ παρ ἔτέρων ἀναπιπλάμενοι πάθους
\end{quote}

\textsuperscript{43} The word \textit{contages} appears thrice more in Lucretius’ verse: at III.734, IV.336 and VI.280. These occurrences are not used in the same sense as in the example above, and instead are employed to illustrate rather disparate phenomena: a soul’s inability to experience various ills without contact with a body; the manner in which a jaundiced person’s eyes project yellow on whatever he or she sees; and the generation of lightning, respectively.

\textsuperscript{44} Lucretius, \textit{On the Nature of Things} VI.1243-1246, Trans. William Ellery Leonard (slightly altered)

\textsuperscript{45} Ibid. VI.1242
καὶ τὴν νόσον ἐφ’ ἑαυτοὺς ἐλκοντες ἀπὸ τῶν πλησίον καὶ ἐκόντες ἀναμασσόμενοι τὰς ἀληθούς, καὶ πολλοί νοσοκόμας καὶ ἰκός ἐντροῦς, ἐτελεύτησαν αὐτοὶ, τὸν ἐκείνων θάνατον εἰς ἑαυτοὺς...

The most, at all events, of our brethren in their exceeding love and affection for the brotherhood were unsparing of themselves and held fast to one another, visiting the sick without a thought as to the danger, assiduously ministering to them, tending them in Christ, and so most gladly departed this life along with them; being infected with the disease from others, drawing upon themselves the sickness from their neighbours, and willingly taking over their pains. And many, when they had cared for and restored others to health, died themselves, thus transferring their death to themselves...  

The Christians who died in this manner are venerated to near martyrdom by Eusebius, and after his account of their actions toward the infected, he contrasts it with the treatment of the sick by the pagans. They are said to have deserted those who began to exhibit signs of illness and cast into the streets those who were nearly dead, and even then were not spared infection. Both the Christians and the pagans seemed to have a definite awareness of contagion (likely through their own observation), but the Christians appeared not to fear infection— or so claims the undoubtedly biased author. Is this propagandist exaggeration or evidence of fear assuaged by the promise of everlasting life? Both explanations are possible, but in either case there is an unmistakable recognition of the communicability of disease.

47 Ibid. VII.xxii.10
1.4 Precautions Against Infection

There is a chapter in Pliny’s *Natural History* in which the author presents 69 observations on the laurel tree, which consist of various concoctions made with the leaves, berries and bark of the tree, intended for therapeutic use. Pliny specifies each mixture’s proper application, of which there are apparently many. Some are used topically, orally, or by insufflation; others are used as a pessary, suppository, purgative, emetic, or as a gargle. He claims that:

*laurus delphicae folia trita olfactaque subinde pestilentiae contagia prohibent, tanto magis si et urantur.*

The pounded leaves of the Delphic bay, if smelt occasionally, keep off infection of the plague, and the effect is greater if they are also burnt.48

I find this excerpt to be especially interesting. The notion that anything applied to the nostrils either externally or internally could protect against contagion suggests to me that the substance may have been thought to act as a filter of some sort. If the air in a room containing a plague victim were fouled by his or her presence, the best protection against infection would be not entering the room—avoidance of the polluted air altogether. If it is the air itself which is infectious, it seems that such a porous barrier would do little to protect its user, for one cannot simply stop breathing. The crushed laurel would not permit a person to cease his or her use of the air in a room—this leaves the possibility of the belief in it acting as a barrier or filter, to remove the infection from the air before it enters the lungs, raising the question: what exactly did Pliny believe that a sick person expelled into the air?

48 Pliny, *Natural History* XXIII.xxx, Trans. W. H. S. Jones
In his history of the Roman Empire the second- and third-century AD historian Herodian offers a possible theory behind the practice of filling one’s nostrils with sweet-smelling oils:

ἀλλὰ καὶ οἱ κατὰ τὴν πόλιν κελεύντων τῶν ἱατρῶν μύρου εὐωδεστάτου τάς τε ὁσφρήσεις καὶ τά ὑτα ἐνεπιμπλασαν, θυμίαμασί τε καὶ ἄρωμασι συνεχῶς ἐχρύντο, φασκόντων τινῶν τὴν εὐωδίαν φθάσασαν ἐμπιπλάναι τοὺς πόρους τῶν αἰσθήσεων καὶ κωλύειν δέχεσθαι τὸ φθορώδες τοῦ ἀέρος, ἢ εἰ καὶ τι προεμπέσοι, κατεργάζεσθαι δυνάμει κρείττονι.

The inhabitants of the city followed the doctors’ orders, too, by filling their nostrils and ears with sweet scented perfume and making constant use of incense and aromatic herbs. Some said that if the sweet-smelling scent filled the sensory passages first, it stopped them inhaling the polluted air. If an infection were to get in, they said, the scent drove it out by its greater potency.49

Herodian’s description of the practice of filling one’s nose with sweet-smelling herbs and/or incense is not as vague as that of Pliny. The theory which he relates states quite specifically that the scented material acts as a sort of blocker of the polluted air, which is essentially a filter, for it is obstructing the harmful air while still allowing the person to breathe.

On the other hand, he also says that the infection may still gain entry into the perfumed individual, but that the scent would have already filled the nasal passages and would drive out the bad air. This seems more like the role of a blockage and not a filter. Again the reader is left wondering what, specifically, Herodian thought that the scented material was blocking.50

49 Herodian, History I.xii.2, Trans. C. R. Whittaker
50 This ancient usage of herbs as protection from disease puts one in mind of Renaissance plague doctors and their macabre beaked masks, which were filled with aromatic plants thought to both safeguard against infection and mask the smell of death. Not pertinent, but also not to be missed is the seventeenth-century Latin and German engraving “Der Doctor Schnabel von Rom” by Paulus Fürst (searchable online in the British Museum’s Collection Database).
1.5 Intra-Species Contagion in Animals

Examples of infection within a single species in ancient literature are not confined to humans alone; in the world of agriculture and farming there is a definite understanding of the potential of one herd animal’s illness to spread to the rest of its fold.

The latter fifth or so of Book III of Publius Virgilius Maro’s *Georgics* concerns animal diseases and how best to staunch their proliferation. He warns the sheep farmer that an animal that withdraws from the flock into the shade, grazes listlessly, and lags behind the other sheep might be suffering from scabs, and he advises immediate action:

continuo culpam ferro compesce, prius quam
dira per incautum serpent contagia volgus.

Straightaway with the knife check the offence [i.e. the sore], ere the dread taint spreads through the unwary throng.51

In the same passage he tells of the possible consequences of not addressing such a problem in short order, stating that some diseases will kill not only a few individuals but will truly devastate a flock:

non tam creber agens hiemem ruit aequore turbo,
quam multae pecudum pestes. nec singula morbi
corpora corripiunt, sed tota aestiva repente,
spemque gregemque simul cunctamque ab origine gentem.

Not so thick with driving gales sweeps a whirlwind from the sea, as scourges swarm among cattle. Not single victims do diseases seize, but a whole summer’s fold in one stroke, the flock and the hope of the flock, and the whole race, root and branch.52

52 Ibid. III.471-473
Here the author paints a particularly desperate scene; not only would a flock of animals become ill, but so many would be incapacitated (i.e. would die or have to be culled) that the fold could not ever re-establish itself. Gone would be the animals, the hope of more animals, and a man’s livelihood. It is little wonder that the author recommends the swift treatment of infected members of a flock.\textsuperscript{53}

In his book \textit{Dread: How Fear and Fantasy Have Fuelled Epidemics from the Black Death to Avian Flu}, Philip Alcabes calls the definition of the word “pestilence” in ancient times “malleable”\textsuperscript{54} and he cites one of Virgil’s uses of the word in his \textit{Georgics}:

\begin{quote}
Disce et odoratam stabulis accendere cedrum, 
galbaneoque agitare gravis nidore chelydros. 
saepe sub immotis praesepibus aut mala tactu 
vipera delituit caelumque exterrita fugit, 
aut tecto adsuetus coluber succedere et umbrae 
(pestis acerba boum) pecorique adspergere virus, 
fovit humum.
\end{quote}

Learn, too, to burn in your stalls fragrant cedar and with fumes of Syrian gum to banish the noisome water snakes. Often under sheds uncleansed has lurked a viper, deadly to touch, and shrunk in terror from the light; or an adder, sore plague of cows, that is wont to glide under the sheltering thatch and sprinkle venom on the cattle, has hugged the ground.\textsuperscript{55}

\textsuperscript{53} In the preface to his translation of Vegetius’ \textit{Of the Distempers of Horses}, the anonymous translator (ix) remarks that in their management of diseased animals, the Romans never “knocked any of their cattle on the head,” i.e. did not euthanize them, but instead practised quarantining and attempted to treat them medically. Euthanasia of livestock was not a principal concern while conducting my research for this paper; consequently, I am unable to verify the claim of this translator. Commenting on the fact that many references to contagion in ancient literature are found in agricultural treatises, Nutton (1995: 54) suggests that the ancients did indeed practice euthanasia in animal populations, saying that “slaughtering animals with contagious diseases was not a remedy easily transferable to human plague; it was... against the humanity of medicine.” I suspect that one reason for the tendency of the ancients to attempt to treat livestock medically before resorting to culling must have been the value of large farm animals and the hardship of losing one unnecessarily. In his book on the care of oxen, Columella mentions that “it was held among the ancients that it was equally a capital crime to have killed an ox and to have killed a fellow citizen” (On Agriculture VI.praefatio.7, Trans. E. S. Forster and Edward Heffner).

\textsuperscript{54} Alcabes 14
Here the poet is using *pestis* in its metaphorical sense to express that the snakes are bothersome to a farmer; while it seems that they do pose a real danger to animals, they are pests, in the manner that rats in an apartment building are such. This usage of the word does not connote any type of contagion, nor does the contrasting definition here invalidate the interpretation of *pestis* in the preceding excerpt— it is quite clear that previously the author intends to discuss a fatal contagious illness, whereas here he is describing the (albeit hazardous) nuisance of venomous snakes in livestock stalls.

Virgil also mentions contagion of disease within a given species of animal in his *Eclogues*. The first of these pastoral poems is a conversation between Meliboeus, whose land (along with that of his fellow countrymen) is being expropriated for the use of soldiers colonizing in the area, and Tityrus, a fellow shepherd whom he comes upon playing a pipe under the shade of a beech tree. Tityrus explains how he managed to obtain his liberty and his exemption from having his own home and land taken by soldiers, and in response Meliboeus remarks that in old age, Tityrus’ fields shall remain his own, and points out how this may also be beneficial to his animals:

> non insueta gravis temptabunt pabula fetas,<br> nec mala vicini pecoris contagia laedent.<br>

Still, no strange herbage shall try your breeding ewes, no baneful infection from a neighbour’s flock shall harm them.

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56 Stuart 106
57 Ibid.
Virgil’s description of the possible infection of herd animals is not terribly detailed. He writes only that an infection (singular translation of a plural form of the noun *contagium*) shall not harm them, but he does not specify the manner in which it would do so. However, the word *contagium* alone is revealing, given its etymological roots in the verb *tangere*. *Contagium* implies the communication of disease through physical contact, and I suspect that Virgil included it here for that very reason.

Lucius Junius Moderatus Columella, the first-century AD author of *On Agriculture* seems also to recognize that the illness of one animal can translate into an epizootic (the animal equivalent of an epidemic) that may affect every individual in a farmer’s herd. In this treatise he, like Virgil, declares the necessity of immediate treatment of scabs in sheep, to prevent infection of the whole fold:

*Cui primo quoque tempore occurrendum est, ne totam progeniem coinquinet, si quidem celeriter cum et alia pecora, tum praecipue oves contagione vexentur.*

This must be treated at the first possible opportunity, lest it defile the whole flock, since, while other cattle are readily attacked by contagious disease, sheep are particularly so.  

The word with which Columella indicates the action of infection is the verb *coinquinare*, which comes from *inquinare*, “to pollute” or “contaminate.” This reference to the propagation of illness is not particularly telling, but the presence of the noun *contagio* has implications which suggest contagion through contact.

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59 Columella, *On Agriculture* VII.v.6, Trans. E. S. Forster and Edward H. Heffner (slightly altered)
Further on in the same book and chapter, Columella addresses the problem of a sheep disease called *erysipelas* or *pusula* which he identifies as a typically incurable affliction capable of wiping out a flock. He asserts that destruction of the fold by this disease is guaranteed unless the first animals infected are segregated from the rest, and he indicates that the only known treatment (fomentation with goat’s milk) merely postpones the inevitable. He does, however, present a terribly inhumane treatment described by the Egyptian Bolus of Mendesium (whom he says claims it is an outright cure) involving the live interment of the infected animal⁶⁰ — essentially it is quarantine, but to a most macabre extreme.

It is evident that through either first-hand observation or that of another, Columella understands that one diseased animal may pass on its illness to another or many others, and he therefore sees the value in segregating such an animal from the flock.

Another example in the same vein sees the author recommend separation of ailing lambs from their mothers:

Agnis quoque succurrendum est vel febricitantibus, vel aegritudine alia affectis. Qui ubi morbo laborant, admitti ad matres non debent, ne in eas perniciem transferant.

Succour must also be given to lambs when they are suffering from fever or affected by any other sickness; those which are labouring under any disease ought not to be admitted to their dams, lest they pass on the malady to them.⁶¹

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⁶⁰ Columella, *On Agriculture* VII.v.17
⁶¹ Ibid. VII.v.20, Trans. E. S. Forster and Edward H. Heffner
Once again, the verb employed to denote the transmission of disease is rather non-specific; *transferre* indicates a transfer or transmission, but there is no further detail regarding the way in which the transfer actually takes place.

The author must realize that these precautions create more work for the farmer, whom he then instructs to retrieve the milk from the ewes, mix it with equal parts rainwater and feed it to the ailing lambs; however, he also knows that if these measures protect the ewes from infection, the farmer will avoid losing even more sheep to illness. The modern reader must remember that the loss of livestock in ancient times (and indeed at any time in an agrarian society) was not simply an inconvenience, but rather a loss of livelihood. One can almost imagine the author reassuring a work-weary husbandman with some Latin equivalent of the English adage that says an ounce of prevention is worth a pound of cure.

A very dissimilar passage in which knowledge of contagion is evident is in Book II of the first- and second-century AD poet Decimus Junius Juvenalis’ *Satires*, which is a condemnation of the hypocrisy of upper-class Romans, including the emperor Domitian;\(^2\) the author compares the spread of immorality to that of a contagious illness. He uses the example of the proliferation of disease among herd animals and also calls to mind the manner in which a spoiled piece of fruit will cause any contiguous pieces to decay as well:

\[
\text{dedit hanc contagio labem} \\
\text{et dabit in plures, sicut grex totus in agris} \\
\text{unius scabie cadit et porrigine porci} \\
\text{uvaque conspecta livorem ducit ab uva.}
\]

This stain is caused by infection and it will spread further, just as the entire herd in the fields dies because of the scab and mange of

\(^2\) Macleane 22
a single pig, just as a bunch of grapes takes on a discoloration from the sight of another bunch.\textsuperscript{63}

It is this type of remark which most illuminates the average ancients’ understanding of disease transmission; for this reference is not found in a medical treatise, nor is it written for the purpose of educating others about the proper maintenance of herd animals (as are the examples from Columella and Virgil). Rather, it is a poem which any literate Roman would be able to read and comprehend. Certainly the author would not equate the rampanty of corruption in the city with a phenomenon with which no one was familiar—why write something that no one will understand? Instead Juvenal selects an example of something that likely every one of his contemporaries has observed: the transmission of an illness from an infected individual to those surrounding him or her.

Yet more evidence of the understanding of contagion between animals can be found in Metamorphoses (also known as The Golden Ass) by Apuleius, the second-century AD Latin writer. In Book IV, the man-cum-ass Lucius has been taken by a group of bandits and put to work as a beast of burden. It is not long before they rest for the night, and as they feast and drink, Lucius listens to them recounting previous escapades and plotting those to come. They speak of a plan to rob Demochares, a wealthy man in Plataea who is mounting a gladiatorial show, the likes of which had scarcely been seen before. Demochares’ menagerie of animals includes bears, which “were seized with a sudden pestilence, and reduced to a very inconsiderable number” (repentina correptae pestilentia paene ad nullum redivere numerum).\textsuperscript{64}

\textsuperscript{63} Juvenal, Satires I.ii.78-81, Trans. Susanna Morton Braund
\textsuperscript{64} Apuleius, The Golden Ass IV.14, Trans. Thomas Taylor
The band of thieves skin the carcass of one of these dead bears and one of the men wears it; he is then sold to Demochares who thinks he is a genuine bear. The sellers want Demochares to bring his latest purchase to his home, so that in the night the bandit in the bearskin can escape from the cage and kill the guards, thus leaving the house vulnerable to looting. The scheming men tell Demochares that he should not put the bear in his great herd of animals, as many are already sick, and because Demochares knows that a new animal may very well catch the disease with which the herd is presently infected, he keeps it away from the others.

The ersatz bear is indeed taken to the house of Demochares and has initial success in disposing of the guards. His comrades join him in the house to rob it of its riches, but a surreptitious slave-boy alerts the rest of the household of their presence and chaos ensues.

This episode is entirely dependent on Demochares’ belief that the bear may be infected by the other animals already ailing; as in the previous example from Juvenal’s *Satires*, this excerpt speaks to the general populace’s familiarity with the phenomenon of disease contagion.
Chapter 2

Inter-Species Infection

2.1 Terminology

Less common than examples of intra-species infection are those of what I shall call xenoosis, i.e. the spread of disease from one species to another. I shall be discussing three types of xenoosis: animal-to-human, human-to-animal, and animal-to-animal infection. There exist proper terms for the former two varieties only, which are zoonosis and anthroponosis, respectively; therefore, “xenoosis” shall henceforth refer to inter-species animal-to-animal infection only, as it is the single of the three which is innominate.

2.2 Zoonosis

In the literature of the Greeks and Romans, the source of a zoonotic illness is most often identified as canine, bovine or ovine, which is hardly surprising, as these types of animals would have had the most frequent contact with humans. The first example I shall discuss comes from one of Aristotle’s works on animals (The History of Animals), in which he addresses diseases in dogs, one of which is rabies—λύττα (the Attic spelling of λύσσα). His take on the transmission of rabies from an infected dog to other animals and humans is curious:

 harga λυττα ἐμποιει μανιαν, και ὅταν λυττωσιν ἀπαντα τα δηχθεντα πλην ἀνθρωπου ἀναιρει.

Rabies produces madness, and when [it] develops in all animals that the dog has bitten, except man, it kills them.  

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65 Aristotle, History of Animals VIII.xxii.1, Trans. D. M. Balme
D.M. Balme, editor and translator of the edition of Aristotle which I consulted, comments on the author’s assertion that humans are not killed by rabies: “The excepting of man is no doubt due to the medical belief that in man rabies is neither an inevitable result of the bite nor invariably fatal.”

This claim that the bite of a rabid dog will not infect a human could be explained by the nineteenth-century hypothesis that a change has occurred in the pathology of the rabies virus, and that it now affects humans where previously it did not. Another possible reason for this alleged discrepancy between the modern-day and ancient characteristics of the virus was proposed in the sixteenth century by Girolamo Fracastoro (and is rather like Balme’s offering), who postulated that by making the differentiation between infection of animals and humans, Aristotle was simply drawing a distinction between animals, which he thought would be infected inevitably with “frank disease” if bitten, and humans, who “may or may not develop clinical disease.”

Several centuries later Pliny informs us that humans can indeed become infected by the bite of a rabid dog, but his take on the matter is also somewhat curious:

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66 He also refers the reader to sections of text in Celsus and Dioscorides. At V.xxvii.2 of On Medicine Celsus describes treatment for the bite of a mad dog, which includes instructions for several methods of drawing out the poison from the wound, as well as cauterization. He also advises how to proceed when a human bitten by a mad dog has developed hydrophobia, a symptom characteristic of rabies. Dioscorides, at II.49 (although Balme cites II.47) writes that if a bite victim roasts and eats the liver of a mad dog, he or she will be protected from hydrophobia. He also claims that when put in a bag and tied to the arm of the victim, a tooth of the biting dog will also protect the victim from disease. The remedies recommended are not pertinent to the topic at hand, but Celsus’ and Dioscorides’ assertions of the fact that rabid dogs can and do infect humans are relevant— it proves they have knowledge of zoonotic illnesses.
67 Balme 183
68 Wilkinson 2
69 Ibid.
Rabies in dogs, as we have said, is dangerous to human beings in periods when the dog-star is shining, as it causes fatal hydrophobia to those bitten in those circumstances.\textsuperscript{70}

The implications of this short passage are not obvious immediately upon reading it. Is the author claiming that canine madness is fatal to humans during only this particular period of time, or that it is especially fatal during this time? Pliny does not tell us about humans’ acquisition of the virus—can they be infected at any time of year, or only during the dog days of summer? One could very well ask the same question of dogs’ infection with rabies.

Illuminating the issue ever so slightly is the excerpt to which the author alludes with \textit{ut diximus}. Here he means to indicate a passage in an earlier book and chapter of the tome, which is on the subject of the rising of the Dog Star. Therein Pliny writes of the peculiar effects of this celestial body on the world, among which is the following:

\begin{quote}
canes quidem toto eo spatio maxime in rabiem agi non est dubium.
\end{quote}

There is no doubt that dogs, during the whole of this period, are peculiarly disposed to become rabid.\textsuperscript{71}

The \textit{maxime} tells us that a great number of cases of canine madness occur during the specified period; had Pliny meant to indicate that all incidences of rabies in dogs took place during this time, he would perhaps have used the adjective \textit{totus} (the \textit{toto} above modifies \textit{spatio}—it is used adjectivally, whereas \textit{maxime} is adverbial). This passage does little to bring

\textsuperscript{70} Pliny, \textit{Natural History} VIII.63, Trans. H. Rackham
\textsuperscript{71} Ibid. II.40, Trans. John Bostock
to light Pliny’s thoughts on the transmission of illness, however, because one cannot infer contagion from the text—a dog “becoming” rabid is not synonymous with a dog “catching” rabies.

Pliny the Elder has rather a lot to say about rabies; in fact, general information about and remedies for the virus can be found in no fewer than six books of his *Natural History*. He claims that menstrual blood will cure hydrophobia in dogs,72 while cauterisation of a wound from a rabid dog (performed with a piece of iron) will prevent the same in humans.73 For treatment of canine bites, Pliny recommends all of the following: ingestion of hyena flesh (the liver being most efficacious),74 packing the wound with unwashed wool and leaving it there for seven days,75 and incision around the bite wound followed by the application of raw veal (he-goat’s liver in place of veal will prevent hydrophobia) and ingestion of either veal broth or hog’s lard mixed with lime.76 He also offers various measures which he claims are useful in the prevention of rabies in humans, most of which involve carrying around some piece of a dog as a sort of amulet.

Although Pliny’s recommendations seem like witchcraft to the modern reader, they certainly suggest his awareness of the vulnerability of humans to be infected with rabies. Fuelling the prophylactic measures especially is a palpable fear of infection, which indicates the knowledge that transmission of rabies from dogs to humans is indeed possible.

Another example of the recognition of a zoonotic illness in antiquity is in Virgil’s *Georgics*, in which the author outlines the practice of animal husbandry, and offers advice on

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72 Pliny, *Natural History* XXVIII.21
73 Ibid. XXXIV.59
74 Ibid. XXVIII.25
75 Ibid. XXIX.9
76 Ibid. XXVIII.40
the subject of dealing with outbreaks of disease in herds. He reports that some animal
afflictions may be passed on to humans through the fleece or hides of the victims:

iamque catervatim dat stragem atque aggerat ipsis
in stabulis turpi dilapsa cadavera tabo,
donec humo tegere ac foveis abscondere discunt.
nam neque erat coriis usus, nec viscera quisquam
aut undis abolere potest aut vincere flamma.
ne tendere quidem morbo inluvieque peresa
vellera nec telas possunt attingere putris:
verum etiam invisos si quis temptarat amictus,
ardentes papulae atque immundus olentia sudor
membra sequebatur, nec longo deinde moranti
tempore contactos artus sacer ignis edebat.

...in the very stalls piles up the bodies, rotting with putrid
foulness, till men learn to cover them in earth and bury them in
pits. For neither might the hides be used, nor could one cleanse
the flesh by water or master it by fire. They could not even shear
the fleeces, eaten up with sores and filth, nor touch the rotten
web. Nay, if any man donned the loathsome garb, feverish blisters
and foul sweat would run along his fetid limbs, and not long had
he to wait ere the accursed fire was feeding on his stricken
limbs.77

In this example Virgil provides a very brief outline of the evolution of the Romans’
knowledge of zoonotic illness. The farmers realize the importance of the burial of the infected
animal corpses by first discovering that the disease may be passed on to humans by contact
with the hides; this knowledge is imparted through Virgil’s use of the verb *attingere* (this point
alone is significant because he is acknowledging his awareness of the threat posed by non-living
vectors of contagion). They then learn (probably through trial and error) that the infectious
properties of the animal skins cannot be neutralized by washing or by fire. This reference to

77 Virgil, *Georgics* III.556-566, Trans. Henry Rushton Fairclough
the contaminated hides’ mastery by fire is ambiguous; for surely the exposure of an animal skin to fire would damage it extensively, and why would a person have much further contact with an unusable pelt? In saying that the hides could not be mastered by fire, Virgil indicates that those skins treated with fire still held the potential to infect either humans or other animals — but through what means? Contact seems the most likely possibility, as the author uses *attingere*, a verb connoting touch, and he also does not describe in detail any other type of contagion; however, he does mention the foul smell generated by the decomposing animal corpses. Given the propensity of the ancients to ascribe the proliferation of an illness to the putrefaction of human or animal remains through miasmal infection, perhaps the author intends to suggest that the disease in question was also passed to humans through the air, and not through physical contact alone. The modern scholar may only hypothesize.

In their article “Brefs rappels sur l’histoire des zoonoses,” Blancou and Meslin allege that this animal affliction described by Virgil is in fact anthrax (fièvre charbonneuse). They agree that Virgil has an obvious recognition of contagion through physical contact and that these infectious properties of anthrax were later somehow forgotten until the sixteenth century.78 The authors do not cite another study nor do they otherwise substantiate this hypothesis in any way; nevertheless, aside from being guilty of retrospective diagnosis79 (a field that with

78 Blancou and Meslin 18
79 Perhaps the most frequent subject of this practice is the fifth-century BC Plague of Athens, as described by Thucydides. Bollet (19) writes that one author (whom he does not name) once quipped that “more ink has been spilt trying to explain [the Plague of Athens] than blood spilt during the [Peloponnesian] war itself.” Commenting on this seemingly never-ending trend, Duffin (164) remarks that “whenever a new infectious disease is described, it seems that sooner or later someone connects it to the plague of Athens.” She also articulates (164) an observation that I, too, made in my research: that a remarkable number of “would-be diagnosticians fail to account for the bioecological reality of rapidly mutating germs.” I imagine that although (and perhaps because) none of these diagnoses can be proven, scholars will always endeavour to identify the microbe responsible for Thucydides’ plague.
epidemic speculation and often arbitrary assumptions is “little more than a game, with ill-defined rules and little academic credibility”\textsuperscript{80}, they do commend the ancients for their insight, where so many others do not:

En revanche, la contagiosité de la fièvre charbonneuse, de la tuberculose et surtout de la morve, plus souvent attribuée à des causes extrinsèques, ne fut admise que tardivement. Cela était d’autant plus regrettable que, dans le cas de la fièvre charbonneuse et de la morve, les auteurs de l’Antiquité avaient été beaucoup plus perspicaces.\textsuperscript{81}

Dionysius of Halicarnassus is also among the ancient authors to describe the zoonotic properties of an illness. In his \textit{Roman Antiquities} he relates some of the effects of what he calls the most severe pestilence ever to seize Rome:

καὶ οὐ μόνον ἐν τῇ πόλει τὰ δεινά ἦν, ἀλλὰ καὶ ἐπὶ τῶν ἁγρῶν· καὶ οὐχ ἠκιστὰ ὁ γεωργὸς ἐπόνησεν ὄχλος ἀναπημπλάμενος, καὶ προβάτων καὶ τῶν ἄλλων τετραπόδων ἀμα διαιτωμένων, τῆς νόσου.

These calamities occurred not only in the city, but in the country as well; in particular, the husbandmen were infected with the contagion, since they were constantly with their sheep and the other animals.\textsuperscript{82}

The language in this passage is fairly simple and straightforward, and does not invite multiple interpretations as many of the previous excerpts cited. Transmission of the disease from livestock to humans is expressed with the verb ἀναπημπλῆμι, which we have seen in several examples above. Although this does not indicate explicitly the notion of contagion,

\textsuperscript{80} Elmer xv
\textsuperscript{81} Blancou and Meslin 18
\textsuperscript{82} Dionysius, \textit{Roman Antiquities} X.liii.5, Trans. Earnest Cary
Dionysius’ understanding of the concept can be inferred from this passage because he does indicate that the husbandmen were infected due to their continual exposure to herd animals.

2.3 Anthroponosis

In ancient literature one may also find cases of humans spreading disease to animals through contact—anthroponoses. Two such examples occur in narratives of the great Plague of Athens: the first in Thucydides’ account, and the second in Lucretius’ On the Nature of Things.

Thucydides’ narration of the Plague of Athens describes the progression of the illness from its onset to the final stages preceding death. The description gives the modern reader a glimpse into the dire and often horrendous conditions of an ancient city during an outbreak of plague. While this example is a case of anthroponosis, it may also be considered necronosis (the proliferation of disease by corpses—see p. 51 for definition), because the humans from whom the animals acquire the illness are unburied corpses. However, because there are relatively few passages in ancient literature in which there seems to be recognition of anthroponotic illness, I have chosen to discuss it in this section.

The historian speaks of bodies of victims too numerous to bury, and how they spread infection to scavenging animals:

τὰ γὰρ ὄρνεα καὶ τετράποδα ὃσα ἀνθρώπων ἀπτεται, πολλῶν ἀτάφων γιγνομένων ἢ οὐ προσῆκε ή γευσάμενα διεφθείρετο. τεκμηριον δὲ τῶν μὲν τοιούτων ὀρνίθων ἐπίλειψις σαφῆς ἐγένετο, καὶ οὐχ ἐωρίωντο οὔτε ἄλλως οὔτε περὶ τοιούτον οὐδέν· οἱ δὲ κύνες μᾶλλον αἰσθήσιν παρείχον τοῦ ἀποβαίνοντος διὰ τὸ ξυνδιαιτάσθαι.
All the birds and beasts that prey upon human bodies, either abstained from touching them (though there were many lying unburied), or died after tasting them. In proof of this, it was noticed that birds of this kind actually disappeared; they were not about the bodies, or indeed to be seen at all. But of course the effects which I have mentioned could best be studied in a domestic animal like the dog.

Thucydides’ use of the verb συνδιαιτάομαι tells us that the effects of the corpses on scavengers were best seen in dogs because of their proximity to diseased humans. From this statement we might infer poisoning, contagion via contact, or the phenomenon of miasmal contagion, and that because domestic animals were near to humans, they were infected by either physical contact with people (alive or dead) or the miasma generated by the bodies lying about. Alternatively, he might be referring only to the dogs’ scavenging of the remains of plague victims; it is difficult to be certain which of these situations the author believed to be the case, but we do know that whatever the process involved, we see humans causing animals to become ill.

The description of this plague written by Lucretius several centuries later reports the same phenomenon. The author writes that the animals tempted by the sea of bodies lying about “would languish in approaching death” (languebat morte propinqua) upon consuming a part of them. Lucretius echoes Thucydides’ assertion that of the animals, the faithful dog (fida canum) was among the first infected by humans. From this statement we might again infer

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83 Bollet (18) speculates that if the disease in question were bubonic plague, its transmission to the scavengers would be caused by infected fleas on the deceased.
84 Thucydides, The History of the Peloponnesian War II.l.1, Trans. Richard Crawley
86 Ibid. VI.1222
the communication of disease through physical contact, but to suppose an explicit understanding of the concept is far too presumptuous.

In his history of the Roman Empire, the second- and third-century AD historian Herodian also tells of anthroponotic infection occurring during an outbreak of plague during the reign of the emperor Commodus:

πλὴν οὐδὲν ἦττον ἡ νόσος ἐπὶ πλείστον ἤκμασε, πολλῆς ἀνθρώπων φθορᾶς γενομένης πάντων τε ζώων τοῖς ἀνθρώποις συνοίκων.

In spite of [the aforementioned precautions] the plague was rampant, causing enormous loss of life among men and all the animals that came into contact with men.87

The verb συνοικέω is not terribly informative; that people were living or associating with animals does not tell us if it was believed that the sickness was spread through miasma, direct physical contact or by some other means. Notwithstanding the passage’s ambiguity concerning the mechanics of infection, it does provide undeniable evidence that ancient people were aware of a disease’s ability to be transmitted from a human carrier to an animal.

2.4 Xenoosis

There is an example of xenootic infection in Columella’s On Agriculture, which is found in his instructions regarding the care of oxen. The author comments on the importance of keeping other animals out of their stalls:

Cavendum quoque est, ne ad praesepia sus aut gallina perrepat.

87 Herodian, History I.xii.2, Trans. C. R. Whittaker
Nam hoc quod decidit immixtum pabulo, bubus affert necem.

Care must also be taken that no pig or chicken slips into their stalls, for the excrement which falls from them, mixed with their food, is fatal to oxen.\textsuperscript{88}

This reference is as intriguing as it is ambiguous; it seems that Columella has either observed or been told that an ox’s ingestion of pig or chicken feces causes death, by means of either poisoning or infection with disease—there is not sufficient detail to distinguish which of the two processes the author believes would occur in such a case (or for that matter, whether he would or could specify one over the other if he could be asked). How long after consumption death occurs or if it is preceded by a lengthy illness is not indicated; because the author does not fully explain the phenomenon, we are left wanting for more information—how can Columella be certain that the individual did not acquire the illness from a fellow ox? In order to precipitate the infection of the ox, must the chicken or pig be ill as well, or is there a chemical or substance in the waste of a healthy animal that is toxic to bovines? Are the symptoms acquired only through the ox’s consumption of the excrement, or might they also be picked up through contact with the animal from which it fell? Once an individual has become ill, can it pass on the illness to another, and if so, through what means? Only so much information can be extracted from these two short phrases, and it is simply not possible to answer these questions with what we are given.

Further on in the same passage of his treatise, Columella mentions the potential effect of contact between a herd of cattle and a sickly pig, and reiterates the importance of quarantining the affected individuals:

\textsuperscript{88} Columella, \textit{On Agriculture} VI.v.1, Trans. E. S. Forster and Edward H. Heffner
Sus aegra pestilentiam facere valet. Quae cum in gregem incidit, confestim mutandus est caeli status, et in plures partes distributo pecore longinque regiones petendae sunt, atque ita segregandi a sanis morbidi, ne quis interveniat, qui contagione ceteros labefaciat. Itaque cum ablegabuntur, in ea loca perducendi sunt, quibus nullum impascitur pecus, ne adventu suo etiam illi tabem afferant.

A diseased sow may cause plague. If this falls upon a herd, a change of climate must immediately be made, and the cattle must be divided up, in a number of groups, and sent to distant places and those which are infected segregated from the healthy, that no infected animal may come into contact with the rest and destroy them with the contagion. When they are thus isolated, they have to be taken to places where no herd is pastured, so that they may not by their arrival bring the plague there also.

In this passage concerning bovine plague, the mechanics of infection are not specified; however, this excerpt is found immediately after the example which warns against an ox’s ingestion of pig or chicken manure. Can we assume that such a cattle plague is incited by one individual consuming pig feces? Or might it be a case of transmission through contact?

Examination of the Latin text is hardly enlightening— the translation provided is literal and accurate; no further information may be gleaned from Columella’s words. Despite our desire for more specific commentary on the precise means of disease transmission, we must appreciate the wealth of information that is contained within the passage. The author displays an unequivocal awareness of the inter-species communication of an illness facilitated by physical contact of some form or other, and the understanding that the process of infection

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89 The word *pecus, -oris* may refer to cattle, swine, sheep, or indeed to any other group of beasts (as opposed to *pecus, -udis*, which indicates an individual animal). Because the sixth book of *On Agriculture* concerns the care of oxen and cattle, I do not believe there is any likelihood that the *pestilentia* in this passage is thought to affect a group other than bovines.

90 Columella, *On Agriculture* VI.v.1-2, Trans. E. S. Forster and Edward H. Heffner
may be quelled through isolation of the affected animals. It is the recognition of disease
contagion of which I sought evidence, and not a complete comprehension thereof; no matter
Columella’s perception of the processes involved, his cognizance of the phenomenon is
incontrovertible.

My suppositions— that my first example of xenootic infection is indeed that and not a
simple poisoning, and particularly that Columella means to suggest that the above bovine
plague is caused by an individual’s consumption of pig waste— may seem arbitrary; however, I
uncovered supporting evidence in two antiquated versions of *On Agriculture*, one in the original
Latin and the other in an English translation. The apparently anonymous eighteenth-century
translation of this passage in Columella’s treatise contains additional information regarding the
ability of an ailing sow to infect a herd of cattle, but on its own, the author’s interpretation is
perplexing:

...that especially, which a sick sow throws up and vomits, is
enough to raise the plague...  

The unnamed translator does not provide the original Latin to indicate from where he
derives this mysterious porcine vomit; however, the same passage in a sixteenth-century Latin-
only text of Columella’s opus contains several additional words (indicated with italics):

Cavendum quoque est ne ad praesepia sus aut gallina perrepat.
Nam hoc quod decidit immistum [sic] pabulo, bubus affert
necem: & [sic] *id praecipue, quod egerit sus aegra*,

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91 Columella (1745), *On Agriculture* VI.v, Trans. Unknown
92 R. H. Rodgers’ *Oxford Classical Text of Res Rustica* does not contain any reference to these extra words whatsoever. Apparently the text was neither present in antiquity nor in any of the manuscripts consulted in his research for the book. It is curious that two sources— a sixteenth-century Latin version of the text and an
facere valet.\textsuperscript{93}

This corresponds to the anonymous English translation above, and clarifies the passage somewhat. The author of these inexplicable words (most likely a scholiast) does not indicate the manner in which the pig vomit incites a plague, but given its location immediately following the reference to the ingestion of excrement and its capacity to affect another animal’s health, it seems more likely that he means to warn against another animal’s consumption of porcine emesis. Without these supplementary words, one may be more inclined to interpret the aforementioned phenomenon (an ox eating chicken or pig waste and subsequently dying) as simple poisoning— the animal that ingests the feces dies and there are no further consequences. However, with the extra text, it becomes more feasible that the author means to convey that an ox’s ingestion of said fecal matter causes illness before death— an illness which may be passed on to another member of the herd. This is not to say that the argument for poisoning can no longer be made; rather, given the additional text in question, it appears to me to be more plausible that the evidence indicates that the pig or chicken ordure causes a transmittable illness in oxen, as does the vomit.

Whether the first example is a case of poisoning or xenoosis is a matter of secondary interest to me, as it is not possible to know whether more than one animal is thus affected, and if so, through what means. Even without the supplementary text presented above, there still remains conclusive evidence of xenoosis in the second passage (see p. 45).

\textsuperscript{93} Columella (1595) 311
A fourth-century AD work on veterinary medicine by Publius Flavius Vegetius Renatus also discusses the dangers that pig or chicken excrement can pose to oxen:

Periculosum quoque est, si ad praesepia sues aut gallinae pervenerint. Nam bos cum gallinae fimum inter pabula sumperit, statim nimio ventris dolore torquetur inflatusque moritur. ⁹⁴, ⁹⁵

It is also dangerous if swine, or hens come to their cribs; for when an ox swallows hens [sic] dung with his fodder, he is presently tormented with a violent pain in his belly, and when he swells with it, he dies. ⁹⁶

Quite similar to Columella’s passage on the subject, Vegetius’ version also does not specify whether or not the symptoms that the ox acquires from ingesting the chicken droppings are in fact signs of an illness that can be passed on to another member of its species. One difference, however, is that where Columella writes of boves, Vegetius writes of bos. This discrepancy may very well not carry any significance at all, but it is possible that by using the plural, the earlier writer means to express that chicken waste eaten by one ox will cause multiple deaths, perhaps of those that did not ingest the tainted food, implying the transmission of disease. Likewise, Vegetius’ use of the singular in his passage might indicate a simple poisoning—no other oxen die as a result of the death of the one that had eaten chicken droppings. This seems most logical to me, as there is no mention of any other individuals becoming ill. Nevertheless, I believe that this is excessively speculative, and that in all likelihood neither author intended his respective phrase to be particularly revealing. Without ⁹⁴

⁹⁴ Vegetius, Digestorum Artis Mulomedicinae Libri IV.ii.13
⁹⁵ The book, chapter and section numbers in this translation did not correspond to those of the Latin edition I consulted; consequently, I have indicated the proper location of the passage in note 89 (and in note 92 on p. 49).
⁹⁶ Vegetius, Of the Distempers of Horses III.i.2, Trans. Unknown
further elucidation from the original authors, one may only theorize as to the implications of the above quotations.

There follows, however, a most interesting passage in which Vegetius also discusses what problems may arise if an ox eats pig manure:

Si autem porcinum stercus bos devoraverit, statim pestilentiam contagionis illius malei sustinet morbi. Qui cum semel in gregem vel armentorum vel domitorum incesserit iumentorum, statim omnia animalia, quae vel levem suspicionem habuerunt, de possessione tollenda sunt et distribuenda illis locis, ubi nullum pecus pascitur, ut nec sibi invicem nec aliis noceant. Nam pascendo herbas inficiunt, bibendo fontes, stabula praesepia: et quamvis sani boves odore morbidorum afflante depereunt. Usque eo etiam mortua cadavera ultra fines villae proicienda sunt et altissime obruenda sunt sub terris, ne forte ipsorum corporum interna sanorum contingantur et pereant.97

But if an ox has swallowed hog’s dung, he presently undergoes the plague of that contagious disease they call the maul, which when once it has broke in upon an herd, either of great or small cattle, whether of such as are broke for labour, or otherwise, presently all the animals, which have the least suspicion of the distemper, must be removed from the pasture they were upon, and distributed into those places where no cattle is pastured, that so they may neither hurt one another, nor hurt themselves; for by feeding upon the grass, they infect it, and the fountains also by drinking in them, and they infect also the cribs in the stalls where they stand; and oxen, though perfectly sound, and in good health, perish by the smell, and by the breath of those that are sick and diseased, blowing upon them; the dead carcasses also must be thrown out at a great distance beyond the bounds of the villa, and buried very deep in the earth, lest the internals of those that are sound be infected by them, and they perish.98

97 Vegetius, Digestorum Artis Mulomedicinae Libri IV.i.15
98 Vegetius, Of the Distempers of Horses III.i.2, Trans. Unknown
Where his previous excerpt reads that only the individual ox dies from consuming chicken droppings, this one states expressly that the individual ox that ingests the tainted fodder becomes a danger to those around it, and that if it is not segregated from the rest of its herd, it will infect them as well. This is irrefragable proof of an ancient person’s awareness of the ability of an illness to be passed from a member of one species to that of another. While he identifies contagion through necronosis and miasma (suggested by the participle of *afflare*) in this passage, the author also shows his recognition of xenoosis. Particularly noteworthy is Vegetius’ identification of vectors of contagion— the infected oxen taint the grass, fountains and stalls that they frequent, and these vectors are able to transmit the disease to other individuals after the source animal is no longer present.  

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99 Virgil also shows that he has knowledge of inanimate vectors of contagion— see pp. 37-39.
Chapter 3

Necronosis and Miasma

3.1 Terminology

There does not appear to exist a recognized term to denote the proliferation of disease by corpses;\textsuperscript{100} thus, for the sake of concision I have created the word \textit{necronosis}, a marriage of the Greek words νεκρός and νόσος, using the formula employed for the words anthroponosis, zoonosis and xenoosis.

3.2 The Ancients’ Belief in Necronosis

In his \textit{Natural History of Infectious Disease}, Sir Macfarlane Burnet states that “from the earliest times, putrefaction, especially of unburied human corpses, was regarded as likely to breed disease” and that even as recently as 125 years ago, epidemiologists thought that several epidemic diseases “might be initiated by the diffusion of gaseous material from poisons in the soil, usually of putrefactive origin.”\textsuperscript{101} The literature of the ancient Greeks and the Romans contains many accounts in which it is specified that an epidemic of plague was either incited by the decomposition of uninterred bodies (usually casualties of war or famine) or further propagated by corpses of the epidemic’s victims.

It is not difficult to understand why the ancients believed that any putrefying body (whether the victim of a plague or not) could generate a miasma that caused sickness in

\textsuperscript{100} I am sure this is largely due to the lack of an actual need for such a word, for as I have stated, a decomposing body does not taint the air around it, and poses virtually no risk to anyone who inhales its noisome by-product.

\textsuperscript{101} Burnet 1-2
previously healthy people—the effluvia produced by decaying bodies certainly do not smell benign. Under epidemic conditions in antiquity, it was not at all unusual for there to be bodies strewn about in the streets, so a person moving about in a city during such a time would have been in contact with not only other live citizens (who might be ill and contagious), but he or she would also have been in the presence of foul-smelling corpses. I suspect that if asked to identify whether a rotting corpse or another citizen going about everyday business (who may or may not appear to be sick) seemed more likely to infect another, any lay person would indicate the cadaver, for the reason I have stated above: the fetid nature of decay.

3.3 Actual Risk Posed by Corpses

The ancients were incorrect in their assumption that as a body is decaying, it emits particles capable of infecting others.\textsuperscript{102} In fact, we now know that nothing harmful is released into the air by this decay, and also that the infectious agents of a contagious disease do not survive long in the body after death; therefore, a survivor provides “a much more important reservoir for disease.”\textsuperscript{103}

3.4 Necronosis from Human Remains

There is a very early reference to necronosis within the first two-hundred lines of Sophocles’ fifth-century BC tragedy \textit{Oedipus the King}, occurring when the chorus calls upon the gods to end the plague that is ravaging the city of Thebes. They refer only in passing to the

\textsuperscript{102} While decomposing remains do not cause the air around them to be infectious, they can, however, contaminate drinking water. This shall be discussed in the following section.\textsuperscript{103} Morgan 308
bodies of the dead lying on the ground, describing them as θαναταφόρα,\(^{104}\) or “death-bringing”:

> ῥὲν πόλις ἁνάριθμος ὀλλυταί·
> νηλέα δὲ γένεθλα πρὸς πέδῳ θαναταφόρα κεῖται ἀνοίκτως;

With such deaths, past numbering, the city perishes. Unpitied, her children lie on the ground, spreading pestilence, with no one to mourn them.\(^{105}\)

There follows no elaboration; consequently, the precise manner in which the bodies spread disease is unclear—perhaps it is thought to take place by means of a miasma created by their putrefaction, or through direct physical contact (e.g., with those attempting to dispose of the corpses). Although we now understand that corpses pose virtually no risk to those around them, Sophocles’ claim—that the bodies of the plague victims further perpetuate the disease—shows the ancients’ knowledge that person-to-person infection is indeed possible; i.e., that each occurrence of the pestilence is not thought to be inflicted upon the victim by the gods.

Furthermore, the presence of such a reference in a non-medical work speaks to a pervasive (albeit misconstrued) recognition of the communicability of disease; for a tragedian would likely have been considered a layman concerning matters of medicine. Sophocles was no physician—there is no reason to presume that he possessed some knowledge of disease beyond the grasp of any of his literate Greek contemporaries.

Another work in which the gods and necronosis are both said to cause illness is Diodorus Siculus’ first-century BC tome Historical Libraries. In it he describes the fourth-century BC

\(^{104}\) This single word and its implications first ignited my interest in the topic of ancient conceptions of disease contagion, and ultimately led to this paper.

\(^{105}\) Sophocles, Oedipus the King 179-180, Trans. F. Storr
Carthaginian attack on the tyrant Dionysius’ city Syracuse, and the author states that a pestilence was visited upon the Carthaginians as divine retribution for “acts of impiety”—
their troops had mercilessly sacked the temple of Demeter and Kore in Syracuse. Although the root cause of the plague is attributed to the gods, Diodorus suggests that there is another force at work— necronosis is also occurring. As in the Sophoclean example, however, the implications are not entirely evident:

διὰ γὰρ τὴν τῶν ἀθάπτων δυσωδίαν καὶ τὴν ἀπὸ τῶν ἔλλων σηπεδόνα πρῶτον μὲν ἡρχετο τῆς νόσου κατάρρους...

For by reason of the stench of the unburied and the miasma from the marshes, the plague began with a catarrh...  

From this excerpt one cannot conclude unequivocally that the author intends to indicate that the rotting corpses of plague victims contribute directly to the perpetuation of the illness. Is Diodorus suggesting that those who took in the air polluted by the putrefaction of dead plague victims were infected by those means alone, or that the effluvia produced by the corpses acted with the malodourous swamp air as a sort of catalyst for infection? Because of this identification of the miasma from the marshes as another source of pollution in the air, his meaning is vague— is the plague being spread by both sources? Could it be passed on by only one of them and not the other? We are left with fewer answers than further questions.

Dionysius of Halicarnassus also reports the phenomenon of necronosis in his *Roman Antiquities*, saying that in the year of the eighty-second Olympiad, Rome was seized by the most severe pestilence in its history, which killed the entire slave population and about fifty

107 Ibid. XIV.lxxi.2
percent of the citizens. In this first-century BC work, the author reports that the disposal of
victims’ corpses was conventional at first (cremation followed by burial) when the city was well
stocked with supplies, but later describes it as negligent, when the casualties were too many
and supplies too few:

Not the least of the evils the city suffered, and the reason why the
pestilence did not quickly abate, was the way in which they cast
out the dead bodies. For though at first, both from a sense of
shame and because of the plenty they had of everything
necessary for burials, they burned the bodies and committed
them to the earth, at the last, either through a disregard of
decency or from a lack of the necessary equipment, they threw
many of the dead into the sewers under the streets and cast far
more of them into the river; and from these they received the
most harm. For when the bodies were cast up by the waves upon
the banks and beaches, a grievous and terrible stench, carried by
the wind, smote those also who were still in health and produced
a quick change in their bodies.¹⁰⁸

Here we see necronosis via miasma infecting those who were previously healthy; we are
told of the terrible odour produced by the bodies washing up on the shores of the river, but not
the manner in which they infect others. What is this rapid change—ἡ τροπή—occurring in the

¹⁰⁸ Dionysius, Roman Antiquities X.liii.2-4, Trans. Earnest Cary
bodies of those exposed to the stench of the corpses wafting inland from the Tiber? What are their symptoms? From the information Dionysius provides, we know only of the vague phenomenon of miasmal infection.

The accounts of the Mithridatic and Punic Wars written by the historian Appian of Alexandria in the second-century AD contain allusions to necronosis as well, although they too are rather ambiguous. He tells of a famine brought on at Cyzicus by the Romans’ interception of goods coming into the city, and how this led to a plague:

καὶ τὰ νεκρὰ σφῶν ἄγχοι ἀταφα ῤυπτούμενα λοιμὸν ἐπῆγεν ἐπὶ τῷ λιμῷ.

Moreover the corpses that were thrown out in the neighborhood unburied brought on a plague in addition to that caused by famine.\(^{109}\)

The author does not reveal precisely what he means by this and yet again we are unsure of the manner of the spreading of disease by the bodies lying about— is it due to miasma? Are those disposing of the bodies into the streets thought to be infected through their direct contact with the corpses? As with the previous Dionysian example, miasmal infection seems the most likely explanation in this case; as is typical in ancient accounts of contagion, in this example by Appian we are told that the infection spreads, but not the manner in which it does so.

There is a similar reference in this author’s *Punic Wars* in which he describes the living conditions at Carthage during part of the second Punic War. The author cites several factors contributing to the many deaths of citizens at the time: famine, lack of exercise, the heat of the

\(^{109}\) Appian, *Mithridatic Wars* XI.lxxvi, Trans. Horace White
African summer, and cramped conditions in the city. He writes that the dead could not be removed from within the city because the enemy camped outside the walls kept constant vigil, and that the Carthaginians could not cremate the bodies either, because there was a lack of fuel:

\[ \text{o oyn fthoro aytouz en polo} \text{ te kai periwdunos, sunoisin odwdo} \text{si kai smpomenois sswmasin.} \]

So there was a terrible pestilence among them in consequence of living in the stench of putrefying corpses.\(^ {110} \)

The translation of \( \varphi\theta\rho\omicron\omicron\) affects the implications of this passage. The word “pestilence” connotes a contagious malady, which \( \varphi\theta\rho\omicron\omicron\) can indeed indicate, but nothing else in the author’s words suggests that, once acquired, the sickness is passed from person to person. As in the previous example from the *Mithridatic Wars*, Appian tells us nothing more of this plague other than that it seems to be a result of necronosis of some type or other—one may infer contamination of the air from the information imparted by the author, but the possibility of the pollution of water, or people’s close contact with the bodies contributing to the illness’ rampancy cannot be ruled out entirely.

Livy mentions in his account of the fall of Syracuse that many victims of the plague at that time went unburied there as well, as those left behind were loth to approach or touch victims, for fear of infection. This led to the generation of a miasma:

\[ \text{...sed ne efferrent quidem aut sepelirent, iacerentque strata exanima corpora in conspectu similem mortem expectantium, mortuique aegros, aegri validos cum metu, tum tabe ac pestifero} \]

\(^{110}\) Appian, *Punic Wars* X.lxxiii, Trans. Horace White
odore corporum conficerent.

…the lifeless bodies were left lying about before the eyes of those who were awaiting a similar death. So what with fear and the foul and deadly miasma arising from the bodies, the dead proved fatal to the sick and the sick equally fatal to those in health.\textsuperscript{111}

It is curious that Livy should say that the dead caused the death only of those who were already sick, but not the infection of those who were previously unaffected by the illness. Does this necronotic miasma affect only those who have already been weakened by the plague, or can it also infect healthy people— is its pathology detrimental only, rather than infectious? The details of pestilences in some historical treatises are minimal, for the author is typically most concerned with the particulars of battles and the like, rather than a pestilence’s mode of transmission; however, despite the paucity of details in some of these descriptions of plagues, we are still able to glean valuable information about the Romans’ and ancient Greeks’ concepts of both disease contagion and transmission.

3.5 Necronosis from Animal Remains

The ancients did not believe that human corpses were the only remains that held the potential to cause disease; animal corpses were also thought to create miasmata that were harmful to humans.

In the account of the mythic plague at Aegina told by Aeacus in Ovid’s \textit{Metamorphoses}, the author reports the effect of the decaying animal corpses lying about:

\ldots silvisque agrisque viisque

\textsuperscript{111} Livy, \textit{The History of Rome} XXV.xxvi.10, Trans. Rev. Canon Roberts
corpora foeda iacent, vitiantur odoribus auroae.
...dilapsa liquescunt
adflatuque nocent et agunt contagia late.

Decaying carcasses lie in the roadways, fields and woods, and the
air is fouled with the stench...
They rot on the ground, pollute the
air with their dying breath, and spread contagion far and wide.\textsuperscript{112}

The subsequent line reads that the pestilence increases in its virulence and then spreads
to farmers: the tillers of the soil. He might intend to suggest that the plague was spread by
miasmal infection; his use of the word \textit{afflatus} certainly substantiates the implication of
miasma theory. However, Ovid mentions previously that among the first to succumb to the
illness are cattle, oxen and sheep. Since farmers and husbandmen are the first humans to fall
ill, might the author be indicating that their physical contact with the animals was the reason
for their infection? The presence of the noun \textit{contagium}, separated from \textit{colonus} by one line,
implies that this is so, given the origins of \textit{contagium}. Or might Ovid intend to mean that it is
the proximity of the \textit{coloni} to the foul air expelled by the sick animals that is their downfall? It
seems most likely that the author was simply not concerned with the precise manner in which
the plague might have been proliferated, and that implication to the nebulous theory of
miasmal infection was sufficient enough an explanation for a poet’s purposes, and those of his
contemporary reader.

\textsuperscript{112} Ovid, \textit{Metamorphoses} VII.547-548, 550-551, Trans. A. S. Kline
3.6 Necronosis from Insect Remains

In ancient literature there are also instances in which authors claim that the rotting of dead insects has incited a plague. Illnesses which are passed from arthropods to humans are called “arboviruses,” short for “arthropod-borne viruses.” There seems, however, to be lacking a specific word the actual transmission of these viruses, and so to fulfill this need, I propose the word *entomonosis*, from the Greek words ἔντομα (insects) and νόσος.

There is a fragment from one of the lost books of Livy’s *History of Rome* in which the author states that locusts caused many deaths in Africa in 127 BC:

> Pestilentia in Africa ab ingenti lucustarum multitudine et deinde necatarum strage fuisse traditur.

> An extraordinary multitude of locusts in Africa, killed and lying dead on the ground, is said to have produced a pestilence.\(^{113}\)

Here the translator’s choice of the word “pestilence” is somewhat misleading. *Strages* may indicate an overthrowing, downfall, or death by illness, although not necessarily one that is contagious between people.

Fourth-century AD author Julius Obsequens also shares this account (which he dates as 125 BC), but he uses the word *pestilentia*, which is more suggestive of a contagious disease than Livy’s *strages*:

> ...apparuit locustarum ingenti agmine in Africa, quae a vento in mare deiectae fluctibusque eieectae odore intolerabili Cyrenis mortifero vapore gravem pestilentiam fecerunt pecori; hominumque DCCC milia consumpta tabe proditum est.

\(^{113}\) Livy, *History of Rome* LX, Trans. William A. McDevitte
...there appeared a huge horde of locusts in Africa, which were driven by the wind into the sea and emitted from the waves an intolerable odour to Cyrene and with their deathbearing stench they caused a grave plague for animals. And as for men it is handed down that 800 thousand were consumed by this wasting.\textsuperscript{114}

This occurrence is also mentioned by St. Augustine in his fifth-century AD work \textit{The City of God Against the Pagans} in which he recalls the many calamities which were visited upon Rome before the time of Christ. He asserts that had Christianity come into being before the Punic Wars, those who were accusing the Christians in St. Augustine’s time would have attributed the disasters to the Christian religion, even though they did not blame the gods of their own religion at the time. The author lists a number of events with which he says he is familiar through Roman historical texts (although he does not mention specific authors). One of these events takes place in Africa:

\begin{quote}
Lucustarum etiam in Africa multitudinem prodigii similem fuisse, cum iam esset populi Romani provincia, litteris mandaverunt; consumptis enim fructibus foliisque lignorum ingenti atque inaestimabili nube in mare dicunt esse deiectam; qua mortua redditaque litoribus atque hinc aere corrupto tantam ortam pestilentiam, ut in solo regno Masinissae octingenta hominum milia perisse referantur et multo amplius in terris litoribus proximis. Tunc Uticae ex triginta milibus iuniorum, quae ibi erant, decem milia remansisse confirmant.
\end{quote}

In Africa, which by that time had become a Roman province, they record that there was also a prodigious number of locusts which, when the fruit and the leaves of trees had been eaten up, were hurled, they say, into the sea in one huge and incalculable cloud. When they were cast up dead on the shore and the air was polluted with them, there arose such a pestilence that in the Kingdom of Masinissa alone eight hundred thousand people are

\textsuperscript{114} Julius Obsequens, \textit{Book of Prodigies} 30, Trans. Alex Nice
said to have perished, and many more in the districts bordering on the sea. Of the thirty thousand troops then at Utica, they assert that only ten thousand survived.\textsuperscript{115}

It seems that the ancients did not discriminate between human, animal and insect remains in their ideas about necronosis—rotting organic matter of any type was thought to bring about a plague (including vegetable material, as shall be pointed out in the chapter concerning environmental miasmata, beginning on p. 75).

Most of the above references to necrotic infection either state explicitly that the disease in question is being passed on via miasma or they allude to this phenomenon. Again, the ancients were mistaken in this belief; for despite the foul odours produced by the putrefaction of human, animal and insect remains, they alone do not act as a medium for spreading disease, as the microorganisms acting in the process of decomposition are not pathogenic.\textsuperscript{116} However, animal and human remains can and do spread illnesses through the contamination of drinking water, and during a disease epidemic the presence of uninterred or improperly interred corpses may cause conditions to worsen significantly.\textsuperscript{117}

\textsuperscript{115} Saint Augustine, \textit{The City of God Against the Pagans} III.xxxi, Trans. George E. McCracken
\textsuperscript{116} Morgan 308
\textsuperscript{117} Smith 141
4.1 How Water Becomes Contaminated and What With

The contamination of drinking water has always been a concern for humankind and continues to contribute to the rampantcy of epidemic diseases in present day society, predominantly in third-world countries. In fact, as of 2004, the World Health Organization named water-related diseases “the leading cause of morbidity and mortality worldwide.”

As I have stated above, modern studies have shown that transmission of disease by corpses is very minimal, except in cases where bodies pollute an area’s supply of drinking water (this occurs more often during outbreaks of infectious disease). Following present-day natural disasters where there is no epidemic disease present, there are still risks for those who are in contact with corpses and those who drink water contaminated by them; for although a disaster victim is not carrying what might be considered an epidemic illness, he or she may carry other pathogens of diseases endemic to the area that may be passed on after death (such illnesses are most often gastrointestinal—e.g. rotavirus, campylobacter, salmonellosis, enteric fevers, Escherichia coli, hepatitis A, shigellosis [a type of dysentery] and cholera).

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118 Steere-Williams 765
119 Morgan 308
120 Morgan (308-309) states that those in contact with cadavers can be at risk of infection with bloodborne viruses (which would require bodily fluids from the deceased making contact with the live person’s mucous membrane [i.e. mouth, eyes, or nose] or an open wound), enteric pathogens (i.e. illnesses acquired through the fecal-oral route of infection), and tuberculosis. A corpse with tuberculosis may expel excess air from its lungs when moved, sending forth aerosol droplets, which can infect others.
121 Morgan 308
4.2 Water Contamination in the Ancient World

In ancient times, when sanitary conditions in large cities were often abysmal, with refuse and human waste in the streets, sewers and rivers, one might expect gastrointestinal illnesses to be rampant and severe at the very best of times. Burnet writes that in ancient times, natural disasters and famines created “violent disturbances [in] the balance between man and his parasites. There was never an opportunity to develop a *modus vivendi* with all the microbes and larger parasites which assailed him.”

Although there does not seem to have been much recognition of the role of water in facilitating the spread of epidemics in antiquity (as there was a general knowledge of the communicability of disease), the ancients did think that water was vitally important to a person’s health. The author of the Hippocratic text *Airs, Waters, Places* lists the quality of one’s drinking water as the third most important factor when considering a person’s health, after the seasons of the year and the winds and he also attributes some endemic illnesses to water quality, e.g., seasonal fevers. Throughout the treatise there are references to water and its effects on people, but it is the seventh part that concerns the subject exclusively. In it the author reiterates the significance of water’s influence on a person’s health, and he presents the following qualities as important to consider when assessing the healthfulness of water: clarity, smell, thickness, colour, temperature, hardness, taste and direction from which it has sprung.

Although ancient physicians examined the various properties of water quite closely, and each was determined to have either beneficial or adverse effects on a person, Hippocratic medicine did not consider water much of a factor in the spreading of epidemic disease unless it

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122 Burnet 16
123 Steere-Williams 766
was foul-smelling and contributed to the corruption of the atmosphere\textsuperscript{124} — yet another example of the theory of miasmal infection.

4.3 Contamination of Water by Corpses

Despite the tendency of ancient people to ascribe the proliferation of an illness to miasma, there do exist passages by several authors in which the knowledge of water contamination by corpses seems apparent and may indeed be inferred.

In his \textit{Metamorphoses}, Ovid alludes to the danger of consumption of water in which there are bodies of plague victims. To the scholar foraging for ancient references in which there is a possible recognition of the transmission of water-borne illness, Brookes More’s 1922 translation of this passage is more tantalizing than the original Latin text:

\begin{center}
Inde graves multi nequeunt consurgere et ipsis inmoriuntur aquis: aliquis tamen haurit et illas.
\end{center}

\begin{center}
Too weak to rise, they die in water they pollute, while others drink its death.\textsuperscript{125}
\end{center}

This interpretation implies that the people who drank the water containing corpses of plague victims died as a direct result of consuming the tainted water, and that the author recognizes the phenomenon. The passage might better be translated more literally as:

\begin{center}
Too weak to rise, many die in the water itself, and yet others continue to draw it [the water].
\end{center}

\textsuperscript{124} Steere-Williams 766
\textsuperscript{125} Ovid, \textit{Metamorphoses} VII 570-571, Trans. Brookes More
The Latin text specifies only that others continue to draw the water for the purpose of drinking, not that the act of drinking it infects them with some sort of disease that causes either illness or death. However, the author’s use of the word *tamen* does connote concern for ill-effects for those consuming the water, which at the very least suggests knowledge that the water has been affected adversely by the bodies.

Dionysius of Halicarnassus reports a similar situation in his account of a terrible plague in Rome in 351 BC, saying that the river is contaminated by the bodies decomposing in it, generating a terrible stench and causing the water to be no longer potable:

\[
\text{πίνεσθαι τε οὐκ ἔτι χρηστὸν ὅν τὸ ἕκ τοῦ ποταμοῦ κομισθὲν ὕδωρ,}
\text{τὰ μὲν ἀτοπίᾳ τῆς ὁσμῆς, τὰ δὲ τῷ πονηρᾷ τὰς ἀναδόσεις ποιεῖν}
\text{τῆς τροφῆς.}
\]

And the water brought from the river was no longer fit to drink, partly because of its vile odour and partly by causing indigestion.\(^{126}\)

A close examination of the original Greek reveals that little liberty has been taken in the translation; unlike the Ovidian example above, this interpretation is largely literal and faithful to the Greek. It does not, however, identify the trouble with digestion more specifically than indicating that the water is causing ἀνάδοσις (digestion) to be πονηρός (toilsome). Whether this means ἀνάδοσις is uncomfortable, painful or impossible (i.e. because of vomiting) we are not told; the only certainty is that the bodies in the river are affecting the integrity of the water, and it is in a decidedly negative way.

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\(^{126}\) Dionysius, *Roman Antiquities* X.liii.4, Trans. Earnest Cary
The historian Ammianus Marcellinus also points out the potential of contaminated water to cause illness. In his account of the Siege of Amida in 359 AD he speaks of a plague affecting the city and the possible role of dead bodies in affecting the health of the people in the area:

Aliis placet auras (ut solent) aquasque vitiatas faetore cadaverum, vel similibus, salubritatis violare maximam partem, vel certe aeris permutationem subitam aegritudines parere levores.

Others believe that when the air, as often happens, and the waters are polluted by the stench of corpses or the like, the greater part of their healthfulness is spoiled, or at any rate that a sudden change of air causes minor ailments. 127

With the details given, we cannot know either the effects on a person’s health or the nature of the ailments which the author claims are brought on by pollution of the air and water by putrefying human remains. Does corruption of the air cause symptoms different than those brought on by the contamination of water? Must water be consumed in order for a person to acquire symptoms? Ammianus’ use of the verb *violare* suggests that these afflictions are not negligible— for possible translations of this verb are: “violate,” “injure,” and “lay waste to.”

It may strike a modern person as somewhat surprising that ancient authors claim that human consumption of water in which plague victims are decomposing results in nothing more serious than indigestion, or a non-specific change in a person's overall well-being; however, previous exposure to some microorganisms and parasites can cause a person to have an acquired immunity to them, although others might always result in symptoms. Perhaps the connection between drinking the polluted water and infection with disease was not made

simply because the contamination of the air was so much more apparent. Any person who has smelled the decomposition of even one small animal knows that a great number of human corpses left unburied would produce an odour of unimaginable putrescence. Alternatively, the phenomenon of an incubation period might also cause the relationship between consumption of contaminated water and infection with disease to not be recognized.

4.4 Stagnant Water

Within Columella’s description of the optimal setting for a farm he discusses water, particularly which types are best for drinking. A source of potable water would have been absolutely essential for the ancient farmer deciding where to place his home.

\[
\text{deterrima palustris, quae pigro lapsu repit; et pestilens, quae in palude semper consistit. Hic idem tamen umor, quamvis nocentis naturae, temporibus hiemis edomitus imbribus mitescit; ex quo caelestis aqua maxime salubris intellegitur, quod etiam venenati liquoris eluit perniciem. Sed hanc potui probatissimam diximus.}
\]

Worst of all is swamp-water, which creeps along with sluggish flow; and water that always remains stagnant in a swamp is laden with death. But the same water, harmful though its nature is, is purified by the rains of the winter season and loses its virulence; from this fact water from the heavens is known to be most healthful, as it even washes away the pollution of poisonous water, and we have stated that this is most approved for drinking.\(^{128}\)

Considering that possible translations of the word *pestilens* include both “harmful” and “deadly,” it is possible that Ash’s words are an exaggeration of Columella’s intended meaning; for there is quite a difference between something that is harmful and that which is deadly.

\(^{128}\) Columella, *On Agriculture* I.v.3 Trans. H.B. Ash
Nevertheless, there are other indications in this passage that suggest the author’s knowledge of water’s ability to cause illness; the water is also referred to as harmful (*nocens*), and Columella says that rain water is able to purify even poisonous (*venenatus*) water by removing its pollution (*pernicies*). One wonders if this pollution is a natural property of the water, or if it has somehow been added by an animal or human, and in the case of human activity if the contamination was accidental or otherwise.\(^{129}\)

Whether the author thought it to cause illness or death, it is certain that he was aware that stagnant water was not suitable for drinking, and that it had the ability to cause sickness in humans, at the very least.

### 4.5 Deliberate Infection with Disease

Along with the knowledge of the contagious properties of some illnesses and the ability of contaminated water to cause sickness, it is also evident that the ancients knew that disease could be inflicted upon a group of people intentionally. Today we know this war tactic as “germ warfare” or “bioterrorism,” and I doubt that few appreciate how far into the past its roots can be traced. In her *History of Infectious Diseases and the Microbial World*, Lois Magner refers to the ancient association of fevers with marshy areas and says that Roman and Greek generals would endeavour to force the opposing army to traverse or set up camp in swamplands, a strategy reminiscent of germ warfare.\(^{130}\)

There are examples of more proactive attempts at bioterrorism as well, such as that found in Thucydides’ *History of the Peloponnesian War*, in which the historian articulates the

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\(^{129}\) See below for deliberate contamination.

\(^{130}\) Magner 8
belief of some Athenians that the fifth-century plague was incited in the city by the Peloponnesians putting poison into the wells of the city:

ἐς δὲ τὴν Ἀθηναίων πόλιν ἐξαπιναίως ἐνέπεσε, καὶ τὸ πρῶτον ἐν τῷ Πειραιεῖ ἕψατο τῶν ἀνθρώπων, ὡστε καὶ ἐλέχθη ὑπ’ αὐτῶν ὡς οἱ Πελοποννήσιοι φάρμακα ἐσβεβλήκοιεν ἐς τὰ φρέατα·

Then it suddenly fell upon the city of Athens, and attacked first the inhabitants of the Peiraeus, so that the people there even said that the Peloponnesians had put poison in their cisterns,\(^\text{131}\)

The author states that this hypothesis is not his own, and that he leaves the speculation of the origin of the illness to other writers; he says that he wishes only to record the nature of the pestilence and its symptoms, so that it might be recognized in the future, should it ever return.\(^\text{132}\)

This example is not particularly poignant, for Thucydides is recording only what the people who dwelt at Piraeus thought had happened with their water supply—surely this was a conspiracy theory driven most likely by the people’s desire to assign blame to the enemy for the calamity that had befallen them. One might argue that even if the Peloponnesians had contaminated the water, it does not necessarily mean that it caused a plague; the illness might instead have been a case of mass poisoning. I do not think this to be an arguable hypothesis at all, however, for Thucydides makes it quite clear throughout his account of this plague that it is an ailment with contagious properties. The fact that the disease is said to have begun in the port city of Piraeus causes me to suspect—just as Thucydides does—that it came from

\(^\text{131}\) Thucydides, History of the Peloponnesian War II.xlviii.2 Trans. Charles Forster Smith
\(^\text{132}\) Ibid. II.lviii.3
elsewhere, and arrived at Piraeus with travellers or traders (Thucydides names Ethiopia as the original source of the plague).

Dio Cassius’ Roman History contains more compelling instances of germ warfare in which the author states that there are cases of the malicious infection of people with disease. One such account is said to have occurred during the reign of the emperor Commodus, when he was killing prominent men in the city:

γέγονε δὲ καὶ νόσος μεγίστη ὡν ἐγὼ οἴδα· δισχίλιοι γοῦν πολλάκις ἡμέρας μᾶς ἐν τῇ Ῥώμῃ ἐτελεύτησαν. πολλοὶ δὲ καὶ ἄλλως οὐκ ἐν τῷ ἄστει μόνον ἄλλα καὶ ἐν ὅλῃ ὡς εἰπεῖν τῇ ἄρχῃ ὑπ’ ἀνδρῶν κακούργων ἀπέθανον· βελόνας γὰρ μικρὰς δηλητηρίως τισὶ φαρμάκοις ἐγχρίοντες ἐνίεσαν δι’ αὐτῶν ἐς ἐτέρους ἐπὶ μισθῷ τὸ δεινὸν·

Moreover, a pestilence occurred, the greatest of any of which I have knowledge; for two thousand persons often died in Rome in a single day. Then, too, many others, not alone in the City, but throughout almost the entire empire, perished at the hands of criminals who smeared some deadly drugs on tiny needles and for pay infected people with the poison by means of these instruments.

The sentence following the historian’s explanation of contaminated needles tells that something similar happened in Rome’s history previously, during Domitian’s reign. Again he describes someone using needles contaminated with poison to prick people to make them ill. In this example he also states that some of the perpetrators were found and punished, but no additional details are given. Dio Cassius’ last comments on the incident are that “this sort of

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133 The Greek νόσος may indeed be translated as “pestilence,” but this English word carries connotations of an illness with contagious properties—not necessarily the intention of the author. Other acceptable (and more ambiguous) translations include “sickness” or “disease.” I admit that this example may be nothing more than a mass poisoning, but the fact that this cannot be proven causes me to consider it as a possible act of bioterrorism in which a contagious disease is inflicted upon a group of people.

134 Dio Cassius, Roman History LXXIII.xiv.3-4, Trans. Earnest Cary
thing happened not only in Rome but over practically the whole world” (καὶ τοῦτο οὐκ ἐν τῇ Ῥώμῃ μόνον ἀλλὰ καὶ ἐν πάσῃ ὡς εἰπεῖν τῇ οἰκουμένῃ ἐγένετο). 135

The notion of ancient acts of bioterrorism is a fascinating one, certainly enough so to warrant further research. 136 If I were to expand the scope of this paper I might do so in this area, and search not only for instances of mass poisonings, but also for any accounts of a contagious illness being inflicted upon a population purposely (other than that of Thucydides, in which the author himself admits was probably not incited by contaminated water).

135 Dio Cassius, Roman History LXVII.xi.6, Trans. Earnest Cary
136 Upon my initial investigations into this topic, I came across a short paper by Adrienne Mayor, a research scholar in the History and Philosophy of Science and Technology program of Stanford University, who has also written a book about biological and chemical warfare in the ancient world. In her paper the author discusses examples of biological warfare found in both ancient history and myths. She mentions the above example involving the use of needles, as well as the Scythians’ use of scythicon, a poison made up of putrefied viper remains, human blood and animal feces, into which Scythian archers would dip their arrow tips. It was said to cause infectious wounds and death. Mayor also cites several well-known myths in which there are acts which might be considered forms of germ warfare, including Hercules’ poisoning of his arrows with blood from the Hydra and Medea’s revenge on Jason, when she sends a contaminated robe to her lover’s wife, Glauce.
Chapter 5
“Creatures” and “Seeds” as Origins of Disease

Preface

Within ancient discussions of miasmata, which often take the form of advisement against residing near swamps or marshes, one finds a number of references to what are most commonly translated into English as “creatures” or “particles,” which travel through the air and cause illness once they are aspirated by humans. It was believed that these tiny creatures were generated by the decomposition of organic matter in stagnant water, most probably because of the unpleasant odours produced by this decay. The ancients had observed that those who lived near wetlands suffered from more fevers than those living on higher ground, and they were generally less healthy as well, reinforcing their belief in miasmata generated by swamps. We now know that this phenomenon was likely a result of malaria,\textsuperscript{137,138} which was caused not by the inhalation of effluvia produced by decaying matter, but by certain types of mosquitoes which carry the virus and their hematophagous predation of humans.

\textsuperscript{137} Credit for the coining of the word “malaria” is disputed. Bollet (35) asserts that it was created by Francesco Torti, the man who introduced to Italy the first treatment for the disease in the eighteenth century, while Desowitz (151) identifies the eighteenth-century English writer Horace Walpole as the first to use the term. Not debated is the etymological origin of the word— it is an elision of the Italian term \textit{mala aria} (literally “bad air”) which is indicative of what was still believed to be the cause of the disease at the time— the foul air emitting from marshlands and swamps (Bollet 35).

\textsuperscript{138} The existence of malaria in ancient times seems to be a widely-accepted fact in the academic world. Shah (37) writes that ancient people (most particularly Hippocrates) “described the disease in vivid enough terms for historians to confirm its identity.” One author suggests that malaria affected humans’ primate ancestors millions of years ago (Aberth 2). Soren tells of a 2002 study of human remains from Lugnano, a site in Umbria in which was found an infant cemetery. DNA analysis of the “more substantial bones” of the eldest child buried there (who was between two and three years of age at time of death) revealed \textit{Plasmodium falciparum} malaria (Soren 203). Often referred to as malignant \textit{falciparum} malaria, it is the most dangerous of the malarial strains, which has the highest mortality in children (Baker 79).
The ancient belief that the origin of malarial fevers was due to standing water is intriguing, for it is not categorically untrue. Mosquitoes breed in such waters and the winged adults do not roam far from their marshy habitat in any direction, neither by their own power nor by the breeze,\textsuperscript{139} causing them to remain congregated around fenlands and consequently infect with malaria the humans living in the area. Stagnant water may be said to be an indirect cause of malaria— one without which the disease would not be spread.

5.1 Varro’s Animalia

In his treatise \textit{On Agriculture}, first-century BC Roman writer Marcus Terentius Varro outlines what constitutes the ideal setting for a farm, and cautions against settling near a swamp.\textsuperscript{140} His discussion of the airborne transmission of disease seems remarkably advanced for its time:

\begin{quote}
Advertendum etiam, siqua erunt loca palustria, et propter easdem causas, et quod crescent animalia quaedam minuta, quae non possunt oculi consequi, et per aera intus in corpus per os ac nares perveniunt atque efficiunt difficilis morbos.
\end{quote}

Precautions must also be taken in the neighbourhood of swamps, both for the reasons given, and because there are bred certain minute creatures which cannot be seen by the eyes, which float in the air and enter the body through the mouth and nose and there cause serious diseases.\textsuperscript{141}

\textsuperscript{139} Celli 6

\textsuperscript{140} Varro mentions at I.xii.2 that some people were so opposed to settling near a swamp that, if unable to sell a farm on such land, they would abandon it.

\textsuperscript{141} Varro, \textit{On Agriculture} I.xii.2, Trans. W. D. Hooper and H. B. Ash
Vivian Nutton notes that Varro, “far from being a repository of practical country lore... was a polymath and an erudite compiler from literary sources.”\(^{142}\) He points out the inconsistency of Varro’s “somewhat confusing” explanation that *animalculae*, *miasmata* and unhealthy winds are all causes of illness;\(^{143}\) indeed the author’s account might not be as illuminating as one might hope, but one must concede that the ancient notion of creatures whose very existence could not be proven at the time is remarkable nonetheless.

5.2 Lucretius’ *Seminae*

The Roman poet Lucretius describes a somewhat different process to explain what causes human illnesses:

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\text{Nunc ratio quae sit morbis aut unde repente mortiferam possit cladem conflere coorta morbida vis hominum generi pecudumque catervis, expediam, primum multarum semina rerum esse supra docui quae sint vitalia nobis, et contra quae sint morbo mortique necessest multa volare; ea cum casu sunt forte coorta et perturbarunt caelum, fit morbidus aeër. atque ea vis omnis morborum pestilitasque aut extrinsecus ut nubes nebulaeque superne per caelum veniunt aut ipsa saepe coorta de terra surgunt, ubi putorem umida nactast intempestivis pluviisque et solibus icta.}
\]

Now I will explain the reason of diseases, or from what place the force of disease can suddenly gather together, and blow together a storm of deadly destruction for mankind and for flocks and herds. Firstly, I have shown above that there are many seeds of things which support our life, and on the other hand there must be many flying about which make for disease and death. When

\(^{142}\) Nutton (1983) 11
\(^{143}\) Varro, *On Agriculture* I.xii.2-4, cf. I.iv.4
these by chance or accident have gathered together, and thrown the heavens into turmoil, the air becomes diseased. And all these diseases in their power and pestilence either come from without down through the sky like clouds and mists, or often they gather together and rise from the earth itself, when through damp it has become putrescent, being smitten out of due times by rains and suns.144

Where Varro describes tiny creatures, Lucretius speaks of *seminae*, something else entirely: the former is a living organism that performs metabolic functions and the latter “the unit of reproduction of a flowering plant, capable of developing into another such plant”145 — potential life.

Lucretius’ description of the role of so-called “seeds” in disease transmission is strongly rooted in the theory of miasmatic infection (as well his own atomic theory), and at certain points, seems quite similar to accounts of disease related in legends, such as Ovid’s *Metamorphoses* (discussed previously in sections 1.3, 3.5 and 4.3), in which the air is pestilential and affects all living things, including trees and plants. Although Lucretius does identify a source for some of these tiny seeds — putrefying matter in stagnant water — he also says that, coming from elsewhere, these seeds can simply gather together and infect the air.

This is not particularly illuminating. Is the reader to assume that these assembling particles were generated in the same manner as others, by material rotting in standing water? Where do they come from? How and why do they accumulate?

A separate matter altogether in Lucretius’ great poem is that of disease contagion. In describing this phenomenon the poet does not mention *seminae* at all, and with his use of

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144 Lucretius, *On the Nature of Things* VI 1090-1102, Trans. W. H. D. Rouse
contages (derived from the verb *contingere*), he only implies that humans act as vectors of contagion. Lucretius does not specify whether his so-called seeds of disease are passed between the individual infected and the person he or she touches to facilitate this transmission of disease.

5.3 Vitruvius’ *Bestiae*

In his architectural treatise dedicated to the emperor Augustus, Marcus Vitruvius Pollio also emphasizes the importance of not settling close to a marshy area:

> Primum electio loci saluberrimi. Is autem erit excelsus et non nebulosus, non pruinosus regionesque caeli spectans neque aestuosas neque frigidas sed temperatas, deinde si vitabitur palustris vicinitas. Cum enim aurae matutinae cum sole oriente ad oppidum pervenient et his ortae nebulae adiungentur spiritusque bestiarum palustrium venenatos cum nebula mixtos in habitatorum corpora flatu spargent, efficient locum pestilentem.

First, the choice of the most healthy site. Now this will be high and free from clouds and hoar frost, with an aspect neither hot nor cold but temperate. Besides, in this way a marshy neighbourhood shall be avoided. For when the morning breezes come with the rising sun to a town, and clouds from these shall be conjoined, and, with their blast, shall sprinkle on the bodies of the inhabitants the poisoned breaths of marsh animals, they will make the site pestilential.\(^{147}\)

Vitruvius’ justifications for this warning distinguish his passage from comparable others in ancient literature. Where Lucretius and Varro cite decaying matter as the source of insalubrious air, Vitruvius identifies the *spiritus bestiarum palustrium*, but he neither clarifies

\(^{146}\) See note 41 on p. 23 for his use of *contages*

\(^{147}\) Vitruvius, *On Architecture* I.iv.1, Trans. Frank Granger
precisely what he means to convey, nor does he use a diminutive term to denote these creatures. Consequently, perhaps we may presume that the *bestiae* are not of the imperceptible variety such as those described by the other authors. If this is indeed the case, might he be describing amphibian and reptilian animals commonly found in marshy areas? Does their exhalation of poisonous breath indicate that they are valetudinary creatures? If so, these fenny beasts could be passing on to humans an illness with which they have already been infected; however, Vitruvius may believe that the creatures themselves are healthy in their own right, but that their *spiritus* brings ill-health to humans. This latter hypothesis seems the most plausible to me, as the author gives no indication that these *bestiae* are themselves unhealthy.

Another way in which this passage differs is that the sun is referred to, but the reference to it appears to be indicative only of time of day— it is not said to cause any substance to decay. In fact, Vitruvius makes no mention of putrefaction at all until the end of this chapter:

> Quibus autem insidentes sunt paludes et non habent exitus profluentes neque per flumina neque per fossas... stando putescunt et uiores graves et pestilentes in is locis emittunt.

Those places, however, which have stagnant marshes, and lack flowing outlets, whether rivers or by dykes, by standing become foul and send forth heavy and pestilent moisture.\(^{148}\)

In the subsequent sentence he speaks of an Apulian town that was relocated due to its proximity to wetlands, which supposedly resulted in improved health for its citizens.\(^{149}\)


\(^{149}\) Scobie points out that although Vitruvius seems concerned with the placement of villas on salubrious grounds and the importance of a source of potable water nearby, he “maintains a discreet silence” on the subject of the disposal of human excreta within homes and cities (pp. 400, 408).
5.4 Columella’s *Animalia*

References to miniscule creatures that produce sickness in humans can also be found in agrarian works, such as Columella’s treatise *On Agriculture*, in which the author describes the optimal setting for a farm:

Nec paludem quidem vicinam esse oportet aedificiis nec iunctam militarem viam, quod illa caloribus noxium virus\textsuperscript{150} eructat et infestis aculeis armata gignit animalia, quae in nos densissimis examinibus involant, tum etiam nantium serpentiumque pestes hiberna destitutas uligine, caeno et fermentata colluvie venenatas emittit, ex quibus saepe contrahuntur caeci morbi, quorum causas ne medici quidem perspicere queunt;

And neither should there be any marsh-land near the buildings, and no military highway adjoining; for the former throws off a baneful stench in hot weather and breeds insects armed with annoying stings, which attack us in dense swarms; then too it sends forth plagues of swimming and crawling things deprived of their winter moisture and infected with poison by the mud and decaying filth, from which are often contracted mysterious diseases whose causes are even beyond the understanding of physicians;\textsuperscript{151}

This passage is curious to me. Columella calls attention to the stinging insects found in marshy areas, which Ash translates as “annoying.” One can hardly argue the validity of this choice of words—mosquitoes, their bites, and most especially their nocturno-aural bombinations are nothing if not aggravating. However, alternate translations for the adjective in question include “dangerous” and “harmful” (an anonymous translation published in 1745

\textsuperscript{150} Nutton (1983: 11) cautions against an anachronous translation of the Latin *virus*. Columella knew it to mean slime, poison or stench, and would certainly have had no associations with the modern meaning of the word.  
\textsuperscript{151} Columella, *On Agriculture* I.v.6 Trans. H.B. Ash
uses “mischievous” which can indicate harmfulness\textsuperscript{152}). The over-zealous scholar might leap upon this single fleeting reference as evidence that it was known in ancient times that mosquitoes are able to infect humans with illness; however, such a reaction would be unwarranted. It is generally agreed that the entomological origin of malaria was entirely unknown until the end of the nineteenth century.\textsuperscript{153} For the modern reader, it is rather intriguing that an ancient author should seem to come so close to identifying a disease’s origin that would not be known until nearly two millennia later.

Columella’s \textit{nantium serpentiumque pestes} are equally puzzling; precisely what are they, and how do they cause diseases in humans? Are any of these swimming or crawling beasts released into the air, and if so, are they small enough to be aspirated or must they be otherwise ingested?

\section*{5.5 Palladius’ \textit{Animalia}}

In fourth-century AD Roman writer Rutilius Taurus Aemilianus Palladius’ treatise on farming and agriculture, he too makes recommendations regarding where it is best to settle and build a farm:

\begin{quote}
Si vicinus est fluvius, ubi statuimus fabricae sedem parare, ejus debemus explorare naturam, quia plerumque quod exhalat, inimicum est, a quo, si talis sit, conveniet refugere conditorem. Palus tamen omni modo vitanda est, praecipue quae ab Austro est vel occidente, et siccaris consuevit aestate, propter pestilentiam vel animalia inimica, quae generat.
\end{quote}

\textsuperscript{152} Columella (1745) 30
\textsuperscript{153} No ancient author identifies mosquitoes as the cause of fevers or any other illness. A great many present-day writers state that the knowledge of the true origin of malaria is indeed modern. See Alcabes 12; Celli 6; Winslow 84; Susser and Stein 321-322.
If there is a river near, where we intend to fix our habitation, we ought to examine its nature, because exhalations are mostly noxious, from which, if it be so, it will be proper for the builder to recede. A fen is by all means to be avoided, especially that which is from the south, or from the west, and which has been used to be dried up, because of pestilential diseases, and of the unfriendly animals which it produces.\textsuperscript{154}

At first glance this advice seems much like that of Vitruvius. Palladius employs the verb \textit{exhalare} (which can carry the definition “exhale” in English) which parallels his predecessor’s use of the noun \textit{spiritus}; however, the source of these expirations is not specified as being the \textit{animalia} that the author speaks of in the passage, but rather \textit{natura}— nature, or the surrounding environment. Although this is an adequate interpretation, a superior one might see \textit{exhalat} translated as “emit.” While the word exhale can be defined as “give off” (as in steam or fumes), its primary definition connotes a living subject, and I do not believe that to be the writer’s intention.

As in the Vitruvian passage, Palladius mentions living creatures but does not use a diminutive form of the word he chooses, perhaps indicating animals that are native to swamplands, or at the very least not indicating miniscule organisms, as do the aforementioned authors. In the above excerpt, \textit{animalia inimica} becomes “unfriendly animals.” This is a perfectly acceptable translation, but \textit{inimica} may also be translated as “hurtful” or “injurious.” One might attempt to argue that the author is associating mosquitoes with illness, but as with the similar Columella passage,\textsuperscript{155} I do not think that to be the case here.

\textsuperscript{154}Palladius, \textit{On Argiculture} I.vii, Trans. Thomas Owen
\textsuperscript{155}See pp. 81-82
5.6 Galen’s σπέρματα

In a 1983 issue of Medical History, Vivian Nutton tells of a “little article, buried deep in the wartime pages of the Mitteilungen zur Geschichte der Medizin” on the subject of second-century AD physician Galen’s use of the term “seeds of disease” (τινὰ λοιμοῖ σπέρματα). In this short article, historian of medicine Karl Sudhoff writes that Galen mentions the phrase “seeds of disease” twice in his extensive oeuvre, and that in its use he echoes the Hippocratic notion that the state of the atmosphere (i.e. the temperature and direction of the air and whether or not it is miasmatic due to rotting corpses, stagnant water or other conditions) can have a detrimental effect on a person’s body, especially if the person is predisposed to a given illness due to the condition of his or her body) the condition of the body being largely contingent upon on the state of the humours within it. To rephrase using Galen’s seed metaphor: a seed will not germinate and develop into a plant unless it is planted in fertile soil, where the conditions are suitable for its growth.

In his treatise examining the different types of fevers, Galen proposes that these tiny seeds are carried in the air and aspirated by humans, having ill-effects when a person’s body is in the proper condition for the seed to blossom into disease:

ἀρ’ ούκ εἰκός τά μὲν εὐθὺς ύπὸ τῆς πρώτης εἰσπνοῆς ἄρχήν τε τοῦ σήπεσθαι λαμβάνειν, ἐπὶ πλεῖστον τε προσέρχεσθαι κακώσεως· ὡσα δὲ ἀπέριττα καὶ καθαρά, τά μὲν μηδόλως, τά δὲ ἔπ’ ὀλίγων πάσχειν, ὡς ῥάστην αὐτοῖς γίγνεσθαι τὴν εἰς τὸ κατὰ φύσιν ἐπάνοδον;

156 Nutton (1983: 3) points out that Sudhoff missed one other such reference in Galen’s work that had “lurked forgotten in a Galenic commentary on Hippocrates.”
157 Sudhoff 227-228
Is it not likely that some, immediately upon taking the first breath take the beginning of the disease, mostly those who have been damaged by bad habits, but as much as people are simple and clean they suffer either not at all, or for only a short time, since the onset in the prepared body will happen more easily for them.\textsuperscript{158}

An interesting concept preceding by centuries any genuine evidence of microorganisms, the notion of tiny seeds (or creatures, as in prior examples) causing illness is not directly parallel to the passages in Chapters 1 and 2 in which recognition of contagion is apparent. In the excerpts in which they are discussed, the \textit{animalculae} and seeds of disease are indeed said to cause maladies, but nowhere is it stated that these miniscule creatures travel from a sick person to one formerly healthy, infecting him or her with the same disease.\textsuperscript{159} In putting forth his theory on disease-inducing seeds, Galen and the other authors examined in this chapter explore the origins of illnesses, not their communicability between humans. Nutton corroborates Galen’s failure to discuss contagion, saying that “[he] and other writers in the Hippocratic tradition… say nothing at all about contagion.”\textsuperscript{160}

On the subject of \textit{animalculae} and seeds as transmitters of disease (which he calls “das Contagium animatum”), Puschmann points out that the concept did exist in ancient times, but instead of commending the ancients for their acumen, he offers the following rather dismissive appraisal:

\begin{quote}
Der Gedanke, dass kleine, mit den Augen nicht wahrnehmbare Thierchen die Ursachen mancher Krankheiten bilden, wurde schon
\end{quote}


\textsuperscript{159} Varlik (133) confirms that “despite awareness of contagion…epidemic diseases were usually blamed on corruption of the air and miasma, or on exhalations rising from putrefying ditches, city garbage, human corpses, and rotting animals.”

\textsuperscript{160} Nutton (1995) 54
Whether a fortuitous abstraction or an ingenious hypothesis, the notion of tiny creatures or seeds held no advantage for the ancient physician in the treatment of his patient, because the miniscule seeds could not be detected or isolated as being within the patient or the atmosphere around him or her.\textsuperscript{162} Nutton writes that “the hypothesis of causative seeds was a philosophical luxury for the intellectual practitioner” and that “the hypothesis of [the seeds’] existence in no way contributed, in Galen’s time, to their elimination.”\textsuperscript{163}

Regardless of its lack of benefit to the ancient medical practitioner, I believe that the notion of imperceptible animals as the cause of maladies to be a remarkable and perspicacious theory for early scientists to have advanced. Although few seem to acknowledge or recognize these ideas of ancient writers, the beginnings of the foundation for what would eventually become germ theory were built in the time of the Greeks and Romans.
Conclusion

While conducting my research for this paper, I found that many secondary sources acknowledged the ancients’ recognition of contagion between members of the same species, but none punctuated to any great degree their awareness of inter-species infection of the various types. This oversight surprised me, as there is ample evidence of the ancients’ knowledge of each of these phenomena. Other modern sources simply overlooked or ignored the contributions of Greek and Roman scientists and writers.

It is true that many ancient theories have been disproven, but we modern people cannot thereby dismiss all such hypotheses. Before one assumes an attitude of what I might call “chronocentrism,” one must remember the dearth of both instruments and prior knowledge at the disposal of ancient people. We in the twenty-first century are equipped with tools that such people could not have even begun to fathom. Consequently, it is unreasonable for us to proclaim the theories of prior and infinitely less be-gadgeted peoples as inferior to our own.

Using little more than observation, the Greeks and Romans recognized the phenomenon of disease contagion, allowing for perhaps the first real defense against certain types of illness: the practice of quarantine. The ancients ought to be commended for their postulations and given due recognition for their part in humans’ understanding of the transmissible nature of illnesses.

The Greeks’ and Romans’ knowledge of the communicability of disease cannot be disputed. I have presented a wealth of information that verifies their recognition of contagion
between humans, between humans and animals, and between animals of different species.

Awareness of non-living vectors of contagion has also been shown, as has ancient conjecture concerning the existence of imperceptible creatures as a cause of morbidity. This has proven that not only were the origins of humankind’s understanding of disease transmission conceived in the writings of ancient peoples, but also that these peoples’ recognition of the phenomenon was more pervasive than one might think.
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