

WASTE, WATER, AND WORMS: THE SANITATION AND TREATMENT OF WATER AND
PARASITIC INFECTIONS IN
YORK, ENGLAND

By

Lauren Elizabeth Easton

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WASTE, WATER, AND WORMS: THE SANITATION AND TREATMENT OF WATER
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Lauren E. Easton, B.S.

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The history of public health is commonly seen as beginning in the 1800s after the industrial revolution, but archaeology has allowed for components of public health to be examined for populations that existed well before the 1800s. Waterlogged soil has led to deposits of organic material to be recovered from York, England—a site that has been occupied for over 6,000 years. Both the organic and inorganic artifacts along with the skeletal remains from the site have been used to reconstruct daily life which provides us with a window to examine past health issues. In particular, data from Roman, Viking, and Medieval occupations of the site have been compared in order to better understand the water supply and the treatment of parasitic infections during each different occupation. In order to assess changes in health and sanitation, data sets composed of both direct and indirect evidence allows for a comparative analysis between each occupation. The results from this study are used to evaluate the extent to which the state was involved in ensuring the health of the community, as well as the way parasitic infections were treated during the different occupations of the site. The information may then add to our understanding of public health today because we will be able to see how it differs from past views of state involvement in community health practices. We will also have more evidence suggesting that human health has been a concern of the state for thousands of years and should continue to be a concern of the state.

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INTRODUCTION

The history of humankind is marked with several important inventions, concepts, and ideas that have been essential to our survival. One such concept, which was not even used until the 1950's, is public health (Porter 1994). Public health differs from medicine because it is concerned with the health of the population as opposed to the health of the individual. In *A History of Public Health* (1958) George Rosen discusses the origins of the term along with the various components which make up the subject. According to Rosen, “the major problems of health that men have faced have been concerned with community life” which indicates that sanitation, the control of transmissible disease, the quality of food and water supply, along with the provision of medical care, have all formed “public health as we know it today” (Rosen 1958). Although we currently have an understanding of how public health affects us today and how it came to be, what is less clear is the way public health practices affected earlier groups of people. Even though the term public health is still relatively new and is used to address a more recent past, we have historical and archaeological evidence showing us that the health of communities has been a state-level concern for thousands of years.

History provides us with valuable information about the past, but occasionally history is not able to provide us with enough information. Archaeology fills in the gaps that the historical record leaves behind, and the combination of history and archaeology help us create a holistic view of the past. When addressing topics pertaining to the health of communities, archaeology provides us with an opportunity to learn about past water and food supplies, and pathologies

provide us with information about the diseases that affected past individuals and communities. Archaeologists have excavated urban areas, such as New York and London, with hopes of learning more about past health issues and concerns of the population. The waste disposal and water systems encountered during excavations relate directly to the ideas of health and sanitation that the past inhabitants had (Fisher et al. 2007:172). Cemeteries, latrines, cesspits, and privies yield botanical remains, skeletal remains, and coprolites, which provide us with clues to understanding the overall health and sanitation of past populations. Previous research endeavors have produced information pertaining to the living conditions of the individuals who once occupied the site, but have failed to compare the changes in communal health over time. Comparing changes in health practices and policies may help us better understand the role states have and have not played in ensuring the health of the community.

Because of the extraordinary preservation of artifacts, ecofacts, and features at York, England, an immense amount of archaeology has been done at several sites (Figure 1). The recurrent flooding that comes to the region has led to waterlogged ground and thus the preservation of artifacts has been ideal. The remains from this site are essential for the examination of health practices and policies because remnants of everyday life have been found. These vestiges also provide a time depth that is lacking from other sites; humans have occupied York for over 6,000 years and the city provides a rich archaeological record.

Data from Roman, Viking, and Medieval occupations of York were compared in order to better understand the changes in health practices during these three major occupations. The changes could reflect the degree to which people during each occupation attempted to secure the health of the community at the state or household level. The significance of this case study of York is that it allows us to demonstrate cultural patterns of disease and eliminates the

environment as a confounding variable. In particular, the examination of the water supply along with the parasitic infections suffered by inhabitants during each occupation provide a comparable data set which is used to examine the role of the state and the utilization of household treatments when it comes to the health of the community. The analysis may then add to our understanding of public health today because we will be able to see how it differs from past views of state involvement in community health practices and we will have more evidence suggesting that human health has been a concern of the state for thousands of years and should continue to be a concern of the state.

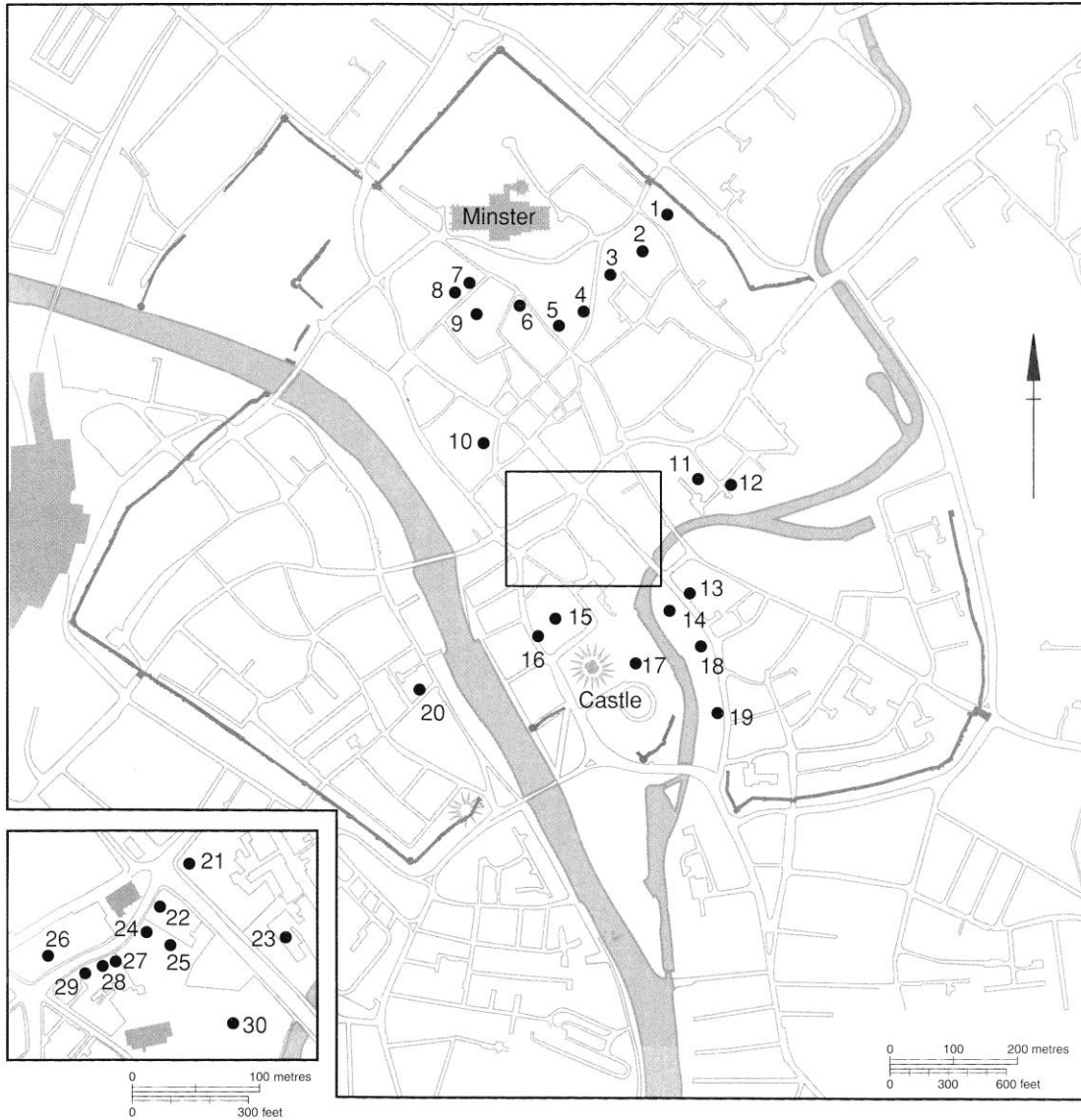


Fig.392 Other sites in York mentioned in the text. Scale 1:10,000; inset of Coppergate area (nos.21-30) 1:5,000

Key:

- | | | |
|------------------------------------|--------------------------|---------------------------------------|
| 1. 1-5 Aldwark | 11. Hungate | 21. 6-8 Pavement |
| 2. The Bedern | 12. Carmelite Street | 22. 28-32 Coppergate |
| 3. 49-51 Goodramgate | 13. 17-21 Piccadilly | 23. Merchant Adventurers' Hall |
| 4. Lady Row, Goodramgate | 14. 38 Piccadilly | 24. 26 Coppergate, building recording |
| 5. 66-8 Low Petergate/Hornpot Lane | 15. 1-2 Tower Street | 25. 26 Coppergate, watching brief |
| 6. 65 Low Petergate | 16. 23 Clifford Street | 26. 5-7 Coppergate |
| 7. 54-60 Stonegate | 17. York Castle Car Park | 27. 14 Coppergate |
| 8. 48-50 Stonegate | 18. 50 Piccadilly | 28. 12 Coppergate |
| 9. Barley Hall, Coffee Yard | 19. 84 Piccadilly | 29. 8 Coppergate |
| 10. Feasegate | 20. 58-9 Skeldergate | 30. Piccadilly Car Park |

Figure 1. Map of excavated sites in York.
Source: Hall and Hunter-Mann 2002:figure 392.

BACKGROUND

The city of York, located in Northern England, sits between the rivers Foss and Ouse (Figure 2 and Figure 3). It has been occupied since the Neolithic period, but it has only been “a large scale nucleated settlement with a considerable head of population” since the beginning of Roman occupation in A.D. 71 (Addyman 1989:245). Research done by Addyman et al. (1976) explains that despite the different groups of people who have lived in York, its occupants would have lived in similar climates because temperatures have changed only slightly over the past two millennia. Inhabitants of York would have experienced warm summers, winters cold enough to freeze the rivers, and flooding which would have led to a low-lying countryside regions to spend some of the winter under shallow water. Because there is evidence for “repeated flooding from the late Roman period until about the twelfth century” we can infer that “flooding restricted the area then available for occupation” (Addyman et al 1976:228). As different groups of people moved into York, the city continued to build on and around the preexisting structures; this indicates that the population lived in nearly the same exact place during the different occupations.

Even though there could be some changes in micro-environmental factors, York’s environment and climate would have been similar during its different occupations. If the river levels increased it was likely from soil erosion caused by agriculture as opposed to an increase in precipitation. The climate underwent minute changes and people lived in the same areas despite changes in cultural occupations; thus the environment can be seen as a constant in this study because it provided the same environmental stresses and reassurances to each population (Addyman et al. 1976:227-229). Because the environment was relatively the same for each group, the similarities and differences seen between each occupation regarding health and

sanitation cannot be attributed to environmental factors. Three of the major occupations of York are Roman, Viking, and Medieval. These particular occupations span from A.D. 71-1485 and are comprised of three very different cultures.



Figure 2. Map of England showing the location of York.
Source: Lonely Planet (modified).

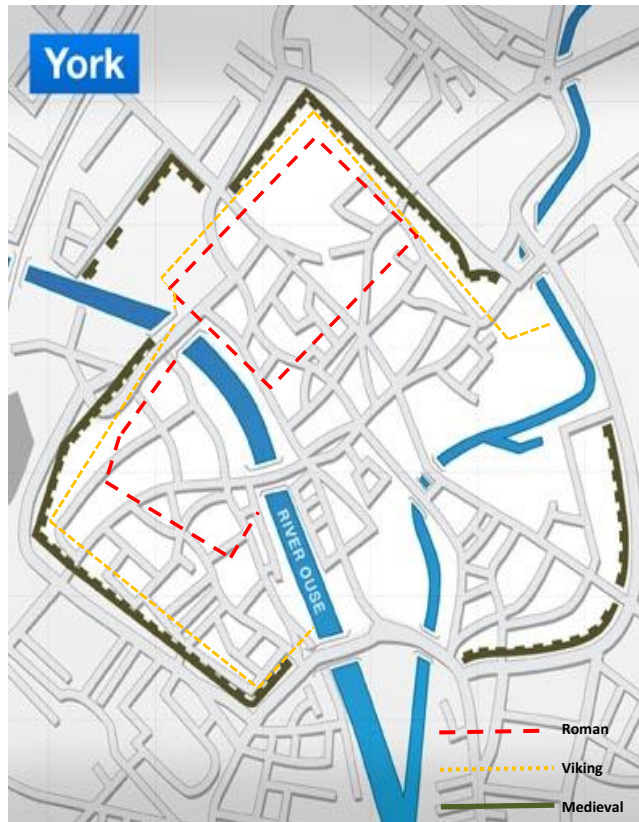


Figure 3. Boundaries of York’s Cultural Occupations.
Source: History of York (modified).

Occupations

The history of Roman York begins in A.D. 71 when the Romans settled between the Ouse and Foss rivers. They built the fortress *Eboracum*, military barracks, grain storage locations, and roads (Addyman 1989:246). During the Romans’ stay at York, the city became organized, clean, and efficient. The layout of the site indicates that it was a well-maintained military base that benefited from a readily available good water supply (Addyman 1989:246). Romans used water not only for drinking and for agricultural purposes, but also for bathing, which had become an even more important practice with the institution of bath houses (Monteleone and Smith 2007:113). We see evidence for both aqueducts and sewers in Roman York and know that Roman society was structured and valued cleanliness. The Romans were pushed out of Britain

in A.D. 410 and York was nearly deserted. Because there was a decline in state power and authority in York, there was no incentive in maintaining the buildings, water supply systems, or roads that the Romans had left behind.

In A.D. 866 when the Vikings entered York, the city had not fully recovered from the Roman abandonment. Viking craft and industry revitalized the city and made York a booming industrial area (Hall et al. 2004:459). York became known as Jorvik, and was established as a true Viking city in England. Differing from the Romans, who implemented sanitation practices, the Vikings appear to have had little concern with the cleanliness of the city (Addyman 1989:255). York's previous aqueduct and sewer system decayed because "little or nothing was done to preserve them" (Rosen 1958:26). Garbage and feces comingled in pits and occasionally on the streets, and the rivers became polluted (Addyman 1989:256). During this Viking Age in York, the living conditions would have been crowded and dirty, and the quality of the water that was used is questionable.

William the Conqueror was displeased with Viking York and in A.D. 1066 invaded and drove out the Vikings. York became a Norman city which easily transitioned into a Medieval city in the years that followed. Castles were built in the area and walls enclosed the city. The fortified walls served to protect the city, but led to more health problems because walled cities were "overcrowded, dark, and filthy" (Swain 1962:89). Filth diseases, like tuberculosis, typhoid, bronchitis, and pneumonia, would have continued to thrive in the city because they result from unsanitary and overcrowded conditions. There was a distinct hierarchy in society which would have influenced the access certain individuals had in terms of medical care (Sullivan2005:256). The Church began to take on some of the responsibilities of the state, including caring for the sick (Hall et al 2004:313). Hospitals begin to occur in churches because they saw it as their duty

to embrace the sick (especially the lepers) and provide care (Catling 2009:22-29). Because hospitals were seen as a means of charity, we know that the state was not obligated to provide those institutions to the public. Medieval York, like Viking York, would have been very crowded and dirty, and the health of the community would not have been a pressing issue.

In York, the population grew as the city aged and the increasing population led to health problems for many citizens (Fisher et.al 2006). Although the occupations being examined are very different, water is a human need and is something that would have been a common concern to all of the citizens of York. Sickness is another human universal, and the methods used to treat sickness differ all around the world. Looking at the same location over time will allow for treatments administered on state and household levels to be examined and compared.

METHODOLOGY

Because York is located in very close proximity to the rivers Foss and Ouse, it has suffered a great deal floods. The frequent flooding in York has resulted in waterlogged soil and has preserved a great deal of organic material (Kenward et al. 1977:58). The anaerobic conditions have made the finds from York unique and plentiful; wood, bone, and other rare materials have been uncovered during excavations. Extensive excavations of York have taken place since the 1960s; the deposits examined contain organic artifacts and biological remains which have allowed for the reconstruction of the environment (Addyman et al. 1976:220). Daily life has been reconstructed from the finds; understanding daily life practices is important when we are trying to better understand how health and sanitation were experienced by past populations.

Findings from York have been compiled into a 20 volume collection by the York Archaeological Trust. The discoveries from these excavations were used to create a comparable data set that allowed for relationships to be established between the health of the population and the occupation of the city. The living conditions, water supply, and level of parasites were all considered in order to better understand what problems the population faced in terms of sanitation. In particular, the data found from latrines, privies, and wells have allowed for an assessment of the water conditions at the site. Because many members of the community used the rivers or the same wells as a water supply, there is a greater chance of contamination that needs to be considered (Sullivan 2005:256). Furthermore, coprolites and soil samples have detected parasites which provide evidence as to what diseases the inhabitants of the city endured.

In attempt to fully understand the health and sanitation at the site, direct and indirect evidence has been analyzed. Research on the archaeoparasitology and paleopathology of York make up the direct evidence used for comparisons; the data utilized in this study come from the analysis of coprolites and skeletal materials from excavations at York. The indirect evidence of disease was examined through the correlation between the various types of botanical materials found and the recorded treatments of the time for treating parasitic infections. If we see a regulated water supply system for the entire population, then the state would have invested in the health of the community. Historic documents provide descriptions of remedies for particular health problems; if there are botanical remains that correlate with the remedies for parasitic infections, then we may have evidence that people of York were aware that they had parasitic infections and were beginning to develop methods to treat their disease.

The specific parasitic infections that will be examined, roundworm and whipworm, come from ingesting contaminated soil on unwashed foods, on dirty hands, or from drinking contaminated water (Fisher et al. 2007:187). Even though the presence of worms is not necessarily due to a contaminated water supply, it does reflect the level of sanitation at the site. Because there is evidence of both whipworm and roundworm we know that people would have been in contact with soil mixed with human feces (Figure 4).

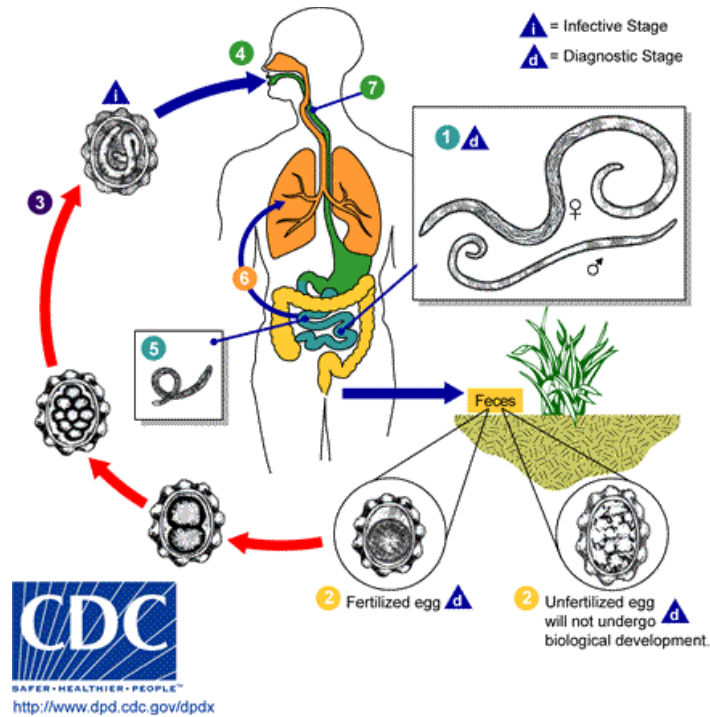


Figure 4. Life cycle of parasitic worms.
Source: CDC Parasites.

One parasite that will be examined is *Ascariasis lumbricoides* or roundworm (Figure 5). Roundworms are the most common parasitic worm worldwide and can live for up to two years in humans (Fisher et al. 2007:187). Roundworm ova enters humans by ingestion, but once the worms develop, they do not always stay in the intestines (Gutierrez 1990). The liver and lungs

may also house these worms which cause patients to produce more symptoms (Gutierrez 1990). Some of the symptoms that accompany this infection are: cough, abdominal pain, weight loss, bloody stool, nausea, diarrhea, and shortness of breath (Gutierrez 1990). Female roundworms can lay up to 200,000 eggs per day which can stay viable for over 14 years after they have been passed into the soil (Fisher et al. 2007:187). The other parasite that will be examined is *Trichuris trichiura* or whipworm (Figure 6). This parasite typically enters humans when soil has been mixed with human feces and then is consumed (Gutierrez 1990). These worms usually live in the human colon, and female worms lay 10,000 eggs per day. The eggs that were in the soil hatch in the human intestine after being ingested. Whipworms burrow into the intestinal wall which protects them from the treatments that affect roundworms (Gutierrez 1990). Symptoms vary depending on the number of worms in the intestines; if there is a large number of worms then people experience abdominal pain, diarrhea, and can become anemic (Gutierrez 1990). Acquired iron-deficiency anemia can be a result because the parasitic infection can cause intestinal blood loss and diarrheal diseases (Sullivan 2005:256).

Both of these infections can be seen archaeologically through the presence of eggs in coprolites and soil samples taken from the site. Unfortunately, the eggs found during excavation do not give us an exact representation as to how heavy the burdens of parasites would have been for past populations because non-fecal material in cesspits can lower egg counts (Jones 1985:110). Despite the possibility that the parasitic ova encountered in York may not fully represent the severity of the infections, the presence of eggs do indicate that the population was suffering from parasitic infections. We may then look to other evidence to determine whether or not any treatment was being used for the infected individuals.

Data sets were compiled for each occupation of York which allowed for analysis of the water supply and sanitation. We also see the degree to which public health measures were taken in the forms of hospitals, latrines, ditches, and wells. Each data set is based on the archaeological evidence from latrines, privies, cesspits, wells, sewers, garbage disposal locations, botanical remains, and historical documentation of health practices and treatments. These occupations were compared in order to better understand how cultural occupation affected the treatment of water and soil-borne parasitic infections.



Figure 5. Adult Roundworm and roundworm eggs.
Source: CDC Parasites-Ascariasis

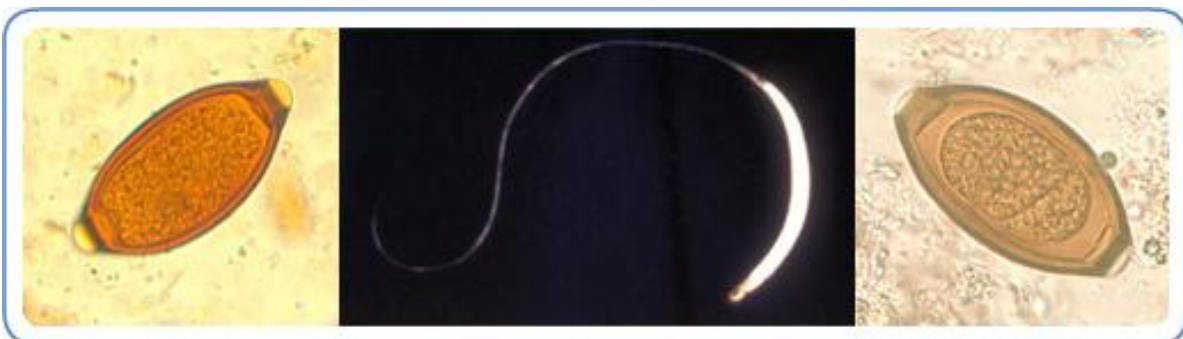


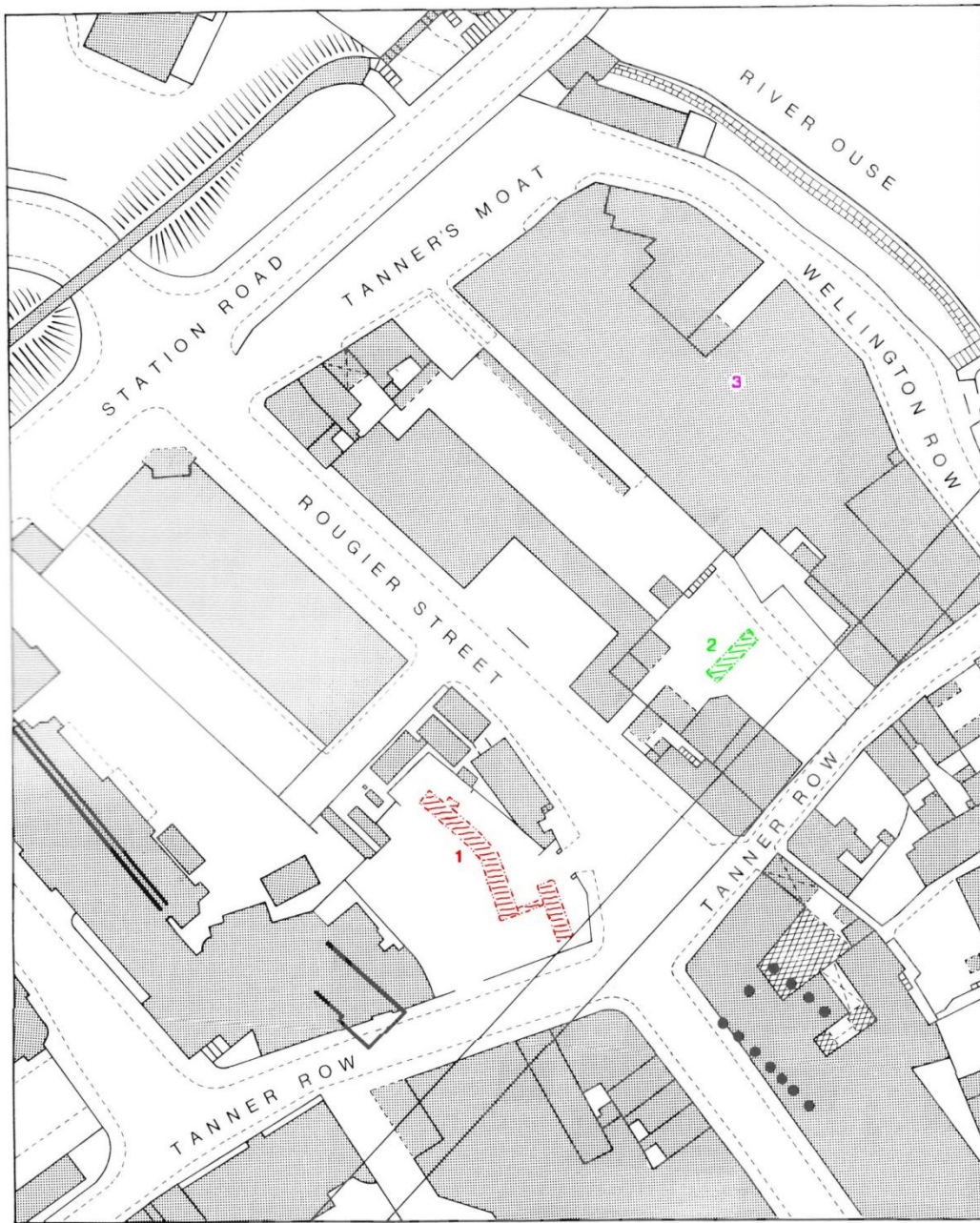
Figure 6. Adult Whipworm and whipworm eggs.
Source: CDC Parasites-Trichuris

DATA PRESENTATION

The Roman, Viking, and Medieval occupations will be discussed chronologically. A brief description of the circumstance of each period will provide context for each period. Each cultural occupation will be analyzed based on water, sanitation, and treatments of infectious disease.

Roman York

Modern York overlies the majority of Roman York which has made it difficult to acquire a substantial amount of evidence from Roman York. Despite problems of excavation accessibility, excavations were conducted at Micklegate, the General Accident Site (24-30 Tanner Row), Skeldergate, Wellington Row, and 5 Rougier Street (Figure 7). These excavations have yielded enough evidence to reconstruct daily life during Roman occupation. We know that by the fourth century York was a capital city. The Romans were very urban people who took their cultural practices with them; as the empire grew, Roman traits were diffused to new environments, and York was no exception (Aldrete 2004:98). York differed from other Roman colonies because it was more than just a housing location for Roman citizens and retired veterans. York was a military capital that eventually led for a town with the classification of *colonia* to develop; the combination of the military fortress and *colonia* allowed York to be seen as a vital asset to the Empire (Figure 8).



Numbered sites: (1) General Accident (24-30 Tanner Row), (2) 5 Rougier Street, and (3) Wellington Row

Figure 7. Map of Roman Excavations of York.
Source: The Archaeology of York 14/6:figure 62 (modified).

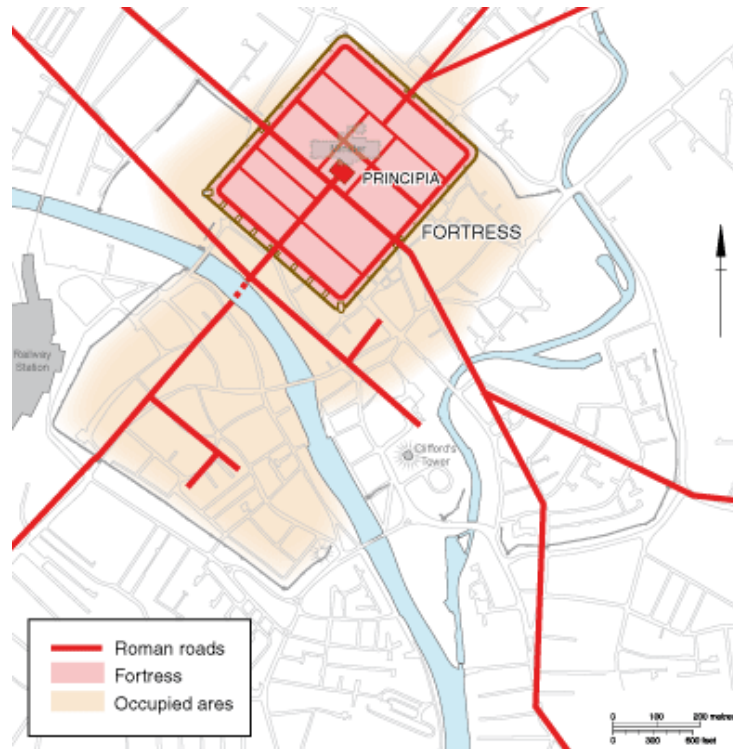


Figure 8. Map of Roman York.
Source: The York Archaeological Trust.

The Romans who settled York likely chose that location because of the confluence of the Ouse and Foss rivers; the location provided an easily accessible water source and allowed for riverine resources to be exploited (Hall and Kenward 1990:414). The 53 acre fortress, Eboracum, would have been similar to other Roman fortresses of the time. Remains of Eboracum (Figure 9) supports John Wacher’s reconstruction of Roman Britain ; he describes the fortresses as being rectangular in shape and “surrounded by ramparts, set with gate-towers, and possibly interval towers”(Wacher 2000:31). Figure 10 shows how the external walls of the fortress would have been constructed out of clay blocks on timber beams and the internal layout of the fortress which would have only been a single story and comprised of the barracks (Wacher 2000:32). Within a century after the construction of Eboracum the civil settlement of colonia began to grow in

population—soon York was large enough to be seen as a town enjoying a some independence from local governors (Aldrete 2004:98).



Figure 9. Remains of a multangular tower from Eboracum.
Source: The York Archaeological Trust Online Picture Library ref:001837.



Figure 10. A reconstruction of the Roman legionary fortress at York.
Source: The York Archaeological Trust Online Picture Library ref: 001816.

Water

The Romans had always taken water issues seriously, and even had a water commissioner in Rome who ensured a clean water supply (Jackson 1988:44). In Rome, all inhabitants were able to benefit from clean water fountains and basins, and some inhabitants were able to have a piped water supply (Jackson 1988:45). The Romans brought their water supply practices and hydraulic technologies with them to their colonies. In York, the Romans more than likely only used the river water because rain water was used for specific medical purposes (Jackson 1988:47).

Because the Romans were the first to heavily occupy the site, it is believed that the quality of the water that the Romans had access to was far greater than any other occupation to follow (Hall and Kenward 1990:386). Remains of fish bones have shown that there was more oxygen in the river during Roman occupation than during any other time which supports the claim that Romans had the cleanest water out of the many occupations of York (Hall and Kenward

1990:386). People used the rivers, timber-lined wells, and aqueducts to obtain water (Addyman 1989:246). Aqueducts (Figure 11) had been used by the Romans since 312 B.C. and allowed the Romans to use water for agriculture as well as other sanitary institutions (Monteleone and Smith 2007:113). Evidence of aqueducts from Pompeii has allowed for a better understanding of how the Romans used them to supply water; water from upstream springs traveled through pressure pipes into tanks that were elevated on pillars (Monteleone and Smith 2007:114). The channels that carried the water from the spring to the city were open to air at all times and particulate impurities could settle to the bottom of the channel during its course (Monteleone and Smith: 117). Within the fortress, lead pipes (Figure 12) have been found to have distributed the water to the residents (Addyman 1989:246). Eventually the progressive water practices used in and around the fortress spread to the civil settlement near the river Ouse. As population increased the

settlement had been reorganized in such a way that allows public health practices and policies to be seen. The systematic layout of the town, the roads, the presence of major public buildings, and the elaborate wells that supplied water all suggest that the state was involved in providing order to the community (Addyman 1989:250).

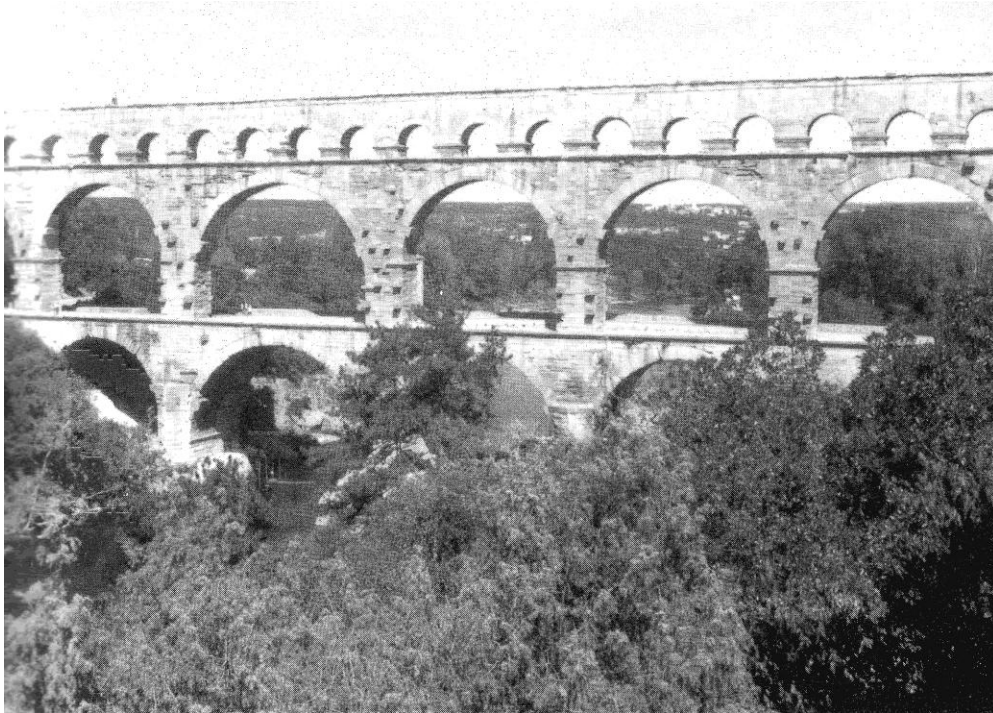


Figure 11. Pont du Gard Aqueducts used by the Romans in France.
Source: Jackson 1988:figure 8.

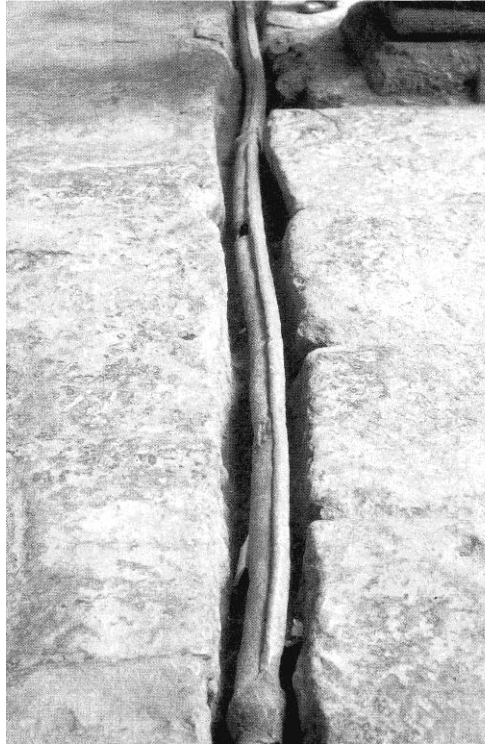


Figure 12. Roman lead pipe from the legionary fortress.
Source: Jackson 1988:figure 33.

Sanitation

From studies done on Roman culture, we know that Roman towns were kept as clean as possible. Having access to clean water for drinking and for bathing was very important to Roman citizens. Bath houses were not only accessible to those individuals of high status or those who lived in Rome; baths were enthusiastically adopted throughout the Empire and were found in small and large towns (Jackson 1988:49). The importance of bathing can be seen in Ralph Jackson's research when he discusses the topic:

A town of any pretension normally had at least one bathing establishment, whose construction and upkeep, like other public buildings, was largely funded by benefactors. As a result the entrance fee was nominal—one quadrans, the smallest copper coin—while children, soldiers and occasionally slaves entered free of charge. Hence admission was not restricted and the public baths commonly combined a social role with their primary hygienic function (Jackson 1988:49)

Bath houses were essential to maintain Roman society because they were places that people went to not only cleanse, but also to socialize, and receive medical treatments (Jackson 1988:47). The bath houses aided the health of the community because routine visits to the bath houses “would have reduced the frequency and transmission of those epidemic diseases” because the amount of vectors which thrive on unclean human bodies would have decreased (Jackson 1988:49).



Figure 13. Example of Roman Latrines from Ostia.
Source: Jackson 1988:figure 9.

The bath houses also would have had public latrines nearby (Figure 13) because both would produce a great deal of waste water (Jackson 1988:50). Jackson's description of latrines claims that they would have been public areas where:

Normally some ten to twenty people could be accommodated on wooden or stone seating around three sides of the room. Sometimes there were ornately carved marble seats and statues in ornamental niches, while in a latrine at Ostia, appropriately enough, an altar to Fortune, goddess of health and happiness, was discovered. In place of toilet paper a small sponge tied to the end of a stick was commonly used, and this could be rinsed in the water in a small channel which ran around the room at floor level in front of the seating before descending into the sewer. Finally, hand-washing water was often provided in marble or stone basins (Jackson 1988:51).

The waste from the latrines and bath houses were deposited into sewers which were constructed out of stone. In York, sewers were "a microcosm of the public health preoccupations of the Roman military command" (Addyman 1989:246). There was an elaborate sewer network underneath the legionary fortress in York and during excavations a lavatory sponge was recovered. Even though the sewers were flushed due to the foul smell and not in order to keep the city healthy, they still were vital in keeping the city clean (Jackson 1988:52). Sewers and drains were constructed in an effort to accommodate the population's need for waste disposal and clean water (Figure 14). Roman period excavations of York have had less preserved organic material than other periods which could be due either to poor preservation or to Roman cleanliness (Hall and Kenward 1990:389).



Figure 14. Roman sewer system under Eboracum.
Source: Jackson 1988:figure 10.

It has been suggested that one of the reasons we find less Roman period artifacts and ecofacts is because the Romans were not unclean individuals and their living environments would have been kept hygienic. Human feces have been found in contexts that are not cesspits, but this is not attributed to a lax attitude toward sanitation. Occasionally people would bury the contents of their chamber pots near wells which may have caused intestinal parasites in some people. The Romans knew that cleanliness was important, but they may not have fully understood the many different ways water can become contaminated (Curse 2004:86). The presence of parasite ova and human feces are found in drains and cut fills in York (Hall and Kenward 1990:391). Even though the Romans attempted to control waste disposal and water supply, there is evidence from Roman period excavations to suggest that occupants did suffer from intestinal worms, human lice, and fleas (Hall and Kenward 1990:392). Both *Ascaris* and *Trichuris trichicra* ova were recovered and indicate that at least some members of the population

were dealing with intestinal parasitic infections (Table 1). Medical documents from the Roman Empire indicate that diarrhea and dysentery would have been very common in most places (Jackson 1988:53). Compilations of disease in the Roman Empire note that there were many places within the Empire that saw intestinal parasites as endemic (Jackson1988:37).

Table 1. Counts of Parasitic Ovum from Roman Deposits.

	Trichuris Ova	Ascaris Ova	Total
5 Rougier Street	458	79	537
General Accident	2462	392	2818
Total	2884	471	3355

Source: Modified from Hall and Kenward 1995:Tables 143 and 144.

Treatments

Because there is a lot of evidence to suggest that parasitic infections would have been semi-common among Roman inhabitants of York, the question is raised as to how those infections were treated. Humans have learned to use the resources around them as remedies for ailments (Jackson 1988:75). Previous Roman scholars had compiled books full of medicines and herbal remedies; the knowledge from the works of Dioscorides, Galen, and Pliny would be known by the inhabitants of York and would have allowed for diagnosis and treatments to be administered. The Michigan Medical Codex was one source that would have been used in the late Roman period; it offered medicinal prescriptions for a variety of different medicines (Curse 2004:57). There were also remedies that existed within families; sometimes the head of the house was also seen as the resident physician and thus had his own methods of treating ailments that had been

passed down from previous generations (Cruse 2004:57). Because a lot of what is known about Roman medicine comes from Rome, it is a little more challenging to know what was done for colonies throughout the Empire. In Britain, it is believed that the Roman Army would have taken advantage of the native folk medicine and would have imported different dried herbs that could be used later for healing purposes (Cruse 2004:74). Both olive and black walnut remains have been found in Roman deposits at York; these items may have only been nutritional, but there is a possibility that they were used to treat parasitic infections. People did not use rain water that was collected for drinking or cleaning; instead it was used to dilute some of the compounds given to treat diarrhea (Cruse 2004:86).

If people were unable to obtain the resources needed to cure sicknesses, the Gods were looked to for help. The Roman goddess of health was Salus and shrines have been found throughout the Empire to Salus (Cruse 2004:110). In Roman Britain, depictions of the Mother goddess and Mars (god of war) have been found around military settlements and hospitals (Cruse 2004:134). The Roman hospitals that existed typically were not used for illnesses like parasitic infections, but nonetheless, the Romans did have hospitals and Gods to pray to when they were very ill or injured. Altars to Fortune, Jupiter, Mars, and the Mother Goddesses have all been found during excavations in York (figure 15). Some of the inscriptions on the shrines and alters said things like, “To the goddess Fortune, for the welfare of Publius Auspicatus and his son...” (Rollason 1998:101). Shrines and alters are not only found in burial contexts; they have also been found near urban buildings, fortifications, and areas of economic activity. The Romans had sophisticated treatment centers in the form of hospitals as well as household treatments in the form of herbal remedies and shrines or alters.

York had become a fully functioning Roman capital city and with it came social stratification. In the growing urban areas of the city there may have been a low standard of basic facilities (Jackson 1988:42). The wealthy members of society could afford separate kitchens, piped water, private baths, and private latrines; the majority of the population was unable to have such accommodations (Jackson 1988:42). The concepts of germs and the use of true soap were unknown during this time which meant that individuals were in charge of maintaining their hygiene in attempt to avoid infectious diseases. In Roman culture “personal hygiene was placed on the daily agenda and made available to the humblest Roman” (Rosen 1958:25). Roman York would have provided public bath houses, running water, and latrines for those living in the city, but city dwellers would have also dealt with over-crowding, waste disposal problems, and would have been more susceptible to contagious diseases. Rural inhabitants would have had less access to the public bath houses and running water, but would have had fresher air and lived in less crowded circumstances. Military hospitals to the North would have been available to soldiers, but all people in Roman York would have had folk medicine to treat their health problems.

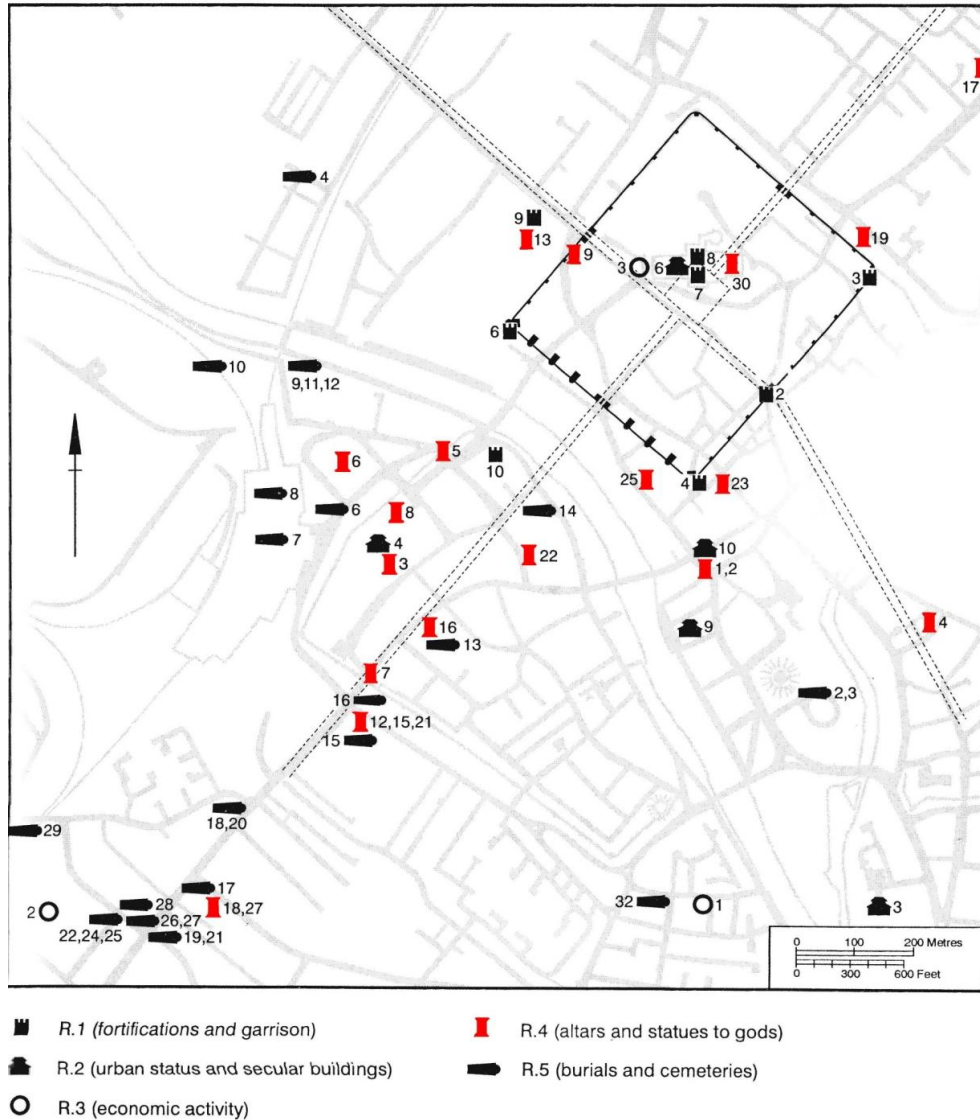
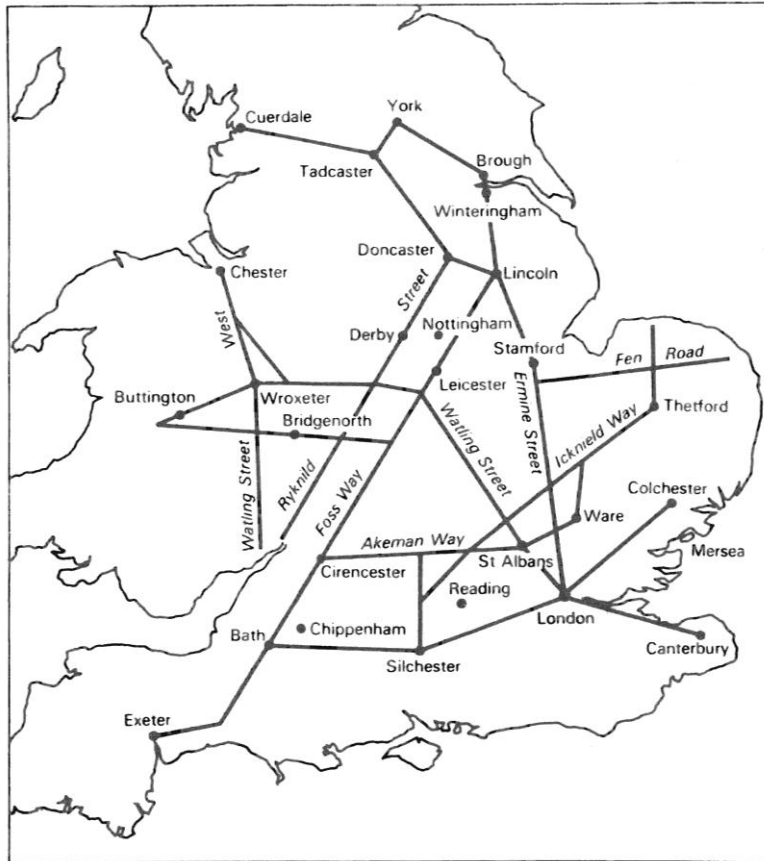


Figure 15. Map of Roman shrines and alters found during excavations of York.
Source: Rollason 1998: figure 1 (modified).

Viking York

Vikings were not only fierce sea travelers and raiders, but they also were settlers who established towns across Scandinavia and Europe (Christiansen 2002:153). The Vikings' supreme navigational and ship building skills allowed for people to move out of Scandinavia and into the British Isles and Russia when population pressure became an issue (Sawyer 1971:208). The settlements served as urban centers that rivaled other urban cities in Europe (Christiansen

2002:154). The Viking towns created a complex trade network that allowed for warriors and merchants to become extremely wealthy (Sawyer 1971:208). England was invaded by a small group of Danish warriors who utilized the remains of the Roman roads to travel across the country (Figure 16).



**Figure 16. Map of Roman roads used by the Vikings.
Source: Sawyer 1971:figure 16.**

When the Vikings attacked in A.D. 793, the English scholar Alcuin documented the invasion:

...never before has such terror appeared in Britain as we have now suffered from a pagan race, nor was it thought that such an inroad from the sea could be made. Behold, the church of St Cuthbert spattered with the blood of the priests of God, despoiled of all its ornaments; a place more venerable than all in Britain is given as prey to pagan peoples. (Wilson 1970:72)

It is evident that the Vikings who entered England did not share the same English beliefs and cultural norms, and were focused on obtaining more resources for trade. York was resettled by Anglo-Saxons after the Romans left, and had dubbed the city Eoforwic. Eoforwic was beginning to emerge as a commercial center; the Vikings saw the economic potential of the location, conquered the Anglo-Saxons, and decided to make the city an even more successful trading area (Christensen 2002:73). York was not intended to simply be another colony, but instead a city where pirates could continue to grow their riches by extending the range of their activities (Sawyer 1971:208-209).

When the Vikings decided to permanently settle York, the Roman fortress, buildings, and walls were avoided; instead the Vikings occupied the area that had been *colonia* and the surrounding suburbs because they had the readiest access to the Ouse and Foss rivers (Kirkby 1977:14). The Viking town, Jorvik, came to one edge of the previous Roman settlement, and when compared to the still surviving Tadcaster stone buildings and walls of the Roman city, looked like a shanty-town (Kirkby 1977:24). The inhabitants of Viking York viewed themselves first and foremost as international merchants, traders, shipmen, and artisans who were only “making use of an ideal site on which a former civilization happened to have left behind a city” (Kirkby 1977:24). Because the primary purpose in settling York was to trade, the Vikings did not put in the same effort as the Romans had done to maintain the city.

Water

There was an increase in population from Roman York and the inhabitants of Jorvik were living in crowded conditions (Logan 1991:165). In a translation of a manuscript created by Archbishop St. Oswald describes York as:

Formerly it was nobly built and constructed with strong walls, which have now been left to the ravages of age. The city rejoices, however, in the multitude of its population, which, counting men and women but not infants and children, is numbered not less than 30,000. The city is crammed beyond expression, and enriched with the treasures of merchants, who come from all parts, but above all from the Danish people (Rollason 1998:172).

The population recorded by St. Oswald has been compared with the Domesday Book, and it is believed that the estimate of 30,000 people is too high; instead it is believed that the population would have been upwards of 9,000 people (Rollason 1998:172). The city was a busy trading port and industrial center and a substantial amount of water would have been needed for all the people, the livestock, and for the crafts and industry taking place (Hall and Kenward 2004: 391). It is generally accepted that the Vikings would have used the water from the Ouse and Foss rivers, but the cleanliness of the rivers is uncertain (Hall and Kenward 2004:391). Riffle beetles need clean flowing water in order to survive and small numbers of these beetles have been recorded at excavations at Micklegate and Coppergate (Hall and Kenward 2004:391). Assuming that the water was not imported, the presence of the riffle beetles combined with the remains of freshwater mussels may indicate that the river water was relatively clean (Hall and Kenward 2004:391). There are only two occurrences of true well-like structures that have been uncovered during excavations of the Viking occupation of York. Because there is not a strong presence of wells, it is difficult to understand the treatment of water by Vikings (Hall and Kenward 2004:394). It has been suggested that the high-water-tables during this period would have provided local springs on

the slopes of the moraine underlying the town or that the drains that the Romans had created still carried water occasionally despite the lack of maintenance (Hall and Kenward 2004:391). Generally, there is a lack of evidence of drains and wells during Viking Age occupation of York and it is difficult to really evaluate what they were doing to their drinking water.

Sanitation

Excavations at Hungate, Coppergate, Lloyd's Bank, and Pavement have all yielded Viking Age remains in the form of waste. Fecal concretions in the form of mineralized lumps were frequently found during excavations of Viking Age York (McCobb et al. 2001:930). Pits have been one of the most common finds, and the fills from those pits have been analyzed in order to better understand what life in York was like for the Viking inhabitants. It has been inferred that the majority of the pits were intended for waste disposal; there is not strong evidence for wells and the deposits have been very moist which eliminates storage as a purpose for the pits (Hall and Kenward 2004:394). Cesspits would have been of great importance and people would have wanted them to last for as long as possible; many pits have been found to be lined with wattle in order to prevent them from collapsing (Figure 17).



Figure 17. A Viking Age wattle-lined pit from York.
Source: The York Archaeological Trust Online Picture Library ref: 002073.

The analysis that has been done on the remains has shown us that eggs of intestinal parasites were frequently found, and that some of the cesspits were so foul that only specialized flies were able to exploit the waste (Hall and Kenward 2004:394). Human feces has also been recovered from both cesspits and the main living surfaces; eggs of parasitic worms have been found in several pollen samples and suggests that “fecal matter found its way into general accumulation layers” (Hall et al. 1983:218). Hall and Kenward (2004) claim that nematode gut parasites would have been very common in Viking Age York. Some of the samples have yielded so many eggs that individuals would have carried heavy burdens of parasites. At 16-22 Coppergate, 391 contexts were examined for parasitic ova and yielded 732 eggs total. A complete coprolite (Figure 18) from 6-8 Pavement yielded 66,800-68,100 whipworm eggs per gram and 9,000-12,000 roundworm eggs per gram were recovered (Hall et al. 1983). Based on the number of eggs recovered, it is believed that the individual who passed the worm ovum would have been living with two adult roundworms and 800 adult whipworms (Sullivan 2005:256).

It is not difficult to become infected by nematode gut parasites and it is possible that people were obtaining and storing their water in contaminated ditches or in close proximity to cesspits (Hall and Kenward 2004:402).

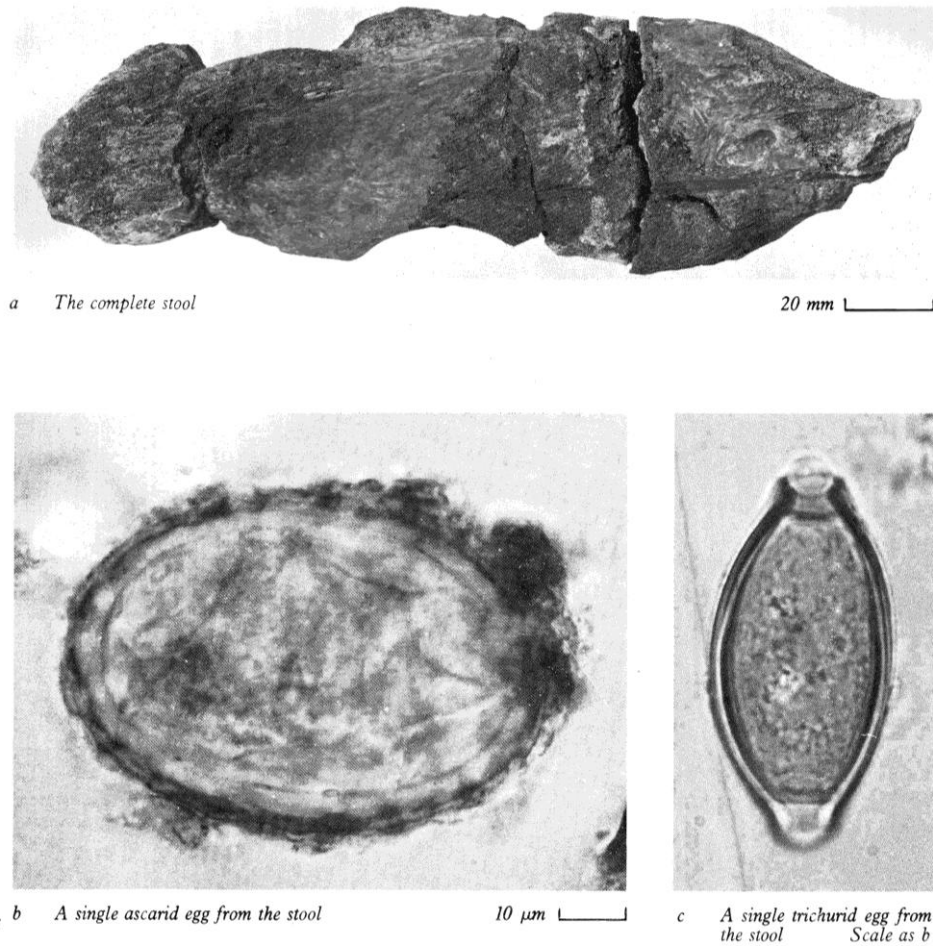


Figure 18. A human coprolite containing parasitic ova from Lloyds Bank.
Source: Hall et al. 1983.

Archaeologists have also looked at the floors of the occupied houses and buildings to better understand the living conditions (Hall and Kenward 2004:384). The insect remains indicate that an abundant amount of rotting material would have accumulated on the ground, and it is believed

that bacteria would have easily been transferred to food (Hall et al. 1983:218). The house fauna suggest that people would have been aggravated by human lice and fleas (Hall and Kenward 2004:385). Based on the evidence recovered from Viking Age York, it is evident that craft and industry were of paramount importance which resulted in little consideration with water and sanitation.

Treatments

Even though there is not a lot of evidence to suggest that the Anglo-Scandinavians were as aware of hygiene and infectious disease transmission as the Romans, the inhabitants may still have been treating their ailments. Even after the spread of Christianity, many people believed that they “should seek the aid of magical powers and unseen creatures in the search for a cure for their ills” (Rubin 1974:13). Magic was not the only treatment for ailments; herbal remedies were used to cure and to protect people from the “invisible beings which were regarded as hurtful and malign” (Rubin 1974:13). The *Herbal* is a medical manuscript rewritten in Old English from the Latin *Herbarium* from the fifth century; this document would have described the characteristics and properties of different herbs (Rubin 1974:46). The text is associated with Anglo-Saxons and possibly may have survived in York after the Vikings captured the city. Throughout the document, worms are depicted because they were thought to be the creature to cause diseases (Rubin 1974:47). Herbal remedies were the main mechanisms of treatment for all ailments during this time. Some modern herbal remedies for parasitic infections use different combinations of garlic, olive leaf, black walnut, clove, and wormwood. The botanical remains from Anglo-Scandinavian period excavations have yielded several of the ingredients needed for an herbal remedy geared at treating parasitic infections (Kenward and Hall 1995:760). Possible herbs used as a vermifuge found during excavations at 16-22 Coppergate include corncockle,

caper spurge, white bryony, and purging flax (Kenward and Hall 1995:760). These herbs may have been used as natural laxatives because they are poisonous to gut parasites. The presence of these botanical remains may suggest that the Vikings had ways of treating their parasitic infections.

Medieval York

Conflict between the Danes and the English led to the demise of Viking York. The city underwent immense stresses during the transition, and many documents and records were destroyed in the flames that engulfed several areas of York (Nuttgens 1976:39). Eventually the Danes were bribed into abandoning their trading center, and York was left in the hands of William the Conqueror in 1069 A.D. Clifford's Tower, the King's castle, was constructed at the confluence of the Ouse and Foss rivers. York was encircled with defensive mounds that eventually transitioned into stone walls to protect the city (Nuttgens 1976:43). Medieval York can be seen as a combination of military influences and commercial interests; the town was a military capital that needed protection and fortification while at the same time provided local inhabitants and nearby villagers a place to engage in commerce. Bridges crossing the Ouse and the Foss became essential aspects of Medieval York; houses, shops, markets, and churches all developed around the bridges (Nuttgens 1976:54). Churches became an important provider of care to the sick; skeletal remains indicate that many individuals were suffering from tuberculosis and leprosy during the Medieval period (Catling 2009:23). The Black Death also took its toll on the population in the fourteenth century. The remains of Medieval York create the image that the city had been heavily populated with winding roads and narrow alleys as the mechanisms in which people used to move about the city. As York grew in size, the occupants moved outside the city walls and into nearby areas; soon York was second to London in terms of size (Nuttgens

1976:56). Unfortunately, most of the structures were built out of timber and were very close together; this combination proved to be disastrous when fires broke out in the city (Addyman 1989:257). With the changes in city structure and size, social stratification became more noticeable. The wealthy could afford to live in less crowded and less filthy areas while the poor were forced to occupy areas that were unclean and very crowded (Sullivan 2005:255). According to research done by Patrick Nuttgens, York was comprised of: exceptional walls, a castle, a cathedral, an abbey, a priory, four great gates, a major hospital, thirty-one churches with eight smaller hospitals within their walls, and a council chamber (Nuttgens 1976:57). By the 13th century, York was a self-governing authority in England (Hall and Hunter-Mann 2002:863). York grew in every way a city can grow, and with the increase in population and social classes, health practices began to change.

Water

The Medieval inhabitants of York, like every group before them, utilized the Foss and Ouse rivers. It cannot be assumed, however, that the quality of the water was the same during the Medieval occupation as it was during Roman occupation. Studies on water pollution conducted by Karen A. Hudson-Edwards and Mark G. Macklin (1999) suggest that smelting and mining, which began during Roman occupation, caused lead pollution in the river Ouse. Excavations on the riverbanks have produced evidence of dumping in the river; shells, tile, brick, mortar, pottery, burnt grain, charcoal, animal bone, glass beads, wattle slag, and fragments of lead roofing material have all been uncovered. The level of lead contamination greatly increases during the ninth, tenth, eleventh, and thirteenth centuries which indicates that the quality of water being used for drinking, cooking, and washing was less pure than the water used by earlier inhabitants of York (Hudson-Edwards et al. 1999:809-819) The natural slopes surrounding York

are believed to be used for natural drains during Medieval occupation because only a few ditches and drains (Figure 19) have been uncovered from this time (Hall and Hunter-Mann 2002).



Figure 19. A rare Medieval wattle-lined drain.
Source: Hall and Hunter-Mann 2002: figure 429.

Because Medieval York did not utilize many drains, a bog may have been caused by the rainwater flow and an increase in muddy silt deposits in the streets would have raised the surface level (Keene 1982:27). Excavations of the Medieval period at York have produced more occurrences of wells; these wells have also been cask-lined or lined with stone (Figure 20). In some instances, excavations have uncovered possible cobblestone paths (Figure 21) that may have served as walkways to the wells (Hall and Hunter-Mann 2002:725). Walkways to different wells would have increased the accessibility of water to the people living in a very crowded and filthy city.



Figure 20. Medieval Stone-lined well.
Source: Hall and Hunter-Mann 2002:figure 435.



Figure 21. 15th Century cobble and rubble path.
Source: Hall and Hunter-Mann 2002:figure 45.

Sanitation

We know that York was a very important English city during the Medieval period and as a result of York's importance, the population grew. Even after the initial outbreak of the plague, immigrants from countryside moved to York to benefit from the economic potential of the city (Hall and Hunter-Mann 2002:864). It is believed that landlords began to build houses that could have multiple tenets (figure 22) in order to accommodate the influx of people; it also appears that the increase in population and large buildings led to a decrease in the areas available for waste disposal (Hall and Hunter-Mann 2002:863).

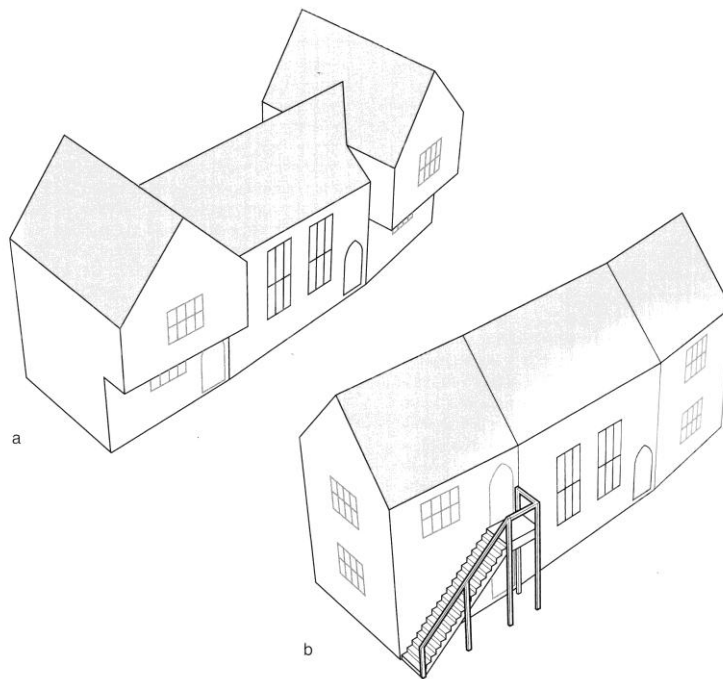


Figure 22. Two possible reconstructions of Medieval houses.
Source: Hall and Hunter-Mann 2002: figure 476.

During the twelfth and thirteenth centuries, garbage appears to be disposed in unlined or wicker-lined pits (Addyman 1989:257). We see changes in the fourteenth century with the use of

stone-lined pits which could be washed and reused (Sullivan 2005:256). Research done by D.J. Keene on the rubbish in Medieval settlements indicates that the authorities in large Medieval towns were concerned with the appearance and smell of the city and did try to manage the public areas. General rules were created in attempt to deal with sewage problems. The regulation of cesspit location was one solution; stone-lined pits could not be closer than two and a half feet to a neighbor's boundary and unlined pits could not be closer than three and a half feet to the boundary. Some problems, like overflowing cesspools and people relieving themselves at night out of a window, were more difficult to manage. People would have private latrines (figure 23), but public latrines were created in busy areas, like market places, and whenever possible were created over running water. Laborers would have been hired to dump the waste and when the smell became too foul.

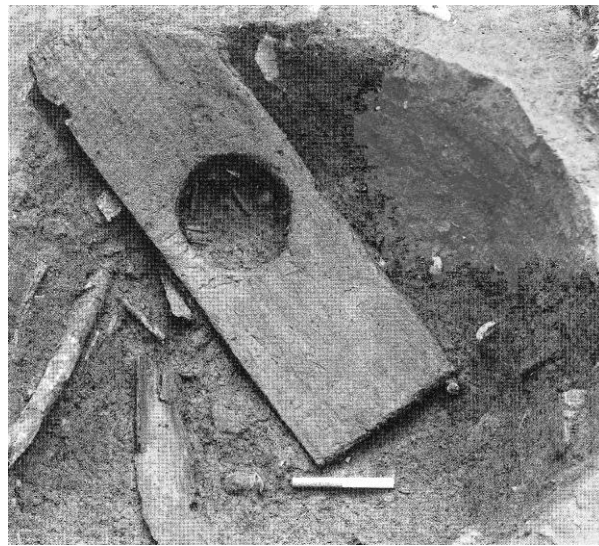


Figure 23. Latrine seat recovered in a Medieval garbage fill.
Source: Hall and Hunter-Mann 2002:figure 430.

Another sanitation issue that would have existed pertains to the presence of animals; many people would have kept horses, pigs, goats, and chickens and the waste from those animals

typically was thrown into the streets. The remains of slaughtered animals were also thrown into the streets by butchers and created more waste in the streets that blocked traffic and contributed to the unpleasant smell of the city (Keene 1982:25-27). When parliament was to meet in York, Edward III ordered for the streets of York to be cleaned because it was “the filthiest and most foul-smelling city in the kingdom” (Keene 1982:28). Because people were running out of waste disposal areas, the rivers became dumping grounds; the excavations conducted by the York Archaeological Trust indicate that people were moving their waste away from the buildings and toward the river Foss (Hall and Hunter-Mann 2001:813). People living in Medieval York would have been exposed to animal waste on the streets, overflowing cesspits, and contaminated water. Parasitic infections were common during this period; parasitic ovum has been found from Medieval samples at York. The samples have yielded egg counts that range from 10 ova per gram (opg) to 100,000 opg (Jones 1985:107).

Treatments

Treating illness in the Medieval period is characterized by blood-letting, purging, and drugging. People treated their health problems on a household level, had access to physicians, and the inhabitants of Medieval York did have hospitals. The main purpose of the Medieval hospitals was to take care of the lepers and those suffering from tuberculosis. Hospitals were reserved for the very sick, and thus people typically treated their ailments themselves.

By this point in York’s history, several different cultural groups had occupied the site. Medieval English medicine has its roots in the folklore and beliefs of any and all groups of people who occupied the site before them. Anglo-Saxons and Normans both occupied York before it became a Medieval city and it is possible that some of their beliefs continued to exist

during the Medieval occupation. Anglo-Saxon medicine can be divided into three elements and are described by Stanley Rubin as:

...the first is the belief that disease is the result of elfshot in which elves throw 'darts' which produce pain and disease. The second concept is that of the *worm* in which it was thought that a wormlike creature was responsible for much illness and the third of these original Germanic concepts was that both illness and its cure could involve the number nine in some way (Rubin1974:111).

People had ways to explain the unexplainable; germs were unfathomable and people did not know why certain illness came to them. Beliefs that would be referred to as superstitions by us today were another way people treated illness. Diarrhea was treated by hanging a piece of paper that had jargon written on it from their neck (Rubin 1974:113). When a man or an animal was known to have swallowed a 'worm' then a song was to be sung in his right ear, but if the worm was a female, the song need to be sung into the left ear (Rubin 1974:117). These actions were thought to help cure the affected individual to lessen symptoms, but these actions were not the only form of treatment. We know that, again, herbal remedies were used to treat ailments. Most monasteries grew medicinal herbs that would have been available to the public (Swain 1962:85). Intestinal problems had several different prescriptions that included "drinking wormwood and butter in sour ale", and eating "honey and wheaten meal boiled with unsalted fat and wax" (Rubin1974:126). Because of the social stratification, treatments would have been more accessible to the wealthy (Sullivan 2005:256). There were physicians in Medieval England, but access to physicians and their treatments would have been limited to the elite classes of society.

When these different occupations of York are compared, we see differing involvement of the state in ensuring the health of the community. The differences can be seen not only through the presence of hydraulic technologies, but the occurrences of parasitic infections also indicate the changes in state involvement. Soil samples and coprolite analysis from each occupation were

compared to determine how much parasitic infections changed over time. Because the levels of parasitic infections change greatly during each occupation (Figure 24) they can be seen as a representation of the sanitation of the site.

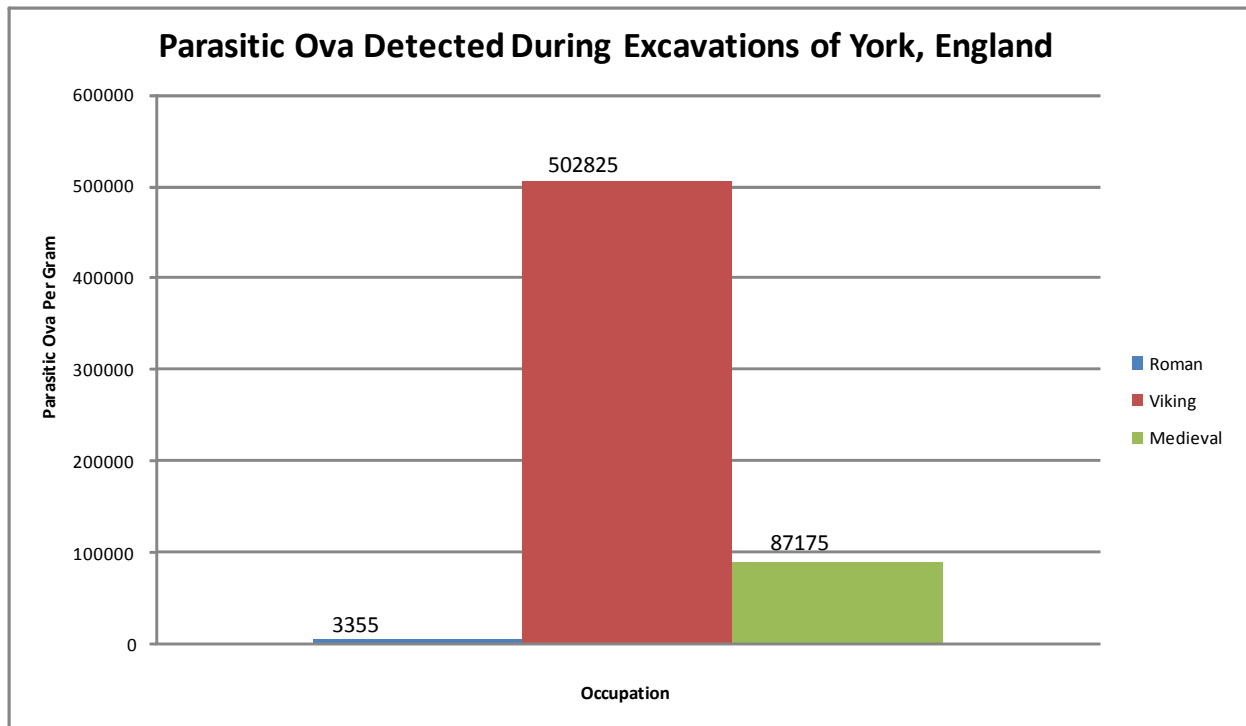


Figure 24. Number of Parasitic Ova detected during each occupation.
Source: Modified from Jones 1985 and Hall and Kenward 1995.

When the state was involved in regulating water and waste disposal, there is a decrease in parasitic ovum. We see that when the state is not involved in creating and maintaining public health structures, there is a very high spike in the occurrences of parasitic infections. Evidence of treatments for parasitic infections have been found during each occupation and suggest that the inhabitants of York during each occupation would have had access to the ingredients necessary to produce an herbal remedy.

DISCUSSION

The purpose of comparing the different cultural occupations of York is to better understand how issues of sanitation were addressed in the past. This study attempts to look at the basic information yielded from archaeological excavations and historical documentation pertaining to each cultural occupation. With the environment not playing a major role in the transmission of infectious disease, we can isolate each cultural group individually to assess what led to the development and use of sanitation practices.

According to the data gathered, we have strong evidence that Roman culture was the driving force behind the health practices we see implemented during the Roman period. The Roman Empire had control over many different areas; their experiences with large populations made them aware that in order for infectious diseases to be uncommon, the health of the community had to be protected by valuing sanitation in society. The Empire developed techniques that were aimed at ensuring clean water to the city as well as keeping the public areas clean and organized. Individuals would have always had access to clean areas and water; to be anything but clean would have been unnatural and unacceptable. The organization and sanitation of the site may be due to the fact that it was a military establishment. Inhabitants of Roman York were there to stay; the buildings were carefully constructed and made to last.

The Roman Empire existed for nearly sixteen centuries, and had developed ways to keep themselves and the population relatively healthy. Colonization was occurring within the Roman Empire, and they realized that people got sick less often if personal hygiene was maintained. Romans viewed themselves as superior beings; they were aware of the power they held and used it to create particular image of themselves. Roman establishments were impressive and clean;

they prided themselves on maintaining pleasant areas. Part of creating a pleasant and impressive settlement is the overall appearance and smell; the Romans paved roads, used the best material in construction, and implemented waste disposal systems that would manage the odor of the city or town. The motives behind the public sanitation institutions may not have been to ensure the health of the community, but the use of bath houses, latrines, and sewers did help reduce the occurrences of parasitic infections.

When compared to the Viking and Medieval occupations, the Roman inhabitants had drastically less incidents of parasitic infections. Because of the low occurrences of parasitic infections, the Romans may not have needed to develop and use treatments as often as the Viking and Medieval inhabitants. Nevertheless, Roman scholars documented the medicinal uses of thousands of plants. Some of the plants and seeds needed for herbal remedies aimed at treating parasitic infections have been found in the botanical remains at York. It is unclear, however, if the plants were used solely for medicinal purposes. The value of health and fortune can be seen through the presence of shrines and alters throughout Roman York. There were specific deities in Roman culture for health and fortune; these religious objects may indicate that the Romans realized that they did not have all of the answers or treatments for human diseases and illnesses. They did not want to become ill and therefore created sacred spaces and objects for the Gods and Goddesses. We see both state and household involvement during the Roman occupation in ensuring the health of the community; the state created the roads and public service areas while individuals kept their living quarters clean, maintained personal hygiene, and paid tribute to the Gods before, during, and after suffering disease and illness. Romans had a wealth of knowledge to draw upon when dealing with issues of health and sanitation. The Empire had existed over a

thousand years, had conquered various areas of the world, and provided scholars with the opportunity to advance in medicine.

The data obtained for the Viking occupation differs in that it is comprised mostly of garbage. Artifacts that were not garbage typically were associated with the industry of the city. Because the Vikings did not have the same military motives that the Romans had, the Roman sanitation institutions deteriorated rapidly. The city that the Vikings created for themselves was run-down and dirty; this differs from their homeland cities because York was not seen as a permanent settlement. It was occupied for a couple hundred years, but there was no incentive in changing York into a well-maintained city. The Roman structures were avoided in favor of areas that were closer to the rivers; this indicates that the Vikings placed a higher value on access to waterways than on utilizing the Roman hydraulic technologies. Economics was the driving force behind the activities and establishments at York.

Due to the fact that Viking York was crowded and based on trade, the cleanliness of the city was not a high priority. If any sanitation practices occurred, it appears it was at the household level. There is no documentation of laws or regulations on waste disposal. As a result of the high population, rubbish and feces took over the city. The fact that an entire coprolite was discovered on a house floor indicates that people may have run out of space to dispose of waste or did not make their young children use the cesspits created. The soil samples and coprolite analysis indicate that many people would have been suffering from parasitic infections. Assuming that parasitic infections were common, the result would have been an even more unsanitary city. People with high counts of worms would have had serious problems; diarrheal diseases would have been prevalent, but with no latrines or specific sanctioned areas for cesspits, more people may have been exposed to the worms, and the cycle would be perpetuated.

Viking York was a city with no sewer system and a population suffering from parasitic infections; the state was not involved in establishing any type of regulated system for clean water or waste disposal because York was just another colony along their trade routes and not a prestigious homeland city. Parasitic infections were very common in Viking York, and instead of trying to create cleaner living conditions, the Vikings were (possibly) using the resources from the natural environment to create laxatives. The botanical remains from Viking deposits do suggest that certain plants would not have had nutritional value and therefore may actually have had specific medicinal purpose. The Viking occupation of York is characterized by the prevalence of garbage, feces, and parasitic infections. It can be argued that because the Vikings never intended on permanently staying in York, there was little consideration in the maintenance and upkeep of the public areas. If the Vikings intended on staying in York until it was no longer a beneficial site, then why would they pour so much time and energy into creating and enforcing policies and institutions protecting the health of the community? With no state intervention or involvement in creating clean public areas, individuals were left to fend for themselves in this city.

Even though the sanitation of York did not improve much during the Medieval period, the inhabitants would have been more invested in the maintenance of the city than the Vikings because it was their permanent home. Medieval York can no longer be seen as a colony, and as a result, we see the state attempting to control and monitor sanitation. The increase in population was troublesome because multiple people were forced to live together and waste disposal areas were dwindling. The walls that enclosed the city would have amplified the feeling of overcrowdedness and filth. The Vikings left York in upheaval and cleaning up the city would have been a daunting task. People continued to throw animal dung in the streets and dump waste in the

rivers; these practices alarmed state officials who attempted to regulate waste disposal. Beliefs that bad odors and filth caused disease may have led state authorities to improve health conditions (Fisher et al. 2007:176). In the 1350s, we see Royal orders forbidding the throwing of filth into the rivers, the prohibition of the slaughtering of animals in the streets, and in 1388 Parliament passed the first Sanitary Act (Swain 1962:89). The fact that the state made attempts to clean the city is an indicator that the health of the community was at least somewhat valued.

Christianity and the Church were very important in Medieval society. The Church took on the responsibility of creating hospitals which seems acceptable since the Church and the state really were not separate entities. People knew that they had a place to go if they fell extremely ill. Hospitals were created for the very sick, and private physicians could be seen if their fee could be paid. Individuals in Medieval York were beginning to have similar access to physicians and treatments as the Romans.

Medieval York was a dirty city with large occurrences of parasitic infections, but the state was beginning to address the sanitation problems. Inhabitants were invested in the city because it was officially an English city governed by native English citizens. York transitioned from being a colony of foreigners to being a valued English center and the health of the community started to be a concern of the state once again.

The history of public health in England is associated with the industrial revolution. This study, however, has demonstrated that issues of sanitation and infectious disease have been addressed by populations living in England since A.D. 71. The motivations for establishing practices and policies that protect the health of the community may vary, but it cannot be disputed that there has been state involvement for much longer than the 1800s. When populations grow, health issues increase, and people are forced to either deal with the health

problems or change the way society addresses those problems. York has served as an example of how different cultural groups living in the same environment can handle the same problem in very different ways. Social organization influences the way public health practices are or are not implemented in a given environment. As we see with York, the cultural occupation did affect the way sanitation and the treatment of parasitic infections was addressed.

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