Growth, and Development of Care for Leprosy Sufferers Provided by Religious Institutions from the First Century AD to the Middle Ages

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Growth, and Development of Care for Leprosy Sufferers Provided by Religious Institutions from
the First Century AD to the Middle Ages

by

Philippa Juliet Meek

A thesis submitted in partial fulfilment
of the requirements for the degree of
Master of Arts
Department of Religious Studies
College of Arts and Sciences
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burial

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DEDICATION

To Will, without your love, support, encouragement, inspiration, your faith in me, and words of wisdom I would not have been able to achieve all I have over the last two years.
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ABSTRACT

This thesis aims to outline the causes, symptoms, and treatments related to leprosy, and how it can be diagnosed in patients and identified in human remains. The thesis also aims to demonstrate the ways in which care for leprosy sufferers developed as the disease became more prevalent and more commonly, and correctly identified. It analyses the social stigmas inflicted upon sufferers, and the medical care and attention provided for them by religious institutions when other groups or organisations shunned those suffering from leprosy. The rationale for this study is to identify trends surrounding the social stigmas attached to leprosy and care from the first identifiable case of strain three of *Mycobacterium leprae* in the 1st century AD to the late Middle Ages when the number of cases of leprosy appears to begin to decline.

Using archaeological evidence, historical records, and the published research of experts in the field, this thesis demonstrates that as leprosy spread throughout the Middle East and Europe, religious organisations often took on the role as care givers for leprosy sufferers through the ideal of religious, often Christian, charity; to look after the poor, sick, and needy. As the trends presented in this study have yet to be published elsewhere in this way, this thesis aims to contribute via an interdisciplinary approach to the fields of religious archaeology, anthropology and bioarchaeology.
INTRODUCTION

This study will examine leprosy, its various symptoms, similarities and differences with other diseases, misconceptions surrounding the disease, and how it can be identified in human remains. It will then examine the history of the disease and how it has often been misdiagnosed or misidentified in biblical and extra biblical historical sources, and is still misdiagnosed or misidentified in patients and human remains to this day. This paper aims to demonstrate how institutions providing care for leprosy sufferers emerged, developed, and expanded from the early Christian period in the first century AD to the Middle Ages to support the growing numbers of sufferers, before the disease declined. It will examine examples of human remains displaying signs of leprosy, geographic locations of institutions, social stigmas and punishments sufferers may have experienced, and examples of dedicated medical care provided over time, including suggested cures and treatments.

WHAT IS LEPROSY?

Leprosy is an infectious disease caused by *Mycobacterium leprae*. There are a number of ways to classify the disease, some prefer to use two classifications; paucibacillary and multibacillary with the former being a milder form of the condition. Paucibacillary leprosy presents with up to five visible skin lesions, whereas sufferers of multibacillary leprosy display a number of different symptoms indicating the severity of the disease. The classifications are based on how the immune system of an individual attacks the pathogen.
Others use the terms tuberculoid and lepromatous to differentiate between the different manifestations of the disease depending on the immune response of infected cells; in the case of this usage, tuberculoid leprosy is considered the milder of the two forms. For the purposes of this paper I will use the terms paucibacillary and multibacillary as I feel the terms tuberculoid and lepromatous can potentially be confused with being concerned with tuberculosis and leprosy in general.

Other categories used to classify leprosy are based on the genome sequence of the disease; four strains have been identified. It is believed that leprosy originated in the Indian subcontinent and spread as humans moved along migration routes into Greece and the Mediterranean basin. Much later, colonisation and the slave trade had an impact on the further geographic spread of the disease; the different identified strains are a result of mutations of the leprosy genome.¹

In modern parlance, leprosy is also referred to as Hansen’s disease named for Gerhard Armauer Hansen, the Norwegian scientist who identified *M. leprae* in 1873 as the cause of leprosy. Today leprosy can be easily treated through a combination of antibiotics commonly referred to as Multiple Drug Therapy, or MDT. Although the effects of the disease cannot be reversed, MDT can prevent transmission to others, cure the patient, and stop any further damage occurring; treatment usually takes six to 12 months (Figure 0.1).

Since the World Health Organisation began providing free treatment for all leprosy sufferers worldwide in 1995, reported cases of the disease have dropped dramatically. The latest figures, published in 2015, report 213,899 newly diagnosed patients in the previous year, with 94% of these patients residing in 13 countries.² The WHO Eastern Mediterranean Region reported only

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2342 new cases in 2014. The European Region reported no data implying that few new cases occurred and those that did were probably due to migration from endemic countries.¹

Diagnosis today is made via visual examination of the patient to identify physical symptoms, when this is not possible, a test known as the slit skin smear can produce a diagnosis following positive laboratory results. However, neither of these tests are viable ways of identifying the disease in human remains. Leprosy can be identified visually in skeletal remains via osteological examination. However, these lesions can often be confused with, or not distinguished from,

lesions left by other diseases such as tuberculosis and syphilis; DNA tests can be carried out to support the visual diagnosis, but is not usually used as the sole basis for identifying the disease.\footnote{Simon Mays, \textit{The Archaeology of Human Bones} 2\textsuperscript{nd} edition (London and New York: Routledge, 2010), p. 305.}

**TRANSMISSION**

We know today that leprosy is not as easily transmitted as once was thought; it cannot be simply contracted by casual contact with an infected individual. While the disease is contagious, it is thought that the vast majority of people have a natural immunity to it. The Bacillus Calmette-Guerin (BCG) vaccination designed to immunise against tuberculosis is also known to provide some level of protection against the disease. It is also thought that those who have been exposed to tuberculosis receive an element of immunity in a comparable way to the discovery of Edward Jenner in the 1790s; that exposure to cowpox provided immunity to smallpox. The condition is predominantly a human disease, although it is also evident in other animals including chimpanzees and armadillos; inter-species transmission cannot be ruled out in the present day.\footnote{Charlotte Roberts and Keith Manchester, \textit{The Archaeology of Disease} 3\textsuperscript{rd} edition (Ithaca: Cornell University Press 2007), p. 194.} The incubation period is shorter and mortality rate much higher in animals than it is in human cases and the level of natural immunity is also much lower; almost one third of wild armadillos are affected by the disease.\footnote{Roberts and Manchester (2007) p. 194.} In humans the incubation period is rather long in comparison to other bacterial infections and can generally range from two to seven years before symptoms present in the patient; although incubation periods lasting decades have also been reported.

It is believed that the most likely means of transmission occurs via inhalation of nasal droplets from an infected person, and to a lesser extent between contact with the broken skin of an infected individual and a healthy one. Good levels of hygiene and cleanliness can therefore be
considered as simple barriers against infection. Other suggestions such as transmission through biting insects have also been proposed in recent years; however, infection in this way ought to be considered rare. Modern science has ruled out transmission through sexual contact and genetic inheritance; two misconceptions of contraction that prevailed for many years, and in the case of the former especially, contributed to the social stigma experienced by leprosy sufferers. After taking MDT for a period of one week, sufferers are no longer contagious.

The difficulty in recreating the disease in laboratory settings means no prophylactic method of preventing leprosy has been developed. Given the small number of annually reported cases, medical care today focuses on the eradication of the disease through the MDT treatment of sufferers. Work toward developing a vaccine has been abandoned as it is no longer deemed cost effective to pursue given the small number of new cases. Prophylactic MDT has been ruled out because of the risk of anti-biotic resistance making drugs ineffective, the difficulty of disease transmission, even amongst those living under the same roof, also questions the necessity of this course of action.

The disease is often contracted in adolescence or later childhood and is more common in males than it is in females. It is possible that children are more susceptible than adults because of their generally weaker immune systems. Reasons for the disproportionate representation between male and female sufferers are not yet fully understood, but could perhaps be due to exposure due to cultural and traditional gender roles. There is little to no risk of transmission from pregnant sufferers to their unborn children and transmission is completely ruled out in cases of pregnant patients on MDT and their babies. Cases of childhood transmission have dropped drastically in recent years following a number of WHO educational campaigns and missions; the organisation

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has a target reducing the number of new cases of childhood diagnoses from the 18,869 reported cases in 2014 to zero by 2020.\textsuperscript{9} Early detection is key to the prevention of the spread of the disease and successful treatment.

\textbf{Symptoms}

The symptoms of \textit{M. leprae} manifest following a lengthy incubation period. The disease affects the skin and peripheral nerves, the bacteria favours temperatures a couple of degrees below human body temperature, meaning that the extremities, and in the case of male patients, the genitals are most commonly affected. Early signs differ between patients depending on how their immune systems attempt to fight the disease, but generally the first signs of the disease present as discoloured patches of the skin accompanied by loss of sensation in the affected area (Figure 0.2).

As the disease progresses the skin thickens and ulcers and lesions develop. As the skin cracks, the immune system attempts to repair itself by continuing to thicken in what can be considered an over-reaction of the immune system, resulting in additional damage to the surrounding areas. The skin surrounding the eyes of sufferers can become thickened and damaged, resulting in impeded vision. The eyes can become infected and this can lead to damage of the optic nerve and the eye itself leading to blindness.

\textsuperscript{9} World Health Organisation (2016) p. 4.
Figure 0.2: Female child with skin discolouration indicating early stage leprosy. Skin discolouration accompanied by loss of sensation in the affected area represents an early sign of leprosy. World Health Organisation funding provides funding to treat leprosy sufferers around the world; catching the disease in its early stages prevents irreparable physical damage and allows the patient recover without any impairment. © Leprosy Mission of England and Wales.

The continued cycle of thickening of the dermis, which occurs in multibacillary cases, leads to severe disfigurement. As the body produces additional anti-bodies to defend itself, it causes the condition to worsen and spread; the immune system is not able to fight the disease. The damage caused can put stress on other parts of the body, damaged skin can go on to affect the bones, causing osteological lesions, which in turn can damage and change the bone structure of the sufferer leading to further disfigurement (Figure 0.3).
Contrary to a popular belief that still persists today, leprosy does not cause the appendages of a sufferer to fall off. The disease affects the nerves of the affected cells leading to numbness and loss of sensation. It is this anaesthetic effect that can cause sufferers to unintentionally injure the affected areas. Loss of sensation in the digits or other appendages such as the testes, ears, and nose can lead to a number of unintentional injuries such as burns, cuts, and other types of trauma resulting in the loss of damaged areas. In chronic cases the loss of one or more limbs may occur, but in many cases, damage to the distal ends of the phalanges, metacarpals, and metatarsals
results in permanent damage to the bones. It is important to point out the distinction that it is the cell nerves, not the central nervous system that is affected by leprosy. Damage to limbs can cause motor function and mobility issues (Figure 0.4). Many multibacillary sufferers are permanently disabled whether or not loss of appendages occurs.

Figure 0.4: Male with appendage loss resulting in limited mobility. This individual requires special shoes and walking aids; damage to the hands also requires the use of special tools to aid in every-day activities. © Leprosy Mission of England and Wales.

Osteological lesions are not caused by \textit{M. leprae} itself, but are rather a hyper-allergenic response caused by the immune system of the sufferer.\textsuperscript{10} Therefore, leprosy is more easily identified in the remains of chronic sufferers who will have become severely deliberated by the disease; this explains why fewer remains of subadults with evidence of the disease are found in the archaeological record than might be expected. In the cases of subadults, it is likely there was

\textsuperscript{10} Mays (2010) p. 305.
another cause of death, and the disease has not yet fully developed into an identifiable chronic stage in the individual.

In addition to the effects on the skin and nerves, damage to mucous membranes occurs, especially in the nose. As a result, leprosy sufferers can be prone to frequent nosebleeds, and nasal and respiratory tract infections. In a similar way to how the immune system reacts to the disease in the dermis, the membranes rupture and thicken causing ulcers. This immune system response to the growing bacteria causes irreparable damage to the surrounding tissue in an attempt to continue to fight the disease, resulting in respiratory difficulties and often damage to the septum resulting in facial disfigurement; additionally the effects of leprosy on the skull can lead to loss of the palate, abscesses, and tooth loss.¹¹

Today, medical professionals and scholars consider the psychological effects of leprosy on the sufferer and care plans take this into consideration. While concerns for mental health can often be considered a modern phenomenon, it is important to note just how much leprosy can affect a sufferer psychologically. The physical changes a suffer goes through can have profound effects on their mental health, often leading to depression and withdrawal, with many sufferers becoming reclusive. Not only are individuals affected by the physical changes happening to their body, but social attitudes and stigmas can further the degradation on an individual’s mental health.

**PREVALENCE IN POPULATIONS**

Today leprosy is almost eradicated in first world countries; this is in the most part due to the access to drugs and quality medical care. As *M. leprae* prefers temperatures slightly below human body temperature, there is some indication that poorer populations without proper access

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to warm homes may be more at risk than others. Despite the difficulties of transmission those living in cramped and unsanitary conditions are at a higher risk than others, again indicating that leprosy is more prevalent in poorer communities where many people are living in small homes without proper access to clean water and washing facilities. Poor diets weaken the immune system; this also makes less wealthy populations more susceptible to the disease.

However, it ought to be noted that married couples can live together and share the same bed for many years without an infected individual passing the disease onto their spouse. Demographically, sufferers of the disease are rarely identified under the age of five, and as mentioned earlier, males are more likely to contract the disease than females; although the reason for this is still unknown. Due to the longevity of the disease, older sufferers are more notable than younger as the visual signs of the disease are more profound. There are certain trends that are apparent in past populations which will be discussed in the following chapters.

MISCONCEPTIONS SURROUNDING CONTRACTION

Throughout history, a number of misconceptions have been prevalent regarding how leprosy is contracted and the ease of contraction. Many of these misconceptions have added to the social stigma imposed on sufferers, especially when issues such as religious impurity and sexual promiscuity are raised. However, not all misconceptions regarding the disease have negative connotations and there has been some suggestion that sufferers from the disease were considered as being blessed.

Galen of Pergamon, writing in the second century AD, made a number of observations regarding leprosy. Many of his conclusions regarding the disease, such as its cause and ways to treat the condition, prevailed until Hansen’s discovery in the 19th century, despite many physicians in the Middle Ages questioning Galen’s understanding of the human body and how disease was
contracted. Nevertheless, Galen’s impact on the understanding of leprosy cannot be underestimated.

**Religious Sin**

Leprosy has at times been considered a divine curse and God the cause the significant disfigurement many sufferers experience. Biblical passages such as Exodus 4:6-7 suggest that leprosy is an affliction that can be caused by God’s whim, the translation is, and many others are, unsound. However, the general message in the Old Testament is that a leprosy sufferer must have done something wrong or committed a sin in order to contract the condition; it would not strike and innocent person who was without fault. The disease in question is unlikely to be leprosy, but nevertheless, the result of mistranslations and misunderstandings means that leprosy was considered a punishment for a number of transgressions such as slander and fraud. Alternative explanations have included sexual transgression as a cause.

**Sexual Transmission**

For many years, it was believed that some sufferers of leprosy had contracted the disease venereally. The idea of this likely has its origin in rabbinical literature. It was argued that unions that occurred outside of Levitical law could result in participants, or issue from that union, becoming infected with leprosy. For example, a child conceived during a woman’s menstrual period, prohibited in Leviticus 20:18, would have leprosy. Of course, this ignores the fact that biologically conception during menstruation is not possible. The incubation period of the disease

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is explained in rabbinical literature by equating the day of conception to the year the disease first presented in the sufferer.\textsuperscript{14}

Early Christian historians, such as Gregory of Tours writing in the sixth century, suggested that children conceived on the Christian Sabbath would be inflicted with either leprosy or epilepsy.\textsuperscript{15}

While some theories of leprosy transmission through coitus are easily swept aside today, there are some reasons why one can understand why the association came into being. For example, some of the symptoms of leprosy are similar to symptoms of sexual disorders, for instance impotence, the penis and testes are affected, or signs of pregnancy, such as gynecomastia.\textsuperscript{16} The coincidences found in the symptoms of these conditions may have provided some room for speculating that they were connected.

Associations between leprosy and sexual desire have also developed, many of these associations stem from the works of Aretaeus of Cappadocia, writing in the first century AD. He likened the appearance of leprosy sufferers to satyrs, referring to the disease as \textit{satyriasis}, claiming that male sufferers were highly sexual and often in a permanent state of arousal.\textsuperscript{17} This misunderstanding of the disease is likely to have come from examinations of individuals suffering from lesions and enlargement of the genital area and comparisons to statues of satyrs which were often depicted with an erect phallus. This misconception continued well into the Medieval Period, often leading to sufferers being forbidden from engaging in sexual relations and punished for sexual encounters.\textsuperscript{18}

\textsuperscript{14} Zias (1989) p. 29.
\textsuperscript{15} Zias (1989) p. 29.
\textsuperscript{18} Demaitre (2007) p. 95.
**LEVEL OF CONTAGIOUSNESS**

As mentioned above, transmission of the disease is not as easy as once was thought, in fact efforts to infect humans in laboratory settings for research purposes have been largely unsuccessful. However, suffers not in treatment will be more infectious the more profound their symptoms are, simply due to the number of active bacteria present and the number of open sores, likelihood of nosebleeds, and sneezing due to nasal and respiratory tract problems. It is possible that the level of contagiousness has changed throughout history, with more people being born with a natural immunity to the disease. This genetic immunity goes some way to explain why it was once thought that leprosy was passed on genetically. While the disease is not hereditary, susceptibility to it could be, meaning that family members may be more likely to contract the disease from an infected family member while living in close quarters due to the lack of natural genetic immunity.

**ALTERNATIVE HISTORIC NAMES**

Many names and alternative terms have been used for leprosy throughout history. The word in English has its root in the Latin and Arabic word *lepra*. Additionally, leprosy has often been confused with other conditions either due to ambiguous descriptions in the historical record, or issues with translation. Historically, leprosy has at times been referred to as *elephantiasis*; from the Greek, it is a term also used to describe other illnesses which can often cause confusion. The term has been attributed to leprosy because of the physical changes to the facial tissue making the skin hard, like the hide of an elephant, and enlarged (Figure 0.5).
Figure 0.5: Male child with facial disfigurement. Cyclical damage and thickening of the dermis caused by repair initiated by the body’s immune system causes these physical symptoms. Historically, some have likened this skin thickening to the hide of an elephant. Image courtesy of World Health Organisation.

Another term used in the past, albeit less frequently, is leontiasis, again due to the effects of leprosy on the face; when leprosy damages the septum and nasal bridge, it flattens the facial features producing an appearance that has been compared to the facial features of a lion (Figure 0.6). As previously mentioned, leprosy was given the name satyriasis in the first century AD due to an incorrect correlation between visible symptoms causing enlarged genitals and the sexualised mythical Greek satyr.

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Other historical names also exist; it has been referred to as the disease of Saint Lazarus.\textsuperscript{20} This name is due to the amalgamation of the two figures named Lazarus in the Bible; Lazarus the brother of Mary and Martha of Bethany, whom Jesus raised from the dead, and Lazarus, another man some have interpreted as suffering from leprosy. The second Lazarus appears in Luke 16:19-31 in a parable known as The Rich Man and the Beggar. The beggar, Lazarus, is described

\textsuperscript{20} Demaitre (2007) p. 90.
as being ‘covered with sores’. A number of institutions and charitable causes supporting leprosy sufferers have borne the name of Saint Lazarus and because of the suggestion that the beggar Lazarus was a sufferer; he has become the patron saint of leprosy sufferers.

As leprosy spread throughout the South Pacific and colonies for sufferers were established there, leprosy became known as mai ho’okawale, or separating disease, in 19th century Hawaii. This demonstrates how common isolation was at the time, and how earlier ideals of required segregation from biblical times were not simply thought of as archaic, but in fact prevailed. In some parts of the world today, laws still state that sufferers of leprosy ought to remain segregated from the general population. The World Health Organisation continues to work towards eradicating these unnecessary and discriminatory laws through education and lobbying.

Today leprosy is often referred to as Hansen’s disease and many sufferers and medical professionals prefer this term; in the most part this is due to the negative connotations and continued stigma surrounding the noun leper. The term ‘leper’ has been used offensively to describe a sufferer of leprosy and as a derogative term to refer to someone as an outcast because of some affliction considering them to be socially unacceptable. The term ‘leper’ will be avoided in this study unless using it retains the original context of a historic document, account, or used in a direct quote from a source using archaic terminology.

**SUMMARY**

Leprosy has a long incubation period and symptoms vary widely between individuals; sufferers can live with the disease for decades. In cases of multibacillary leprosy, severe bone damage can occur resulting in damage, and ultimately the loss of fingers, toes, hands, feet, and limbs depending on the severity of the disease. It is the bone damage present in advanced

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multibacillary cases that are most easily identified in the archaeological record. Many misconceptions have existed concerning the contagiousness of the disease, but in reality it is extremely difficult to contract.

Contraction most commonly occurs via nasal droplets of an infected individual or via open sores; close proximity is necessary, although individuals can live in close quarters for extended periods of time and remain clear of the disease. Simple good practice methods of cleanliness act as an adequate barrier to avoid contraction. Leprosy can today be identified from visible signs of the disease as well as skin slit tests; it is treated with a course of anti-biotics using a multiple drug approach to avoid resistance. Historically, numerous names have been associated with leprosy, today many refer to it as Hansen’s disease after Gerhard Armauer Hansen, who discovered the pathogen in 1873.
CHAPTER ONE:
MISIDENTIFICATION AND IDENTIFICATION IN HUMAN REMAINS

When dealing with human remains, many factors come into play when attempting to identify any injuries or diseases that may have affected the individual, and whether those identifiers were caused ante-, peri-, or post-mortem. Rarely are excavated remains discovered completely intact. Excavated remains may be recovered in a number of ways and the manner of burial often impacts what details can be ascertained from the remains. Often the means of burial is very much dependent on the culture the individual belonged to, or is indicative of an event that occurred around the time they died, for example mass graves are often found following epidemics or major battles.

In the case of cremation, no soft tissue survives and remains of bone and teeth become very fragmented. The composition of the bone changes during the cremation process and shrinkage occurs, leaving the remains extremely fragile and prone to further degradation during excavation. Little can be done to identify any diseases or conditions the individual may have been suffering from, occasionally some pathological data may be recovered but this is not always possible. In the case of mummification, soft tissues are present and it may be possible to visually identify

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some diseases, including leprosy, from unwrapped mummified remains. As most infections that cause bone damage do so in the advanced stages of the disease, earlier stages of infection can be identified when soft tissues remain. With skeletal remains, visual signs of advanced leprosy are possible but must be distinguished from similar lesions and damage caused by other diseases. In some cases, laboratory tests are conducted in order to confirm visual identifications made in the field.

**MISDIAGNOSIS**

Leprosy has previously been confused with a number of other diseases; descriptions in historical documents are often ambiguous leaving the reader unable to identify what is being described accurately. The broad range of symptoms that can be present with the disease allow for easy confusion and misdiagnosis. From the visible skin lesions alone, leprosy has been confused with psoriasis, eczema, scabies, impetigo, and a range of other skin conditions. Even today, especially in countries where leprosy is uncommon, the disease is often misdiagnosed by medical professionals in its early stages simply due to the rarity of the condition.

Often, translations or poor descriptions further confuse interpretation in historical contexts; this is frequently found in the biblical accounts discussed in Chapter Two. In many historic cases, one finds evidence of individuals seeking medical certificates proving that they were not infected with the disease. Due to the symptoms of other illnesses, individuals were often considered by others to be infected, this could lead to accusations that the individual was suffering from leprosy and in turn social stigmatisation. Even when examining historical field reports detailing human remains, it can be difficult to ascertain whether the remains described are that of a leprosy

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sufferer. In the cases of modern field reports, experts can only make inferences based on what they can see. Often, funding restricts the ability to run tests on the remains to confirm their findings categorically.

When examining a live patient, a number of visible symptoms can be used to identify the disease and therefore provide a diagnosis; many of these symptoms are not visible when examining human remains. The majority of infectious pathogens affecting the human body do not affect the skeleton. Therefore, unless soft tissues remain, which is often not the case, identification from bones can be difficult, especially if only partial remains are recovered. Only a small number of infections, and usually only in chronic cases, can be identified in skeletal remains. Infections that do leave evidence on skeletal remains generally present as either abnormal bone growth or abnormal destruction.

In the case of leprosy, destruction of bones usually occurs due to nerve damage of surrounding tissues, in turn causing accidental damage to the bone; this can result in what has been referred to as ‘pencilling’ or bladelike remodelling of the metacarpals, phalanges, and metatarsals (Figure 1.1). This can be confused with conditions such as diabetes and frostbite in remains that only present with damage to these bones. Abnormal bone development or growth in leprosy can also caused by severe symptoms in surrounding areas of the body and the resulting attempts by the body’s immune system to fight the disease. Additionally, lesions within the tissues can have an effect on nearby bones causing bone lesions and malformation.

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Often, human remains of leprosy sufferers cannot be identified as such because no obvious signs of the disease are present in the remains upon excavation. In such cases, inferences may be made based on context, but actual identification can be impossible. However, using palaeomicrobiology, it is possible to rule out a number of diseases with similar symptoms when remains do indicate that the individual may have suffered from an infectious disease. *Mycobacterium leprae*, the bacteria that causes leprosy, is closely related to *Mycobacterium tuberculosis*, the bacteria responsible for causing tuberculosis. Additionally, some symptoms of treponemal diseases, such as syphilis, can present similar symptoms. On occasion, skeletal trauma may be confused with signs of an infectious disease.

**Tuberculosis**

Tuberculosis, caused by *Mycobacterium tuberculosis*, has many similarities to leprosy in both symptoms that can present in patients, and identification of the disease in skeletal remains.
Tuberculosis has been frequently referred to as consumption in the past, although this term has also been used in connection to a number of other pulmonary conditions, somewhat confusingly. As with leprosy, similar issues exist when ascertaining the identity of what has noted as consumption is historical accounts.

The disease is usually spread between humans by the transference of nasal droplets through inhalation. The disease can also spread between species in the form of *Mycobacterium bovis*, or bovine tuberculosis. This can occur in the same way as human to human transmission but more commonly via the ingestion of contaminated cattle products such as milk and meat. The transmission of bovine tuberculosis is relatively rare in comparison to pulmonary tuberculosis; humans are considered the secondary hosts of this form of the disease.

*M. tuberculosis* primarily affects the respiratory system, but as the disease progresses, spreads to the lymph nodes, bloodstream, and other organs and tissues before infected the bones\(^{28}\). When a sufferer is infected with *M. bovis*, the disease usually begins in the digestive tract, due to the means of transmission, and is considered significantly more aggressive in its effect on the skeleton. This form of the disease is found most frequently in children, in part, because of their increased milk consumption compared to the adult population\(^{29}\).

The effects it can have on the skeleton are more often found in children who have contracted the disease, or adults who were infected in childhood, as the disease can cause malformation of normal bone growth. The ability to fight the disease depends on the immune system of the sufferer. Some individuals can become carriers of the disease without suffering from any symptoms; the condition can remain dormant, only becoming evident when the host’s immune system becomes compromised in a similar way to which leprosy can behave.

\(^{28}\) Ortner (2003b) p. 227.

In healthy individuals, recovery can occur naturally, whereas those with compromised immune systems are likely to find fighting off the disease difficult. As a result, tuberculosis has often been identified in populations living in close quarters and poor living conditions where transmission can occur easily. Those who are suffering from malnutrition, those without access to adequate health care, and those already suffering from other diseases, are at risk. The young are the most susceptible due to their reduced immunological capacity. Although tuberculosis is more easily transmitted than leprosy, a similar demographic of individuals have historically been at risk of both diseases. However, the elderly appear to be less susceptible to the disease despite their weakened immune systems; it is thought this is due to incidental exposure throughout life.\(^{30}\)

Conversely this exception is not the case with leprosy.

Confusion between tuberculosis and leprosy often occurs because of the relationship between the bacteria responsible for each disease; this produces some similar symptoms and means of identification, especially in human remains. Both diseases share the *Mycobacterium* genus, although, it is believed tuberculosis has a much longer history with examples in human remains dating from the fourth millennium BC. It is believed that the disease existed in wild animals for thousands of years prior to the first evidence we have of human sufferers before jumped the species barrier, potentially around the time of domestication of animals, but this theory is still debated due to insufficient evidence\(^{31}\).

Abnormal bone destruction and formation can be found in the skeletal remains of sufferers of both diseases. In some instances, fusion between bones and destruction of joints are found when the immune system attempts to fight lesions and abscesses. In chronic examples of tuberculosis,


skeletal changes in the vertebrae can be apparent in up to 60% of cases. Primarily the lower thoracic and upper lumbar vertebrae are affected, but the upper thoracic and upper sacrum vertebrae can also show sign of damage in occasional examples. This occurs when surrounding organs such as the lungs or intestines develop abscesses which in turn impact and spread to nearby bones.

The disease also affects the major joints such as the knee, hip, and elbow, and can cause changes in the ribs, sternum, metacarpals, phalanges, metatarsals, and other bones, but less frequently so than with the spine. It is noteworthy to point out that often in human remains, smaller bones are less commonly found than long bones, as such, it may not always be possible to examine the entire skeleton. In the case of distinguishing tuberculosis from leprosy by looking for pencilling for example, it may not be possible to do this by visual inspection if these are the only bones recovered showing signs of disease.

However, examining the cranial vault can be used to help identify tuberculosis and distinguish it from other diseases affecting the skull. When destructive lesions caused by tuberculosis occur on the skull, they tend to present with larger lesions on the inner vault than the outer; something almost unique to tuberculosis and rarely found with other diseases (Figure 1.2). Cranial vault lesions do not occur in leprosy except in very rare cases. Rhinomaxillary destruction can occur in tuberculosis as it does in leprosy; however, presentation in the former is much rarer than in the later and is only found in a small number of examples.

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32 Roberts and Manchester (2007) p. 188.
An important part of the relationship between tuberculosis and leprosy is a theory of transferable immunity. In recent years, a number of bioarchaeologists have suggested that due to the similarities between the genus of the two diseases, contracting one can produce immunity to the other.\textsuperscript{34} *Mycobacterium tuberculosis* was identified by Robert Koch in 1882. Only 24 years later, Albert Calmette and Camille Guerin developed the first vaccine against tuberculosis; bacilli Calmette-Guerin, commonly referred to as the BCG. Following trials, it was introduced as a routine immunisation against the disease. This led to a significant drop in the number of cases of tuberculosis.

Routine testing for the disease is also common today via a simple blood test. In many countries where the disease is uncommon, it is often required as part of the immigration process for individuals coming from a country that is considered to have a higher risk level. Often a skin

\textsuperscript{34} Roberts and Manchester (2007) p. 204.
Mantoux or Heaf test is carried out prior to administering the BCG to check if the patient already possesses a level of immunity. The skin test involves injecting a small extract of the bacterium into the forearm between the layers of the dermis.

The area is examined two to four days later; if the body has a level of immunity a red mark will be visible where the immune system has attacked the intradermal bacteria. Usually this occurs if an individual has had a casual exposure to, or has previously suffered from the disease; false positives are also common for a number of reasons. If no reaction is visible, the BCG is then administered. The discovery of anti-biotics capable of treating the condition increased the number of individuals recovering from the disease. However, a strain of tuberculosis resistant to anti-biotics has emerged setting back plans to eradicate the disease.

As immunisation against, and cures for tuberculosis proved successful, the number of cases of leprosy appeared to drop. Additionally, during the Medieval period, when the number of cases of tuberculosis increased, the number of cases of leprosy appeared to decline; suggesting that an element of natural cross-immunity has existed. In a similar way to the discovery that milk maids exposed to cowpox seemed not to be susceptible to smallpox, it became noticeable that those who had been exposed to tuberculosis, or immunised against it, appeared to have some level of immunity to leprosy.

Some studies have suggested that transferable immunity can be as high as 80% in modern individuals who have received the BCG vaccine. Likewise, a survivor of tuberculosis gains a level of immunity to leprosy. However, the reverse does not appear to be the case with leprosy survivors remaining susceptible to tuberculosis with no apparent level of immunity.

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35 Roberts and Manchester (2007) p. 204.
36 Roberts and Manchester (2007) p. 204.
extremely rare, it is possible for someone with chronic leprosy to contract tuberculosis due to a compromised immune system, however there is no evidence that the opposite can occur.

**Syphilis**

Syphilis is one of several treponemal diseases which include yaws and pinta. Syphilis itself can be found in two forms; bejel, often referred to as endemic syphilis, and venereal syphilis. Until recently the treponemal diseases were all considered to be *Treponema pallidum* manifesting clinically in four different ways. They are now considered by most to be four different diseases from the same genus, although some debate still continues. Only yaws, bejel, and syphilis affect the bones, with venereal syphilis causing the most aggressive skeletal damage; it is present in around 20% of cases. It is the only one of the four diseases that also affects the nervous system.

In some respects, sufferers of venereal syphilis have been subject to a similar degree of social stigma experienced by leprosy sufferers. The facial disfigurements occasionally found in the later stages of both diseases can lead to confusion with misidentification occurring. In part, the stigma originates from the mode of transmission, with sufferers of venereal syphilis ostracised because of their assumed promiscuity. As leprosy was considered by many to be transmitted through sexual intercourse, sufferers were also labelled as promiscuous frequently and like syphilis sufferers, were often considered guilty of religious sins.

As syphilis is sexually transmitted, individuals are at risk of contracting the disease once they become sexually active and are at greater risk with the more sexual partners they have. It is most prevalent in urban areas where prostitution is common, among groups where attitudes to sexual relations are more relaxed, and is also often found amongst groups of soldiers; it was particularly

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common among knights travelling to the Holy Land during the crusades. Syphilis rarely appears in remains found in small village settings, where promiscuity was rare and monogamous lifelong relationships were the norm. Today, it is most commonly found in the western world among young adults who tend to be more sexually active with more partners than older adults; it is easily treated with a course of anti-biotics. If the disease is diagnosed and treated when symptoms first appear, a full recovery is normal.

Due to the means of transmission, it is seen in individuals following sexual maturity, although it can be transmitted from mother to foetus. When transplacental transmission occurs, the resulting infection in the foetus is referred to as congenital syphilis; infection usually takes place during the early stages of the disease and in the early stages of pregnancy.\textsuperscript{40} Examples of congenital syphilis are rare due to the high mortality rate among infected infants, and the higher risk of miscarriage or delivery of a stillborn preterm neonate.\textsuperscript{41} In around 50\% of cases, death occurs before significant bone damage has the opportunity to occur.\textsuperscript{42} Comparatively, the length of time it takes for leprosy to progress to the advanced stages results in few examples of bone damage in infants and sub adults in the archaeological record.

A type of osteomyelitis of the bone is seen in the later stages of the disease; cycles of destruction and regeneration occur, causing significant bone deformities in advanced cases. As with leprosy, identification in human remains is more likely once in the advanced stages of the disease, as bone damage is evident. However, it can take up to 20 years from the time of infection for bone damage to occur in syphilis and other symptoms may lead to fatality before the disease reaches

\textsuperscript{40} Ortner (2008) p. 204.
\textsuperscript{41} Donald J. Ortner ‘Infectious Diseases: Treponematatosis and Other Bacterial Infectious Diseases’ Identification of Pathological Conditions in Human Skeletal Remains 2\textsuperscript{nd} edition ed. Donald J. Ortner (2003a) p. 289.
\textsuperscript{42} Roberts and Manchester (2007) p. 211.
this stage. Nevertheless, medical records from the Medieval Period suggest that the visible symptoms of syphilis and leprosy were often confused with each other and other diseases in diagnoses by medical professionals.

As complications from earlier stage symptoms often develop, leading to death, it is likely that many sufferers of syphilis are not identified in the archaeological record due to the lack of skeletal damage present. Venereal syphilis can cause severe damage to the skull, which can appear similar to the facial damage caused by leprosy. However, with syphilis, damage also occurs to the cranial vault whereas, this is not usual in cases of leprosy, but does occur. In particular, damage to the nasal region and palate occurs with abscesses and a cycle of destruction and regeneration of the bone; in some cases, to more severe levels of disfigurement than can be seen in leprosy. In both diseases, abscesses in the mouth can lead to secondary infections and tooth loss.

Once the nervous system is affected, damage to the extremities and joints, especially the knees and ankles, can occur; resulting in potential accidental injury due to loss of sensation. This accidental damage can also occur in leprosy for similar reasons. One factor that can help distinguish between syphilis and leprosy, especially with incomplete skeletal remains, is an examination of the long bones. In leprosy, the distal ends of the bones tend to show signs of damage, often in relation to the joints. In syphilis, the mid-shaft of long bones is also affected; often this area can appear thicker than normal if the bone has gone through the destruction and regeneration cycle numerous times (Figure 1.3).

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TRANSFERABLE IMMUNITY

Unlike tuberculosis, there is no transferable immunity between leprosy and syphilis. This is because the diseases come from two different bacterium genera, *Mycobacterium* and *Treponema*. Cross immunity is occasionally found to some degree or other within the same genus, it can be found between the treponemal diseases, but does not transfer between different types of bacteria. It is worth noting that in all cases, species of bacterium, just like animal species, evolve over time.

The bacterium adapts and changes, examples of this have occurred with many bacterial infections in recent years as the bacteria becomes resistant to anti-biotics; this is one reason why today leprosy is treated with a multi drug therapy approach. Syphilis can be easily treated with a number of different general purpose anti-biotics. However, unlike tuberculosis, no vaccine has yet been developed for the disease. Due to its means of transmission, education on prevention is often highlighted and practiced in order to avoid infection. With the idea of evolution in mind, the *Mycobacterium* and *Treponema* from 2000 years ago is likely to have been very different from the form we have in modern cases.
IDENTIFICATION

In order to identifying leprosy in human remains, one must firstly exclude other explanations for any visible abnormalities found, which can be difficult or even impossible\textsuperscript{48}. Trauma and bone damage caused by diseases that looks significantly different to the changes caused by leprosy are usually easy to rule out. When it comes to tuberculosis and syphilis, one must consider the similarities and look for evidence of differences between the diseases. Often, without running laboratory tests, identifying any pathogens present in remains is not possible if the individual died in the early stages of the disease.

Much of the time, analysis of this sort is cost prohibitive, especially when excavating large sites with multiple burials; testing has to be prioritised within budgetary limits, and with the overall research question in mind. If identifying leprosy or other diseases at the site is irrelevant to the research question, then testing is unlikely to take place during the initial analysis of the site. However, this does not mean that testing cannot occur at a later date during the process of other research. The impact of this is many cases of disease from antiquity have been left unidentified in the archaeological record. With this under consideration, it is likely the true extant of infection among past populations is unknown. It is also likely to be significantly higher than confirmed cases in the archaeological record would suggest due to this fact.

Experienced field archaeologists following suggested best practices tend to be inclined to record abnormalities, but only attempt to identify visible signs that they are fairly confident represent a particular condition, rather than recording every possible diagnosis in order to avoid confusion.\textsuperscript{49} Unless soft tissue is present in the remains of early stage leprosy sufferers, and sufferers of other diseases that cause changes to the skeleton in advanced states, leprosy will not be recorded from

\textsuperscript{49} Ortner (2008) p. 213.
a visual inspection, and without pathology results, it will remain unidentified and indistinguishable from remains where no disease is present at all.\textsuperscript{50}

In high profile cases such as the recent Richard III discovery in Leicester, England, national importance or public interest produces additional funding, allowing for numerous tests to take place. Soil samples recovered from the thoracic area during excavation revealed that the King was infested with roundworm. Isotope analysis of teeth and bones provided details of his diet which included large amounts of seafood and exotic foul. Additionally, extensive genealogical research was carried out in order to find descendants of King Richard so comparative DNA tests could be conducted to further confirm a positive identification of his remains. All of these tests were carried out in order to answer the research questions held by the excavation team and funding was available to do so. In many cases, especially in cases where multiple burials are present, financial restrictions often does not allow each set of remains to undergo the same extent of testing.

**VISUAL IDENTIFICATION OF HUMAN REMAINS**

In skeletal remains, the advanced stages of leprosy can be identified from several areas of the skeleton; this is useful when only partial remains are recovered, which is commonly the case. Damage can be either symmetrical or unilateral depending on the severity of the condition; one could expect a right-handed individual to be more likely to be missing fingers on that hand for example (Figure 1.4). However, as soft tissues lesions on the hands are more likely to be noticed and treated by the sufferer, damage to the lower extremities is more commonly found both in the archaeological record and today.

\textsuperscript{50} Anastasiou and Mitchell (2013) p. 33.
Figure 1.4: Male with loss of right hand fingers. This right-handed man has suffered damage to the fingers on the right hand to a much more significant degree to the damage caused to the left hand, this is most likely due to the right being the dominant hand of the individual. © Leprosy Mission of England and Wales.

The bones in the hands and feet are usually the first to show changes due to accidental damage following the loss for sensation and paralysis, caused by the failing nervous system. Initial damage that can be identified in remains is likely to include the loss of one or more of the phalanges and/or metatarsals, with the latter being more common, often showing blade-like destruction\(^{51}\). As the condition worsens, more metatarsals can be expected to be damaged or missing, and the metacarpals can also become damaged once the phalanges have gone. In some extreme cases, the hands and feet can be reduced to stumps.\(^{52}\) The remains are likely to show signs that the sufferer had restricted or limited use of the hands, caused by flexion contractions,

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resulting in a level of paralysis (Figure 1.5).\textsuperscript{53} The sufferer would have probably required the use of tools to assist in common activities. Signs of septic arthritis may be present in very advanced cases.\textsuperscript{54}

![Figure 1.5: Leprosy sufferer with flexion contraction in left hand. © Leprosy Mission of England and Wales.](image)

The foot arch collapses, changing the weight distribution points in the foot; this can be identified in remains by evidence of pressure in the mid-foot area.\textsuperscript{55} Joints may show sign of weakness or damage, especially in the lower extremities, once the metatarsals become affected. At this stage, there will likely be evidence that the individual was suffering from mobility issues caused by partial or complete damage to one or both feet, and signs of secondary infections caused by

\begin{footnotesize}
\begin{enumerate}
\item Ortner (2003b) p. 265.
\item Roberts and Manchester (2007) p. 196.
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staphylococcal pathogens may be present, especially due to the compromised immune system.\textsuperscript{56} Joints, especially in the hands, wrists, and ankles, can also be another entry point for secondary infection and signs further bacterial infections, in addition to evidence of leprosy, may also be evident (Figure 1.6).\textsuperscript{57} In mummified remains, significant skin ulceration is likely to be present in pressure point areas, and post mortem bone loss is more easily identified.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure1.pdf}
\caption{Skin ulceration and bone exposure to right foot. Note the severe level of damage present, despite the bones appearing intact. © Trustees of the British Museum.}
\end{figure}

The distal ends of the tibia and fibula bones develop signs of damage. The visual signs of change on these bones presents in a similar way to other diseases and conditions and should not, therefore, be used solely as a means of identifying leprosy. This kind of change can occur in

\textsuperscript{56} Ortner (2008) p. 204.
\textsuperscript{57} Anderson, Manchester, and Roberts (1994) p. 29.
tuberculosis, scurvy, other diseases, and can also be caused by trauma\textsuperscript{58}. However, it is not common in syphilis, where mid-shaft changes are more common. In some respects, the changes in these bones is due to trauma when it presents in remains of a leprosy sufferer; the stress, pressure, and damage caused to the feet leads in damage to these bones. This is either caused by stress and pressure or the spreading of the disease from the surrounding soft tissue travelling up from the feet. Similar changes in the ulna and radius have also been observed in archaeological records, attributed to a similar spreading of the disease, as occurs in the tibia and fibula, but it occurs less frequently in the lower arms.

Little skeletal damage is recorded in the torso, although potentially any bone in the body can be affected. This is directly related to the regional nature of the anaesthetic effect caused by the failure of the nervous system; the loss of sensation rarely occurred above the knee or elbow\textsuperscript{59}. Often the vertebrae, sternum, ribs, and pelvis can be used to identify other diseases, especially tuberculosis, and rule out leprosy when it is suspected. This is particularly the case when it comes to the vertebrae, where damage can be particularly aggressive in tuberculosis. On occasion, leprosy sufferers have also been identified with signs of advanced stage tuberculosis in addition to leprosy, so there is some precedent for both diseases being present in one skeleton\textsuperscript{60}.

The cervical vertebrae can show signs of infection, typically in relation to the spread from surrounding soft tissues and organs, such as the oesophagus and larynx. Typically, however, the nasal passage, jaw, and palate are more commonly seen affected\textsuperscript{61}.

In the skull, facial bones are affected; particularly the orbital sockets, pyriform aperture, and oral area can be affected. Rhinomaxillary changes, also referred to as \textit{facies leprosa}, that occur in

\textsuperscript{58} Roberts and Manchester (2007) p. 196.
\textsuperscript{59} Anderson, Manchester, and Roberts (1994) p. 22.
\textsuperscript{60} Ortner (2003b) p. 265.
\textsuperscript{61} Roberts and Manchester (2007) p. 198.
leprosy are also common in some other conditions such as carcinoma, which usually presents in a more aggressive form; care must be made to ensure correct identification\textsuperscript{62}. When examining the orbital sockets, \textit{cribra orbitalia} may be present (Figure 1.7). It is a symptom common in a number of diseases, including anaemia, but is also present in leprosy. It occurs when soft tissues, such as the eyes, become chronically infected and the spread of the infection causes the orbital bone to appear porous and sponge-like.\textsuperscript{63} When this is visible in skeletal remains, it is likely that the sufferer had become blind.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1_7.png}
\caption{\textit{Cri}bia orbitalia\textit{a} caused by infection to the eye and surrounding tissue. This image shows the damage caused in the remains of a child, it is likely, due to the damage caused, that the child had been blind at the time of death. \copyright\ Elsevier Science}
\end{figure}

When examining the pyriform aperture, the damage tends to enlarge the opening and the nasal spine can be completely destroyed (Figure 1.8).\textsuperscript{64} This damage has been the basis of at least one of the common names associated with leprosy. The appearance that the loss of the nasal bones would give the sufferer could be considered as a lion-like appearance, hence the term \textit{leontiasis}.

\begin{footnotesize}
\begin{enumerate}
\item Palfi (1997) p. 76.
\item Anderson, Manchester, and Roberts (1994) p. 27.
\end{enumerate}
\end{footnotesize}
With the nasal spine in particular, one must be conscious of the possibility of post-mortem activity being the cause of the damage.

Abscesses on the jaw, and the cycle of destruction and remodelling of the bone due to this could often lead to tooth loss; the incisors were particularly prone to being affected. In the remains of children who contracted the disease in infancy, signs of stunted dental development may be visible, particularly in the dental roots.\(^6\) This incomplete dental development will not be present in remains of individuals who contracted the disease at an older age because dental development happens very early in life; the process begins \textit{in utero}. Tooth loss and signs of related abscesses ought not to be used as a sole point of diagnosis, as many other conditions can cause the teeth to fall out, but should be used in conjunction with other signs elsewhere on the skeleton to determine whether leprosy would be a likely diagnosis for the remains in question.

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\(^6\) Ortner (2003b) p. 270.
EFFECTIVENESS AND CONTEXTUAL PROBLEMS

As has become evident, there are several problems in effectively detecting leprosy in human remains with simply a visual inspection. In order to do so confidently, the remains need to be as complete as possible and show clear evidence of bone damage in several areas that can be identified as leprosy beyond reasonable doubt.\textsuperscript{66} In populations that were particularly susceptible to leprosy, and likely to die from the disease in the early stages, the archaeological record may reflect only a few examples of remains with skeletal evidence of leprosy, suggesting that the disease was uncommon when in fact, the opposite was the case.\textsuperscript{67} Bearing in mind that only a small percentage of leprosy became chronic enough to affect the bone, it becomes clear just how many cases go unidentified in the archaeological record.

Comparing ancient remains to modern remains of individuals known to have died of the same disease can be an effective tool in diagnosing a disease in an excavated skeleton. But one must be aware that in many cases, modern remains may exhibit different kinds of bone damage and change due to medications the individual may have been taking to treat the disease. Additionally, bacterial infections have changed dramatically since the introduction of antibiotics and other therapies; adapting and mutating as the bacteria builds a resistance to drugs used to treat the condition.

This means that the same condition may have presented in a different way 2000 years ago than it does today.\textsuperscript{68} This is potentially significant when examining the prevalence of the disease over time. It could be that in a similar way to how older individuals develop a level of resistance to infections such as tuberculosis, a trend that may be visible with leprosy; populations develop a

\textsuperscript{66} Ortner (2003b) p. 266.
\textsuperscript{67} Mays (2010) p. 200.
\textsuperscript{68} Mays (2010) p. 192.
resistance to the disease, but not immunity, allowing the disease to progresses to the advanced stages whereas earlier populations succumbed to the disease in its early stages.

However, occasionally contextual evidence can be used in conjunction with remains. Often this can be problematic if one becomes too reliant on contextual evidence by filling in the gaps, rather than taking evidence at face value. This being said, there is a place for looking at the wider context in which remains are found. This becomes particularly valuable in circumstances where remains are recovered in the grounds of what has been identified as an institution designated for the care of leprosy sufferers. In such circumstances, one could expect that when multiple burials are recovered, the majority of them are likely to be those of patients who have died while being cared for at the institution.\(^69\)

Due to the level of misdiagnosis in past populations, it is not improbable that a small number of remains within a larger burial complex associated with an institution may include remains of individuals infected with diseases that present with similar symptoms to leprosy. Prior to admission, individuals may have been diagnosed with leprosy and treated as a sufferer while actually infected with a different disease. The breadth of physical symptoms associated with leprosy make this scenario a possibility; therefore, when considering remains in the context of an institutional burial, one should consider that anomalies and unexpected results may occur.

**DNA Analysis**

Genetic analysis of pathogens found in human remains allows for an identification of diseases and other conditions that may not be identifiable from a visual inspection. The use of DNA analysis of pathogen DNA is a relatively new tool used by palaeopathologists but has been

\(^{69}\) Ortner (2003b) p. 266.
incredibly useful since it was first used almost 25 years ago.\textsuperscript{70} Analysing the DNA of a pathogen such as \textit{M. leprae} or \textit{T. pallidum} and tracing the genome of the pathogen can identify changes and mutations that can account for changes in the physical symptoms of a disease over time.

It can also provide evidence and theories as to why a disease may have been more prevalent at different times in history. This is of particular interest when examining leprosy, as we know from historical and archaeological records that the disease appeared to go through an endemic phase in the Middle Ages. On the other hand, because of the extremely long time leprosy takes to develop, the changes in the genome of \textit{M. leprae} can be expected to be less significant than a bacterial infection with a much shorter incubation period.\textsuperscript{71}

DNA analysis of pathogens present in human remains can be a difficult process and results may be inconclusive for a number of reasons. DNA in remains begins to degrade from the time of death, and continues to do so over time, meaning that the older the remains, the more fragmented the DNA sample will be.\textsuperscript{72} Contamination from soil or other organic materials may have occurred post deposition, simply handling bones, especially particularly porous bones, during excavation, can contaminate degraded ancient DNA with fresh modern DNA. While the best source DNA from human remains is often found in teeth, they are not particularly useful when attempting to identify leprosy as samples are required from the site of bone lesions.

When lesions are not present, the chance of positively identifying leprosy in human remains is further reduced, but still may be found residually.\textsuperscript{73} However, best practice dictates that DNA analysis ought to be used to support or confirm visual findings, rather randomly selecting bones for analysis, although some studies have been carried out recently in order to identify other

\textsuperscript{70} Anastasiou and Mitchell (2013) p. 33.
\textsuperscript{71} Anastasiou and Mitchell (2013) p. 33-34.
\textsuperscript{72} H. D. Donoghue, J. Holton, and M. Speigelman ‘PCR Primers that can Detect Low Levels of \textit{Mycobacterium Leprae} DNA’ \textit{Journal of Medical Microbiology} Vol. 50 (2001) p. 178.
\textsuperscript{73} Mays (2010) p. 293.
diseases, such as tuberculosis or bubonic plague, in mass graves using a broader approach of random sampling.\textsuperscript{74}

Bones may be damaged to such a degree, or abnormalities may be so small, that obtaining a suitable sample for analysis is impossible.\textsuperscript{75} DNA, like all other composite parts of the human body, degrades over time making it more difficult to extract a viable DNA sample the older the remains are. The conditions that the remains have endured are also a major factor; cool and dry conditions are usually favourable, whereas damp and warm conditions generally lead to quicker degradation. Interestingly, the pathogenic DNA of \textit{Mycobacteria} tends to survive more frequently than the DNA of the human host, suggesting that the DNA of the pathogen is more robust than human DNA.\textsuperscript{76} The reasons for this are not completely known, but it is partially due to the fact that the cell walls of \textit{Mycobacterium} are particularly thick, making the cells more robust than human cells and \textit{M. leprae} cells in particular, are notably more robust that those of \textit{M. tuberculosis}.\textsuperscript{77}

It is important to note that as technological advances are made, smaller and smaller samples are required to extract DNA, meaning that a sample that was unworkable a decade ago, may be more than suitable today. Since the Polymerase Chain Reaction technique which allows a DNA sample to be amplified through the use of primers was developed in the 1980s, successful DNA analysis has become easier and more commonly used.\textsuperscript{78} However, despite these advances, some samples are still currently unworkable, but may be possible to analyse at some point in the future, smaller and smaller samples of viable DNA are needed in order to positively identify leprosy and other

\textsuperscript{74} Anastasiou, Manchester, and Roberts (2013) p.
\textsuperscript{75} Mays (2010) p. 197.
\textsuperscript{76} Anastasiou, Manchester, and Roberts (2013) p. 34.
\textsuperscript{78} Mays (2010) p. 292.
pathogens in human remains. Attempts should be made to preserve excavated remains as much as possible in order to allow for this.

DNA analysis can be immensely useful in identifying leprosy in remains where a visual diagnosis is inconclusive, especially considering how little the pathogen has changed or mutated throughout its history. This means that ancient DNA of the leprosy pathogen typically contains the same pathology as DNA taken from patients alive today. However, one major drawback of DNA analysis is its cost. It is not possible to test every excavated bone or soil sample; decisions must be made to determine what archaeological answers can be ascertained from conducting tests and whether these will adequately fulfil questions that are under consideration from a particular archaeological site. In a research field where budgets are often restrictive, the potential results of any tests must be an important factor in order to warrant conducting them. This is one reason why DNA analysis is often used simply to confirm visual findings when some uncertainty is held because bone lesions could indicate two or more similar diseases.

**Other Methods**

In addition to DNA analysis, a number of other laboratory tests can be carried out in order to identify leprosy in human remains. The first way to aid in visual diagnosis is through the use of microscopic analysis. Upon closer inspection, many lesions that may not be easily identified by the naked eye, may allow for a clearer diagnosis when examined through a microscope. This can be particularly beneficial when used to observe traces of bone lesions in the early stages of bone damage caused by leprosy. The drawback of this technique is that it is destructive and should

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never be used in isolation as a means of identifying the presence of disease. Slices or plugs of bone are removed for sampling; the samples are often contained within resin or ground down before examination. If findings do not confirm a diagnosis made from other tests, it can often result in the destruction of bone without any diagnostic benefit.

The use of radiography can also be useful, especially in cases of mummified remains, in order to allow examination of the skeleton. Computed Tomography (CT) scans can also be used for similar reasons although this is a more expensive technique. X-ray is a relatively cheap and simple way to create a two dimensional image that can be studied either in digital or traditional film form (Figure 1.9). This is probably the most effective and accessible tool used in studying human remains as many answers can be obtained from the images such as the density of the bone, and observing lesions that may extend internally into the structure of the bone. Most university archaeological departments, especially those offering commercial services, have access to X-ray machines.

![Figure 1.9: X-ray of teeth with failed development caused by leprosy. This X-ray of the teeth of a young child, demonstrates how contracting the disease at the neonatal stage, or in infancy, can result in dental roots failing to develop. The use of radiograph imaging can provide additional evidence of leprosy that would not be visible to the naked eye. This is especially useful in examining dental roots which may not be visible. © Elsevier Science.](image)

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CT equipment is more expensive and access can sometimes be difficult as it may require negotiating the use of machines with medical facilities. It can provide, in some cases, a more useful image than that produced by X-ray imaging, but often the cost and difficulty in accessing the equipment outweighs the potential benefits. CT scanning and radiology can be used for comparative purposes. Images of modern remains from individuals known to have suffered for leprosy and other conditions can used as a reference tool to aid in identifying leprosy in archaeological remains and ruling out other conditions. Images of normal bones can also be used in order to identify abnormalities.

Since X-ray imagery was first used in 1895, a plethora of images have become readily available to osteoarchaeologists for comparison purposes from a time before antibiotic treatments may have altered the presentation of different conditions in human remains. As CT imagery is a more recently developed technology, fewer images of this type are available for comparison. Whenever imagery is used, either X-ray or CT, it should always be used in conjunction with the physical remains and should be used to aid in providing additional evidence to support a diagnosis, rather than being the only means. However, in the case of mummified remains, X-rays and CT scans can be useful tools to use in order to get an internal image without interfering with the wrappings or soft tissues associated with the remains. Visual, microscopic, DNA analysis, X-ray, and CT scanning have all been used in the study of human remains displaying signs of leprosy and these techniques will be central to many of the cases discussed in the following chapters.

86 Wells (1963) p. 402.
SUMMARY

While leprosy is often difficult to identify in its early stages in live patients even today, it is even more difficult to identify it in human remains. Leprosy must usually be in multibacillary advanced stages in order to be identified in the archaeological record, and it can easily be confused with other diseases such as tuberculosis and syphilis. Some transferable immunity is present in individuals who have contracted tuberculosis, meaning they are unlikely to contract leprosy following a bout of tuberculosis. However, the reverse is not the case with leprosy suffers remaining susceptible to tuberculosis. This transferable immunity undoubtedly played a part in the decline of leprosy in the late Middle Ages due to increased cases of tuberculosis.

Identifying leprosy in human remains can be made by visual inspection and is most easily identified in damage to the hands, feet, limbs, and facial bones. DNA analysis, microscopic analysis, X-ray, and computed tomography, can be used as secondary means of identification. In practice, due to financial restraints, methods beyond visual inspection tend to only take place in order to confirm a diagnosis when this is important to an overall research question. X-ray is the most common of these secondary methods, due to the accessibility of X-ray machines and cost considerations.

Identifying leprosy in human remains can tell a great deal contextually about past populations, including the treatment of sufferers, both socially and medically, and give some indication of the number of sufferers and where they resided. The geographic locations where remains have been found can bring context to a site, and in turn a site can give context to remains identified as showing signs of leprosy. This is particularly important when we examine the emergence of leprosy in the Middle East, and the founding of institutions offering care and services to sufferers. As we will see in the following chapter, historical records can often confuse the
identification of leprosy with other conditions, and biblical sources in particular, are responsible for some of the stigmas, and acts of charity, sufferers faced over time.
Many of the reasons for misunderstandings regarding leprosy, its transmission, and the treatment of sufferers, both socially and medically, stem from how leprosy is presented in the Bible. The first problem is that references to leprosy in the Bible do not describe what we understand today as the clinical condition *mycobacterium leprae*, but a whole host of other diseases and conditions. Most of this confusion is due to errors in translation, which had a profound effect on the social stigmas associated with leprosy as the Bible went through several translations. Certain references in the Old Testament identify ‘leprosy’ as a curse, as something unclean. Sufferers are social outcasts, expected to dress in particular clothing, and must follow particular rules such as periods of isolation. Leprosy is a condition that can be inflicted upon an individual, and taken away from an individual, by divine power and a number of examples exist of God personally carrying out these acts, for relatively mundane reasons in some cases. Views of sufferers of leprosy differ between the Old and New Testaments. While a reading of the Old Testament often results in readers considering sufferers as sinners and religiously unclean, the Christian community generally did not consider itself beholden to Israelite laws, and this is reflected in some of the later writings of the New Testament. The love and care bestowed upon leprosy sufferers by Jesus led many to see those suffering from the disease as deserving of charity. Jesus was unconcerned with the rules of confinement, and is described as
residing with a man known as Simon the Leper in Bethany in Matthew 26:6 and Mark 14:3. In turn, many Christians followed the examples set by Jesus by providing alms, and care, for those suffering from the disease.

PROBLEMS WITH BIBLICAL TRANSLATION AND MISIDENTIFICATION

Many problems with translation exist regarding leprosy. The more relevant to this study, however, are those in biblical, and some extra-biblical sources, that have led to, and promulgated, social stigmas. In many of these cases, the translations identify another disease or ailment as leprosy. In other cases, the description is not sufficient enough to categorically confirm that leprosy is being described. Occasionally a text goes through a series of translations, making the original meaning of the word or phrase difficult to determine. When a direct translation is not possible, due to the lack of appropriate words in the translated language, alternative terms must be used; this leads to further diluting and confusion of the original language of the text.

Ultimately, leprosy did not arrive in the Levant until around 350BC; the troops of Alexander the Great likely brought the disease back to the area with them from India. When we consider the dates of composition for much of the Old Testament, the disease often being referred to cannot be leprosy. This is simply because, as far as we know from the archaeological record, the disease did not exist in the area at the time and therefore must refer to some other ailment, unless such a time that archaeological evidence is found to suggest leprosy was indeed present earlier than currently thought. Additionally, leprosy in the Bible is often associated with periods of short confinements of seven days or multiples thereof until symptoms disappear. Physical symptoms of true leprosy will not disappear unless treated with modern medicines, whereas, cases of

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leprosy in the Bible often appear to abate within days or weeks. The Hebrew word *tzaraat* was often used to describe an array of different conditions including impetigo, syphilis, scabies, psoriasis, scarlet fever, fungal infections, and alopecia, amongst many others; its meaning became interchangeable with true leprosy over time. Additionally, the term was also used in relation to mould on fabrics, or within buildings, demonstrating just how broad the understanding of biblical leprosy actually was. Translations of the word *tzaraat* into the Greek *elephantiasis*, meaning leprosy in English, first aided in the confusion of the biblical meaning. Translations of the word into the Arabic *lepra* took place in the ninth century, providing another occasion of mistranslation. The word *lepra* is also used in Latin and can be translated into English as ‘scaly’, indicating how symptoms of *lepra* may have appeared. The term *lepra* was used in the Vulgate and was a Latin word borrowed from earlier Greek and translated into English versions of the Bible as leprosie, solidifying the term leprosy in English translations. Further confusion is found when one considers that some symptoms may be attributed to more than one condition of the skin.

A better understanding of the usage of the term leprosy in its various translated forms in the Bible ought to be to consider it to mean either an identification of a broad array of skin conditions, or as a term used to describe a form of ritual impurity or uncleanness. For example, an individual identified as being leprous, could be considered to be an individual who is not  

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89 Grzybowski and Nita (2016) p. 5.
92 Grzybowski and Nita (2016) p. 3.
ritually clean for any number of reasons and therefore unable to enter into a holy place.\textsuperscript{94} Importantly, the conditions identified as leprosy in the Bible tend to be considered highly contagious. While the biblical concern is of passing impurity onto others, it is clear that the reason for segregation was due to the perceived ease of transmission, whatever the reason.

Tellingly, true leprosy is not easily transmitted at all and has an extremely long incubation period. The segregation method seen in the Bible would be both an ineffective method for containing the disease and for treating it.\textsuperscript{95} Many common misconceptions of leprosy that have lasted up to the modern day are based on misunderstandings of the leprosy described in the Bible. Despite a close reading of passages in the language they were written in providing much needed clarity, it does not change the perception of the disease amongst lay people who rely on translations in the vernacular and are unable to examine the passages in their original language.

While the original meaning of passages is clear upon close examination of the original text, this understanding is not easily understood by the general population. This would have been a particular problem in a time when biblical passages were read in a language congregations could not understand, or at a time when individuals could not read at all, let alone biblical texts before they were translated into multiple languages.

\textbf{Exodus}

The first biblical reference to leprosy is found in Exodus 4:6-7; the narrative describes how God infects the hand of Moses with leprosy, only to cure soon after in a demonstration of His power.

In the New Revised Standard Version translation of the Bible, Moses’ hand is described as being ‘as white as snow’.\textsuperscript{96} The use of the term leprosy, as used here and numerous other times in the

\textsuperscript{96} Exodus 4:6.
Bible, is used to describe a variety of skin diseases and descriptions of whitened skin, are more likely to be describing eczema or a similar condition rather than leprosy. The act of infection here is used simply as a demonstration of divine power and not as a punishment as well, as it is elsewhere in the Old Testament.

LEVITICUS

Chapters 13 and 14 of Leviticus are the main source of information regarding biblical leprosy, and the root of its commonly perceived association with sin and impurity. From the first reference to leprosy in Lev. 13:2, the usage clearly intends for the term to refer to a number of skin diseases. There are a total of seven different symptoms mentioned in chapter 13, which could represent a number of different conditions. Diagnosis here is intended to be made by a priest who determines, based on the visible symptoms, the period of confinement that the sufferer ought to be subject to in order to be clear of the affliction. If confinement is required it lasts seven days, after which further examination is carried out and the patient either released from his confinement, or retained for further periods of seven days until such time as a priest considers it appropriate to end the confinement. The passage also describes in details the reasons why a subject may be considered clean or unclean depending on the presentation of the skin. For example, Lev. 13:13 states that if the skin of the patient is completely white due to the condition, they shall be considered clean. Whereas if raw flesh is in evidence the patient shall be considered unclean according to Lev. 13:15. The emphasis is on the prevention of the moral contamination of others, rather than concerns that the condition may be medically contagious.
Chapter 14 gives details of how sufferers of the conditions termed as leprosy in the Bible ought to be treated, and the ritual they must undergo in order to become clean once more. The ritual begins as follows,

‘the priest shall command that two living clean birds and cedar wood and crimson yarn and hyssop be brought for the one who is to be cleansed. The priest shall command that one of the birds be slaughtered over fresh water in an earthen vessel. He shall take the living bird with the cedar wood and the crimson yarn and the hyssop, and dip them and the living bird in the blood of the bird that was slaughtered over fresh water. He shall sprinkle it seven times upon the one who is to be cleansed of the leprous disease; then he shall pronounce him clean, and he shall let the living bird go into the open field’. 97

The individual is then required to wash their clothing, shave their body, and bathe98. They are then required to make ritual offerings of lambs, flour, and oil; the quantities dictated by the wealth of the individual; the poor could substitute two of the lambs with turtledoves or pigeons99. A priest then uses blood from the animals and oil to anoint the individual; offerings are then made in atonement. In the case of a house becoming infested with mould, the house is to be shut up for seven days, if the mould is still present after this time it is thoroughly cleaned with affected stones discarded. This cycle continues until the house is purged of the disease. Further instructions are provided for those who enter an infected house as to how they can purify themselves after entering. Once the house is clear of the disease the cleansing ritual outlined in Lev. 14:4-7 is carried out on the house by a priest.100

The seven symptoms discussed in Leviticus attributed to biblical leprosy are as follows; baheret refers to bright spots and can also be used to describe a change in the colour of the skin, either whitening or reddening, se’et refers to swelling, schenin is a white inflammation, netek refers to

97 Leviticus 14:4-7.
98 Leviticus 14:8-9.
99 Leviticus 14: 10-21.
100 Leviticus 14:54-57.
the thinning, yellowing, and breakage of hair, *gibachat* refers to alopecia occurring on the anterior scalp, and *karachat* refers to alopecia occurring on the posterior scalp.\textsuperscript{101} It is immediately obvious that these symptoms are not typical of those caused by *M. leprae* and clearly describe a number of ailments.

**Numbers**

In the narrative of chapter 12 in the book of Numbers, Miriam is inflicted with ‘leprosy’ for criticising the decision made by Moses to marry a Cushite woman. This happens following a visit from God. Interestingly, Aaron, who also criticised Moses’ choice of wife is unchanged, the implication in Num. 12:11 is that Miriam is punished for the sins of both herself and Aaron. While begging forgiveness, Aaron compares the leprous Miriam to, ‘one who is stillborn, whose flesh is half consumed when it comes out of its mother’s womb’ (Figure 2.1).\textsuperscript{102}

This extreme comparison and the severity of punishment for Miriam’s criticism of Moses’ choice of bride, further bolsters the negativity associated with leprosy. Despite Moses pleading with God for Miriam to be healed, she is subjected to the customary seven day isolation. After which time, she is allowed to join the rest of the community and the journey continues.\textsuperscript{103}

Importantly however, the narrative also implies that God has the power to cure those suffering from the condition once they are deemed to have suffered sufficiently from their punishment; leprosy was a divine infliction that could be given, and taken away, by the power of God.

\textsuperscript{101} Grzybowski and Nita (2016) p. 4.
\textsuperscript{102} Numbers 12:12.
\textsuperscript{103} Numbers 12:14-16.
Figure 2.1: Woodcut of Miriam afflicted with leprosy accompanied by Moses and Aaron. Miriam kneels before Moses in the hope of being cured of her affliction, notably displaying signs of enlarged hands and face, symptoms of true leprosy. Aaron stands to her left, and Moses, notably depicted with horns due to a mistranslation in the Vulgate, sits in front of her; circa 1525-1530. © Trustees of the British Museum.

**Matthew, Mark, and Luke**

In Matthew 8:1-4, Mark 1:40-45, and Luke 5:12-16, Jesus is approached by a man suffering from leprosy who states that if Jesus chooses to, he has the power to cleanse the man of his affliction. Jesus decides to cure the man, touches him, and cleanses him (Figure 2.2). He then directs the man to visit a priest in order to be examined and declared clean, as per Levitical law. Note that
despite Jesus curing the man, and the visible signs of his condition disappearing immediately, he is still required to visit a priest in order to be officially pronounced clean.

The book of Luke also includes two other narratives involving a leprosy suffer; these tales can be considered as instructional or wisdom stories. The first is known as The Rich Man and Lazarus, also known as The Rich Man and the Leper, using the now defunct term; the second is often referred to as the Grateful Samaritan. These follow a common tradition of stories, in this case told by Jesus, that provide a lesson or moral teaching. The idea of wisdom teachings is extremely old, with the oldest surviving example comparable to biblical narratives coming from the reign of the Egyptian Pharaoh Seti I in the twelfth century BC. Known as The Tale of the Two
Brothers, it may be the basis of the Old Testament story of Joseph and Potiphar’s wife. The moral of the tale is that of kinship and fidelity.

The Rich Man and Lazarus is found in chapter 16 of Luke and tells of a rich man who dines sumptuously every day while a poor man named Lazarus, who was covered with sores, starves and longs to dine on the scraps from the rich man’s table. When the men die, Lazarus is taken away by angels to be with Abraham, while the rich man is sent to Hades. The rich man begs Abraham to allow Lazarus to quench his thirst with a drop of water from his finger, but Abraham chastises the rich man, reminding him that if he had been benevolent in life, he would not have found himself in Hades after death.

Figure 2.3: Depiction of ‘The Parable of the Rich Man, and Lazarus the Beggar’. The print dating to 1784 shows the beginning of the narrative in Luke 16. The rich man is shown dining opulently, while the beggar Lazarus, shown here by the artist as suffering from leprosy, starves, has his wounds licked by dogs, and is ignored by the wealthy diners. © Trustees of the British Museum.

It is uncertain whether Lazarus the leper was actually a sufferer of true leprosy, or was suffering from any one of the other conditions associated with leprosy in the Bible. In any case, this story
is the source of the association of Lazarus with leprosy that continued until the late Middle Ages. The Lazarus of this story was often confused with and amalgamated with that of Lazarus of Bethany, brother of Mary and Martha, whom Jesus raised from the dead in the Gospel of John of a period of many years. This confusion is the reason why a number of institutions for leprosy sufferers emerged as St Lazarus hospitals. It may also account for later assumptions that leprosy sufferers were somewhere between living and dead.

The story of The Grateful Samaritan in chapter 17 of Luke begins when ten ‘lepers’ come within sight of Jesus and called to him from a distance asking for his mercy. He grants it and they are cured. Jesus then tells them to visit a priest so that they may be declared clear of the disease. One of the men prostrates himself in front of Jesus to give thanks and praise to God. He is identified as a Samaritan. In Luke 17:17-19, Jesus makes a point of stating that of all the men he cured, only the Samaritan approached him to give thanks.

**Extra Biblical Sources**

Early extra biblical sources that survive today tend to be in the form of medical treatise. Documented cases emerge in Greece around the time of Alexander the Great’s return from his conquests in the East. There is also evidence from the time of the Ptolemaic kings in Egypt that leprosy was present; probably emerging there as a result of trade between Greece and Egypt or between India and Egypt in the second century BC. Early physicians were able to identify symptoms of the disease, and provide details of how it progressed. They often speculated as to the cause, which was usually in line with the understanding of medicine of the time. Contraction of the disease could be attributed to an unbalance of the bodily humours. Some of these classical

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105 Miller and Nesbitt (2014) p. 11.
theories persisted well into the nineteenth centuries when an understanding of contamination and pathogens emerged.

The Greek physician and anatomist, Rufus of Ephesus, wrote of leprosy in the first century AD and referenced to earlier third century BC works by Straton, a student of Erasistratus, who identified the disease in cadavers and suggested that the cause of the disease was due to an unbalancing of the humours in the body. Straton’s work has been lost, but as is commonly the case, a number of Greek physicians would reference the work of others and some of this survives in texts today. Lucretius, Pliny the Elder, and Plutarch all wrote on the disease in the first century AD. Lucretius and Pliny the Elder both described the skin lesions that appear in the early visible stages of the disease.

In the second century AD, Galen of Pergamon studied leprosy extensively and some of his work on the subject has survived. He discusses what he believes to be the cause of the disease, a rise in melancholic humours entering the blood and rising to the skin, and offers a number of suggested treatments. Galen’s theories persisted for many centuries until more conventional medical explanations were suggested. His treatments, while inventive and imaginative, would have been mostly ineffective and in some cases have been likened to magical solutions.

Perhaps the most detailed account of leprosy that has survived from the classical period is in On Acute and Chronic Diseases by Aretaios of Cappadocia. Unlike most Greek and Roman physicians, Aretaios does not reference the works of others, which makes dating his work difficult; there is some debate regarding when he was writing. His descriptions of leprosy, especially the thickening of the skin, facial disfigurement, and loss of digits are particularly

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106 Miller and Nesbitt (2014) p. 11.
107 Demartie – find ref
accurate.\(^{109}\) He may have been a contemporary of Galen, or may have been writing as late as the third or fourth century AD.\(^{110}\) Aretaios provides a detailed description of the disease and also provides a number of suggested treatments for the condition. Like other medics of the period, he associates the disease with elephants; attributing the association to the appearance of the skin lesions, and because the disease was metaphorically as strong as an elephant.\(^{111}\) Aretaios was perhaps one of the first to rightly suggest that leprosy could be spread via inhalation of the nasal droplets of an infected person or via open wounds on the skin. However, his understanding of the transmission was slightly different to how we understand it today; but the principle was similar. He believed that an infected person exhaled air contaminated with \textit{miasma}, if another individual inhaled this, it would turn into \textit{pneuma} which would spread throughout the body via the arteries. Aretaios believed that pores in the skin could act as another entry point for \textit{miasma} if an individual came into contact with contaminated air.\(^{112}\)

\textbf{ISOLATION AND SOCIAL STIGMAS}

Isolation was imposed from Old Testament times, as per Levitical law. The individual was segregated from the rest of society because the general perception was that they were considered to have committed a sin or become unclean, and isolation was required in order to prevent others from becoming unclean or being rendered sinners by association. The cycle of seven day isolation until the patient was deemed to be cleansed of the disease, and therefore to have completed the punishment for their sin, was associated with true leprosy from an early stage and the belief in this became particularly prevalent in later periods. Despite the biblical symptoms

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\(^{111}\) Aretaios reproduced in Miller (2014) p. 164-166.

being different to those of true leprosy, sufferers seemingly recovering from the conditions, and
the apparent ease of transmission of the biblical conditions, the connection between the two
stuck. This resulted in sufferers of true leprosy being considered as sinners and the assumptions
that others could be cursed by association.¹¹³

Due to the incubation period of true leprosy and the broad range of symptoms sufferers can
present with, the segregation techniques used in the Bible were not likely to be particularly
effective in preventing the transmission of true leprosy. Sufferers can be infectious without
displaying physical symptoms of the disease for many years and there is also evidence to suggest
that especially once Christianity was established, the strict rules on isolation used for biblical
leprosy were not strictly adhered to.

Early examples of human remains with signs of leprosy tend to be found either in family tombs
or alongside individuals with no signs of leprosy, suggesting that, in burial at least, segregation
was not practiced. Segregation in death was deemed unnecessary at this point in time. The
remains we have from cemeteries attached to early monasteries and hospitals also indicate a
range of conditions present in remains, suggesting that leprosy sufferers were treated alongside
people with other medical conditions. This is likely to be representative of the types of
individuals residing at these locations, meaning that some remains may belong to poor
individuals who died of natural causes.

Aretaios had some understanding of transmission, but he believed that leprosy was much more
contagious than it is in reality. His suggested course of action was for infected individuals to be
sent to isolated locations in the desert or mountain regions. He prescribed total abandonment, but
it is unlikely that many families followed this suggestion and it is more probable that sufferers

¹¹³ Joseph Zias ‘Current Archaeological Research in Israel: Death and Disease in Ancient Israel’ The Biblical
Archaeologist Vol. 54.3 (1991) p. 149
were sent to isolated institutions for their confinement, or were at least provided with regular provisions by family members if they were sent to live alone.\textsuperscript{114}

**PERCEIVED LEVELS OF CONTAGIOUSNESS**

In the Bible, little concern is given to the risk of contagiousness of leprosy as a disease that can be clinically transmitted between individuals. The concern and belief is that sufferers of condition are simply unclean and their uncleanliness can be passed on to others. However, the social perception is slightly different that the accuracy of the biblical narrative and individuals were considered to have committed a sin and that sin could be transmitted to other individuals simply by association with the infected. It is a question of uncleanliness, sin, purity, and punishment, and sufferers should be isolated in order to prevent their impurity from being passed on to others. Whether an individual was suffering from leprosy or not was determined by a priest with little or no medical knowledge, and he would be responsible for placing the sufferer under quarantine until the symptoms disappeared.

Nevertheless, the biblical accounts of leprosy describe highly contagious diseases that would have been easily passed on to others. This is in contrast to true leprosy, which is difficult to contract. Even though physicians writing from the first century AD onwards were aware of the disease and were probably aware that it was not easy to contract, the negative connotations and social perceptions associated with biblical leprosy became associated with true leprosy, and remained in place until the present day. Transmission and contagiousness of disease was not understood then as we understand it today. The commonly understand biblical interpretation of leprosy being associated with sinful activity persisted, and became more commonly believed than the literal biblical descriptions.

\textsuperscript{114} Aretaios reproduced in Miller (2014) p. 169.
Physicians did not know about bacteria and simple methods to avoid contamination, such as using clean equipment in procedures and hand washing. Common treatments such as bloodletting, introduced by classical physicians, continued until the nineteenth century. Often epidemics of disease, either among humans or animals, were perceived as being caused by some divine being, because no other logical explanation was readily available to the general public. Some understanding of segregation as a means to prevent the spread of disease was clearly evident in biblical times. But as one can see from the frequent visits from priests to examine the infected, the understanding was that those considered as religiously clean were at less risk of contracting the disease.

**Religious Impurity**

In the Old Testament, the sufferer of leprosy was considered to be unclean and suffering from the condition as divine punishment because they had committed a grievous sin. In order to enter the tabernacle or Temple, one must be religiously clean; it was critically important that individuals were clean in order to approach or be in the literal or figurative presence of God. Examples found in the Old Testament of individuals inflicted with this divine punishment include Miriam, who is punished for criticising Moses in Numbers 12:10, and King Uzziah, named here as Azariah, who is stricken with ‘leprosy’ and forced to live in isolation for failing to stop his people from practising sacrifice and making offerings in high places in 2 Kings 15:5. King Uzziah is mentioned a second time, this time his punishment is for attempting, as king, to burn incense on the Temple altar in 2 Chronicles 26:19; a ritual only priests were permitted to perform.

In Numbers 5:1-3, leprosy sufferers are instructed to live outside of the camp along with those considered unclean due to their contact with corpses. They are instructed to leave the camp
because their presence would defile the Tabernacle, within which God is residing. This ostracising impresses the fact that anyone considered unclean was not suitable or worthy of being in close proximity to God, and would not be able to take part in any religious ceremony if normally eligible to do so.

During the time one suffered from a visible affliction of the skin, like those outlined in Leviticus, an individual was required to be isolated from other members of the community, out of fear that their suffering might transfer to others. It is important to note that this is a cultural concern, little worry was given to the contagiousness of the condition, and indeed, individuals who were suffering from a condition, but not yet displaying physical symptoms, would be free to socialise within the community at a time when their condition was likely to be the most contagious today. Correlation between the persistence of a condition, and the purity of the individual, was drawn and clinical concerns do not appear to be apparent.115

In early Christian times, the issue concerning whether the cause of biblical leprosy was a punishment for sin or not was debated. Some continued to interpret the Old Testament narratives of Miriam and King Uzziah in the literal Jewish tradition, believing that God inflicted the disease on individuals because of their sins; today we know that the conditions attributed to Miriam and Uzziah were unlikely to be leprosy as we know it today. Others however preferred a more symbolic interpretation, and instead considered the disease described in Leviticus as a sign of God’s favour.116 The ritual cleansing was seen by Cyril of Alexandria and others as having some similar symbols as those of the Christian Eucharist; the leprosy symbolised sin and the blood of the slaughtered bird, symbolising the blood of Christ, dying for that sin.117

RETURN TO RELIGIOUS PURITY

The seven day period of isolation that a sufferer would be required to endure was also a process of purification. If the individual no longer showed signs of leprosy after the quarantine period, they were considered to be returned to religious purity and could rejoin the community, following the ritual outlined in Leviticus. If their symptoms persisted, they were considered to still be impure and would be required to continue their isolation until such a time that the symptoms disappeared. Every seven days, the individual would be examined by a priest who would determine if the individual was clear of the disease.

While Miriam recovered from her condition in seven days in the book of Numbers, King Uzziah was not as fortunate and according to chapter 26 in 2 Chronicles, continued to suffer from leprosy from the time of his transgression in the Temple, to the day he died (Figure 2.4).\textsuperscript{118} King Uzziah suffered in forced isolation until his death for continuing to allow sacrifice and offerings in the high places.\textsuperscript{119} The implication here is that Miriam saw the fault in her transgression and was forgiven by God for her sin, whereas King Uzziah did not attempt penitence for his sins and was not forgiven.

As cases referred to as leprosy in the Bible are likely to be less severe conditions than that of true leprosy, it is likely that many individuals would recover from their symptoms after a short period of time and were unlikely to spend protracted periods of time in isolation. Once the physical symptoms disappeared, they were required to make an offering before being able to rejoin society and live once again with their family. Whilst segregated, sufferers were unlikely to be completely alone, and were likely held in quarantine with other individuals suffering from what

\textsuperscript{118} 2 Chronicles 26:21.
\textsuperscript{119} 2 Kings 15:5.
priests identified as leprosy. However, they would have been prohibited from seeing family members or friends and would have been required to live outside of the village and community during their confinement.

![Image: 'A Jew Rabbi’ or ‘King Uzziah Afflicted with Leprosy’. An etching, circa 1820-1829, of the 1639 painting by Rembrandt is often considered to be a depiction of King Uzziah rather than an anonymous rabbi. The hands and slight indications from the facial features could indicate that Rembrandt depicted the presence of true leprosy, suggesting that the painting was based on the belief that the King suffered from the disease and not one of the conditions the term leprosy referred to in the Old Testament. © Trustees of the British Museum.]

**EMERGENCE OF INSTITUTIONS PROVIDING CARE**

As the idea of Christian charity and obligation to those suffering from leprosy became commonplace, institutions providing care for sufferers began to emerge. Formal institutions emerged by the fourth century AD, although care was offered before then on a less formal

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120 Grzybowski and Nita (2016) p. 4.
basis. Initially, sufferers would be treated in institutions set up to provide general charitable care for those in need. Monasteries or hospices would provide for the sick, as well as the poor, without distinction and even the smallest institutions would have had some sort of basic accommodation which would have been made available to guests. The charitable acts carried out by Jesus during his ministry set an example for Christians who wished to follow the example by providing alms and charity. The poor and needy became particularly important and philanthropic endeavours were aimed at providing for those less fortunate than oneself. The stories of Jesus’ kindness towards leprosy sufferers and the gift of restored health that he bestowed upon them, led to them receiving special, almost symbolic, attention. While true leprosy would have been present in the Holy Land during the lifetime of Jesus, it is clear that the Synoptic Gospels refer to the biblical leprosy mentioned in the Old Testament associated with a variety of skin diseases that are not related to true leprosy. In the case of the story of the Rich Man and Lazarus, the description of Lazarus is not sufficient to make a diagnosis. But nevertheless, leprosy sufferers became an object of charity and care, even though some of the stigmas continued to persist. The ideal of an isolated location for hospices providing care prevailed and there is no evidence to suggest that institutions were built or adapted within populated areas, but rather were built in isolated areas in the desert and mountain regions. Laws prevented those diagnosed with leprosy from mixing with other people within the community and they were forbidden from entering areas such as public baths. Indeed, there is little evidence in the archaeological record of remains of leprosy sufferers being identified in populated areas in large numbers; however, there are multiple examples of remains identified as belonging to individuals suffering from leprosy in

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121 Zias (1989) p. 29.
isolated monasteries and hospitals. Some of the remains have been identified as belonging to individuals who were not native to the area, suggesting that sufferers travelled from places, such as Egypt, to seek dedicated care from these religious institutions.\textsuperscript{124}

**Geographic Locations of Identified Remains**

In the first century AD, a number of synagogues providing a provision of rooms for overnight guests emerged. Some scholars have suggested that these types of accommodation may have been used to tend to the sick, but others have disagreed, suggesting instead that the proximity of the synagogues with adjacent accommodation is more commonly found near pilgrimage sites. It is likely that the rooms were offered on a charitable basis for those in need of shelter, but there is little evidence to suggest that any sort of medical care was being offered as well.\textsuperscript{125}

From the late second or early third century AD, there is an example of leprosy identified in the remains of a child around four or five years of age at the time of death. The remains were in very good condition, considering they came from such a young individual, and were dated using associated grave goods including coins and pottery.\textsuperscript{126} The remains were discovered in Tomb 162 at the Martellona necropolis near Rome, Italy. In this case, the signs of leprosy are visibly evident in the skull, with the loss of the nasal spine, damage and remodelling of the nasal aperture, loss of two incisors, and signs of pitting on the hard palate.\textsuperscript{127}

The remains were incomplete, meaning examining areas of the skeleton where other signs of leprosy may have been present, was not possible. The clear indications in the skull were sufficient to visually identify the disease. Furthermore, X-ray analysis was carried out in order to

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\textsuperscript{124} Zias (1986) p. 185.  \\
\textsuperscript{125} Peregrine Horden ‘The Earliest Hospitals in Byzantium, Western Europe, and Islam’ *The Journal of Interdisciplinary History* Vol. 35.3 (2005a) p. 374.  \\
\end{flushright}
confirm the visual results.\textsuperscript{128} The remains of this child are particularly significant in the archaeological record because few examples of childhood leprosy with visual bone damage exist. For the damage to be as obvious as it is, the child must have contracted the disease at a very young age, potentially as a neonate, through the usual means of transmission or breastfeeding from an infected mother, or congenitally \textit{in utero}. The child must have suffered from a particularly aggressive form of the disease, given that advanced stages are present in a child no more than five. Usually such advanced stages would only be expected to be seen in adults.

An example from a family tomb in Bet Guvrin, Israel, dating from some time between 300 and 600 AD, has been identified as having been a leprosy sufferer after samples of the remains were tested for the presence of the pathogen DNA.\textsuperscript{129} Prior to DNA confirmation, there had been some speculation as to the identity of the condition found in the skeleton, with Madura foot and leprosy both in contention.\textsuperscript{130} PCR primers were successfully used to aid in identifying the pathogen DNA. The other remains in the tomb did not show signs of leprosy, and it is likely the sufferer was buried with other family members, rather than a segregated area intended for leprosy sufferers.\textsuperscript{131}

Two examples of leprosy have been identified in fourth century AD human remains, including a mummy and a skull from a second individual, both from El Biga, Nubia.\textsuperscript{132} The mummified remains showed signs of leprosy in the face, hands, and feet, X-ray examination was carried out to confirm the diagnosis identified in the soft tissue present.\textsuperscript{133} Skeletal remains from Poundbury,
England have also been identified as having signs of leprosy in the feet and lower legs from the early fourth century AD.\textsuperscript{134} This is probably the earliest example of leprosy that has been identified in Britain, and it is important to note that the identification was made through microscopic and radiological methods rather than obvious visual signs.\textsuperscript{135}

In the fifth century AD, Empress Eudocia became the patron of a number of institutions providing hospice care for sufferers of what was, at the time, referred to as the ‘holy disease’, what we know today to be leprosy (Figure 2.5). She took a particular interest in these individuals and there are a number of institutions in the desert region to the west of the Dead Sea that have been attributed or connected to her.\textsuperscript{136} While remains have been identified at some of these locations, including the Monastery of Saint John the Baptist, the Monastery of Gerasimus, and the Monastery of Theodosius, in some cases, the locations of some sites have yet to be positively located, such as the Monastery of Phordisia.

Sixth century remains with signs of leprosy in the lower legs have been identified in Beckford, England.\textsuperscript{137} Remains with cranial and post cranial lesions have also been identified in Burwell, England. Seventh century remains from Eccles, England demonstrate typical signs of leprosy in the skull; destruction of the nasal spine, widening of the nasal aperture, \textit{cribia orbitalia}, and damage to the hard palate are all present.\textsuperscript{138} Unfortunately the remainder of the skeleton was absent, but leprosy can clearly and categorically be identified from the skull alone. A seventh century example identified with both cranial and post cranial damage, pointing to leprosy has

\begin{itemize}
\item \textsuperscript{134} Manchester (1984) p. 169.
\item \textsuperscript{135} Keith Manchester ‘A Leprous Skeleton of the 7th Century from Eccles, Kent, and the Present Evidence for Leprosy in Early Britain’ \textit{Journal of Archaeological Science} Vol. 8 (1981) p. 207.
\item \textsuperscript{136} Zias (1986) p. 182.
\item \textsuperscript{137} Manchester (1984) p. 169.
\item \textsuperscript{138} Manchester (1981) p. 206-207.
\end{itemize}
been identified in a male skeleton on the Isles of Scilly; the infection presumably having spread from mainland England.\textsuperscript{139}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{gold_coin}
\caption{Gold coin depicting Empress Eudocia. Obverse portrays an image of the Empress; reverse depicts a cross surrounded by a wreath. Eudocia converted to Christianity and was known for her syncretism of traditional Greek paganism and Christianity. © Trustees of the British Museum.}
\end{figure}

An example from a sixth to eighth century cemetery in Campochiaro, Italy is of a male skeleton with evidence of trauma inflicted in battle. The remains of the individual also exhibited signs of leprosy, particularly in the nasal region, hands, and feet.\textsuperscript{140} The individual had likely lived with leprosy for many years and had advanced stages of multibacillary leprosy at time of death. The symptoms would have likely made fighting physically challenging, and it is probable that the

\textsuperscript{139} Manchester (1984) p. 169.
\textsuperscript{140} Mauro Rubini and Paolo Zaio ‘Warriors from the East: Skeletal Evidence of Warfare from a Lombard-Avar Cemetery in Central Italy (Compochiaro, Molise, 6\textsuperscript{th}-8\textsuperscript{th} Century AD)’ \textit{Journal of Archaeological Science} Vol. 56 (2012) p. 1556.
injuries sustained by the individual in battle were caused shortly before death; it is possible that if the individual was in good health the injuries would not have been fatal.\textsuperscript{141}

Another seventh century example is from a grave site at the Monastery of John the Baptist on the River Jordan. Carbon 14 dating from wood found in the grave produced a result of 600AD ±50 years. This fits with the 614 AD date of a Persian massacre of Christians in the grounds of the monastery itself, so there may be a connection between that event and the death of the individual.\textsuperscript{142} The remains were confirmed to be those of a leprosy sufferer when DNA of the \emph{M. leprae} pathogen was found in multiple samples taken from a metatarsal bone from among the remains.\textsuperscript{143}

\textbf{PROXIMITY TO, AND INCLUSION IN, RELIGIOUS INSTITUTIONS}

It has been suggested that a number of individuals confirmed as having leprosy, including one with a positive identification of the pathogen DNA, have been found at the cemetery at the Monastery of John the Baptist near the River Jordan, as well as other nearby monasteries such as the one at Mar Theodosius constructed in 476AD, for use as a hospital. A tradition associating the nearby River Jordan site with the biblical narrative of a Syrian army commander named Naaman, who suffered from leprosy, being cured after bathing in the Jordan, has suggested that the site may have attracted sufferers wanting to bathe in the River Jordan, in the hope that they would be cured (Figure 2.6).\textsuperscript{144} There is evidence to suggest that the Monastery of Theodosius was providing dedicated care for sufferers of leprosy, although it did provide care for patients

\textsuperscript{141} Rubini and Zaio (2012) p. 1558.
\textsuperscript{142} Zias (1991) p. 150.
\textsuperscript{144} Zias (1991) p. 151.
suffering from other conditions too, based on Theodosius’ belief that no one in need should be turned away.¹⁴⁵

Figure 2.6: Bronze plaque of Naaman being cured of leprosy in the River Jordan. The biblical narrative of Naaman, resulted in the geographic locations of a number of desert monasteries near the River Jordan. Copper plaque circa 1150-1160 intended for use as an altar piece. © Trustees of the British Museum.

Further traditions associating the River site with the location where Jesus was baptised, also added to the importance of the site and perhaps attracted individuals hoping the sacredness of the location could help cure them of the disease.¹⁴⁶ From the remains at the monasteries, a variety of other conditions have been identified including trauma, suggesting that the monasteries were

acting as hospices for those who could not find medical care elsewhere, or were in need of basic charitable care such as food, and shelter. Therefore, while leprosy sufferers have been identified at these sites, the monastery hospitals were not used solely for the care of leprosy sufferers and provided more general care for the needy.\textsuperscript{147}

However, it has been speculated that the Monastery of Phordisia was in fact located at Herodium, and was erected there as a purpose built leprosarium.\textsuperscript{148} Evidence to support this claim suggests that the isolated location of Herodium would be an ideal candidate for a site dedicated to leprosy sufferers, due to its location away from populated areas. Additionally, there is evidence that as the numbers of sufferers throughout the Mediterranean grew, they sort out communities designed for their care.

The building of a dedicated leprosarium at Herodium would have eased the pressure on existing hospitals, as the numbers of immigrant sufferers seeking care increased.\textsuperscript{149} It also accounts for the four churches built at Herodium, which seems an excessive number given the small population of the site during the Byzantine Period. If we consider that the hospital built for 400 individuals by the Empress Eudocia is at Herodium, this could account for a number of archaeological anomalies at the site.\textsuperscript{150} This could be an example of dedicated care provided by a religious institution which provided ample places of worship for those who were sick.

However, to date, no remains have been identified at the site with any signs of leprosy. This could either disprove the theory that a leprosium was built at Herodium, or could simply be that the location of the cemetery used for the remains of those who died there has yet to be located. In any case, it is difficult to categorise the site as a location providing care for leprosy sufferers.

\textsuperscript{147} Zias (1991) p. 151.
\textsuperscript{148} Zias (1986) p. 183.
\textsuperscript{149} Zias (1986) p. 184.
\textsuperscript{150} Zias (1986) p. 185.
without any skeletal remains with signs of leprosy identified there. Until such a time as this theory can be supported with evidence of human remains with signs of leprosy, one must be cautious in classifying the site as a leprosarium.

**Religious Charity and Provision of Care**

The provision of charity to leprosy sufferers by Christians emerged as a reaction to the acts of Jesus towards leprosy sufferers in the Bible. Monasteries were built or adapted with the purpose of providing care for the sick and needy. While some were designed to provide care for anyone in need, institutions built solely for those suffering from leprosy began to emerge. As we have seen, within the Judean desert alone there is evidence that at least six monasteries were providing care for leprosy sufferers. Skeletal remains displaying signs of leprosy have been found at four isolated monasteries with provisions for providing medical care; Gerasimus, John the Baptist, Martyrius, and Theodosius.151 In relatively close proximity to one another, it is possible that they acted together to provide care for those seeking it from nearby populated areas, as well as from further afield.

At the sites of larger monasteries, such as the monastery of Martyrius, evidence of separate hospice living quarters is apparent.152 These hospices include rooms that were likely used as bedrooms and dormitories, as well as a communal room likely used as a refectory. Occasionally, separate kitchen facilities are found independent from the kitchen provision in the main monastery compound.153 It is likely that in these larger locations, the separation of monastery and hospice was more likely in place in order to allow the regular monastic life to continue without

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152 Hirschfeld (1992) p. 43.
being disturbed by the day to day operation of the hospice, while still dedicating monks and nuns to provide care.\footnote{154}{Hirschfeld (1992) p. 197-198.}

The Christian ideal that everyone was equal in the eyes of God encouraged a change, and while this did not eradicate the strict class system in place, it eased barriers to the point where, in theory, everyone was considered deserving of basic care, and the poor could turn to the Church for charity in times of need. Being a Christian was not a prerequisite for receiving care and historical evidence suggests that care was given to anyone in need of it, irrespective of faith. However, care was sometimes reserved for those considered as being in genuine need in a biblical sense; therefore, widows, orphans, and the visibly sick were more likely to have been provided for by the Church, rather than a large family simply trying to make ends meet.\footnote{155}{Horden (2005a) p. 386.}

Families in need of poor relief would more than likely be divided up, determined by sex, and this likely acted as an incentive against seeking shelter from the Church, as the sacrifice was to break up the family.\footnote{156}{Hirschfeld (1992) p. 198.} This could impact a family if a member became infected with leprosy, the prospect of splitting up may have been a deciding factor in seeking care. Further implications to consider would be if the sole earner in a family became ill, the remaining family members may resort to criminality or begging in order to remain together.

A social revolution of sorts occurred, which had an impact on hospitals and places providing alms for the poor.\footnote{157}{Horden (2005a) p. 363.} The irony being, that while wealthy individuals decided to become patrons of hospitals and similar institutions, they were, in turn, gaining their own social notoriety and status for their actions. As well as helping those in need, in many cases, these acts were perhaps not as selfless as one might at first assume. For sufferers of leprosy, the more obvious their
symptoms were, the more likely they were to receive care. However, this unfortunately went hand in hand with an increased social stigma from having the disease.

Early places designed for tending to the sick would have been small, perhaps attached to a religious institution as an additional service provided by the monastery or church. Alternatively houses for the sick hosting a small number of people became common and quickly spread throughout the region, and were more likely to be managed by a small group of monks and nuns or paid for by a wealthy individual who covered running costs and paid for care providers, as opposed to being entirely a religiously funded and managed institution.

These hospitals and alms houses also served a purpose of keeping the poor and needy in one place, and may have limited the freedom that the poor previously had, especially if these institutions were in isolated locations.\footnote{Horden (2005a) p. 365.} There is little to show of these small organisations in archaeological terms, as they would be fairly indistinguishable from other buildings such as houses. However, historical records exist, especially those written by or about the wealthy patrons funding these enterprises.

Formal institutions organised and managed by the Church did not immediately increase in number following the conversion of the Roman Empire to Christianity, despite the means to do so being available.\footnote{Horden (2005a) p. 367.} The expansion occurred a little later, in the late fourth and into the fifth centuries, by which time locations of such institutions could be found throughout the empire with examples in Italy and North Africa.\footnote{Horden (2005a) p. 368.} By the sixth century, institutions had been established in Gaul, Spain, and Persia.
WHO WAS PROVIDING MEDICAL CARE?

As early as the second century AD, Aretaeus of Cappadocia wrote a detailed account of clinical cases of leprosy found in patients he examined.\(^{161}\) By the seventh century AD, the Greek physician Paul of Aegina identified the two different types of leprosy and distinguished between them in his diagnoses.\(^{162}\) This suggests that respected physicians from the Byzantine Period were familiar with the disease, studied it and could diagnose it in patients. However, there is little documented evidence to suggest that they provided care for sufferers of leprosy on a long term basis. It is likely that the role of regular nursing of patients was passed on to others.

The level of medicalisation present in Byzantine hospitals has been a point of debate for academics, with some placing the emergence of medicalised institutions much earlier than others.\(^{163}\) Much of this rests on the definition of what one considers to be a hospital, and what qualifies an individual to provide medical care. Certainly, considering these early institutions as similar to modern hospitals is troublesome because the services provided by, and the functions of, such institutions is different and what once provided care for the sick, poor, and needy in one institution, or fluidly amongst several institutions, is today dealt with by a variety of social services in designated ways. Particularly in the earlier periods considered in this chapter, textual evidence is scarce and it is difficult to ascertain exactly how institutions providing care were organised.\(^{164}\)

Given the rise of monasteries that provided accessible care to the sick and needy, it is safe to presume that many people were receiving care from monks and nuns or others associated with these religious institutions. There seems to have been little difference between the organisational

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\(^{164}\) Horden (2005b) p. 218.
structure of monastics communities operated by monks or nuns. The wealthy could likely afford to pay for private personal care, in the case of wealthy leprosy sufferers, there is little historical or archaeological evidence, but one theory is that they were cared for in an isolated part of their home, or perhaps rehoused at a more isolated location and provided with personal care there. As many wealthy Christians offered their patronage to hospitals and in some cases, founded them, it is possible that friends or relatives of such individuals would be cared for in these institutions; perhaps with some level of special treatment.

The poor, if not infirm due to medical conditions, would have been expected to contribute and work in the institution that was providing them with shelter and food, but would not be expected to pay for services they could not afford, and would often be given provisions to take with them if they decided to leave and move on. This work could involve tending to the sick, or some other role such as working in the monastery gardens, grave digging, preparing food, or manufacturing items such as wine, baskets, and olive oil (Figure 3.1).

These items could be sold to raise the money needed to continue to provide services offered by the institution, if charitable donations were insufficient. Monks and nuns were also assigned the roles of providing nursing care, and other supporting positions required in order to adequately operate each hospice. Additionally, individuals were brought in from outside of the monastic community and employed to provide medical care. These individuals would have been

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166 Horden (2005a) p. 362.
career carers, perhaps with certain special skills such as apothecaries.\textsuperscript{171} While religious institutions gave high regard to the value of prayer in the treatment of the sick, this did not mean the value of what we would consider scientific approaches were ignored, there is evidence to suggest that monastic communities actively sought the advice and treatments of secular individuals.\textsuperscript{172}

Even those who were considered physicians of the day held no formal qualifications and much of their work was theoretical. The famous Greek physicians, such as Galen and others were unlikely to have spent their days tending to the sick. They may have visited institutions on occasions, but any remedies or treatments they provided were likely to be just as effective as any regular nursing care provided in the hospital. They may have been able to identify a disease such as leprosy, but efforts to treat it were probably unsuccessful and at times, may have made matters worse. The best a patient could hope for was to receive shelter, food, and palliative care that would reduce their suffering, and help with basic tasks they were unable to perform for themselves. Luckily, some institutions considered leprosy sufferers as being special cases deserving of attention and actively encouraged them to join the monastic community where they would have access to the provision of care they needed in order to ease their suffering, and have adjustments made to the tasks they were required to carry out depending on their special medical needs; this would have been particularly important to individuals who had developed physical disabilities.\textsuperscript{173}

\textsuperscript{171} Andrew Crislip ‘Monastic Health Care and the Late Antique Hospital’ \textit{Holistic Healing in Byzantium} ed. John T. Chirban (Brookline: Holy Cross Orthodox Press 2010) p. 95.
\textsuperscript{172} Crislip (2010) p. 98.
EVIDENCE OF MEASURES TAKEN TO PREVENT AND TREAT LEPROSY

The emergence of hospitals or places where care was provided for leprosy sufferers would have eased their suffering through the provision of social care, even though curing the disease was not possible. For the poor who were the most at risk of contracting the disease, the provision of shelter, food, and even a minimum level of nursing care would have helped a great deal. Especially in the advanced stages, when mobility would have been an issue and completing simple every-day tasks may have become impossible without aid. In addition, food available within monastic communities far surpassed the variety and standard of food available to the poor on the street. The care provided by these institutions would have, no doubt, extended the life expectancy of the poorest individuals in society who could not afford to provide for their own care without the charity of the Church and would have otherwise resorted to begging on the street and would have most likely died sooner without basic food, care, and shelter.

Galen discusses a number of treatments that he recommended for those suffering from leprosy. Some treatments are related to his theories regarding the cause of infection of the disease. For example, he suggests a change in diet to include vegetables, fish, and fowl as a variant to the usual staples he blamed as a contributing cause of the disease of gruel, donkey meat, and lentils common in Alexandria. While an improvement in diet certainly would not have a negative impact on the patient, the benefit from an improved diet would be negligible; it could help boost the immune system but would not prevent the disease from developing further.

However, his viper meat recipe is a more imaginative treatment. It is unknown why Galen suggests this as a cure, but it has been suggested that Galen drew parallels between the way a snake sheds his skin, with the hope that consuming the viper meat mixture would cause the skin

175 Horden (2005a) p. 385.
lesions and sores to fall off.\textsuperscript{177} The recipe involved cutting off the head and tail of the snake, gutting it, and boiling the meat with water, olive oil, leeks, and dill, or alternatively, simply with salt and dill.

The recommendation was to eat the mixture but using it as a topical treatment applied directly to the skin was also suggested. Other topical treatments proposed by Galen include a berry juice salve, a calcite, and a zinc oxide ointment.\textsuperscript{178} The latter is something that is still used for medicinal purposes today. While it may have been effective as a barrier measure, potentially limiting transmission, the loss of sensation that accompanied skin lesions would mean that it was unlikely to provide any sense of relief to the patient, and would certainly not have reversed the symptoms.

A second century AD Egyptian manuscript provides another example of a magical cure. The document suggests that a leprosy sufferer ought to carry a piece of paper with a passage from Homer’s \textit{Iliad} written on it and tie the papyrus scroll with strands of hair from a mule.\textsuperscript{179} Magical prayers or verses were commonly carried in ancient Egypt as a talisman by individuals and the idea of doing this as a cure for leprosy is not out of line with the practice being used more widely in Egypt at the time for other reasons. It is obvious, however, that it would not have been an effective treatment, and has no scientific basis for acting as a cure other than potentially providing a perceived minor level of comfort to an individual via a placebo effect.

The fifth century Bishop of Edessa, Rabbula, established two hospitals in the area for individuals suffering from a number of diseases. The division of the hospitals segregated women into one, and men into the other. Of particular note in his work, Rabbula discusses the cleanliness of the

\begin{footnotesize}
\textsuperscript{177} Miller (2014) p. 13.
\textsuperscript{178} Miller (2014) p. 13.
\textsuperscript{179} Miller (2014) p. 13.
\end{footnotesize}
hospitals and that clean bedding and clothing was provided for patients, suggesting that some knowledge of the importance of cleanliness was common or available at the time.\textsuperscript{180}

**SUMMARY**

There are many references to leprosy in the Bible, however, few, if any, of these references refer to the disease we know today as leprosy. Certainly in the Old Testament, references to leprosy describe an array of different conditions and predate the existence of the disease in the region based on archaeological and historical findings. These references and a misunderstanding of them have, however, formed the way past populations viewed those who suffered from leprosy and other similar conditions. Individuals were considered religiously unclean and often forced into isolation and segregated from the rest of the community.

New Testament references of Jesus treating leprosy sufferers kindly, and miraculously healing them, helped form a more charitable attitude toward sufferers of leprosy and other similar diseases; this had a direct effect on the growth in the number of institutions providing care. As cases of leprosy became known in the Middle East and the Greek world, a number of figures identified the symptoms of true leprosy and suggested a number of treatments and cures; most of which would have been ineffective, or offered little more than a placebo effect at best.

An incorrect understanding of the ease of contraction, associations with sexual immorality, and religious impurity, resulted in leprosy sufferers seeking sanctuary among isolated rural communities, often seeking the care and charity offered by religious institutions in the form of monasteries and hospices. Human remains showing signs of leprosy from this early period, are rarely found in urban areas, and are more commonly found in, and around, monastic

\textsuperscript{180} Horden (2005a) p. 368.
communities. Individuals would be cared for alongside others in need, including the poor; isolation units within these institutions did not emerge until later.

Provision of care was often funded by charitable donations to the Church, or by individuals founding small hospices and patronising them in order to cover operating costs. Care would be provided by other individuals at the institution such as monks, other patients, or the poor seeking shelter. Medical professionals were non-existent, and although some notable physicians of the time such as Galen wrote extensively on the disease, they held no formal qualifications, and while able to identify the disease and offer suggested cures, were unlikely to provide day to day care. Nursing was left to those with basic or non-existent medical knowledge. However, as we have seen, and will see if the following chapter, the organisation of care, and structure of institutions, developed and improved over time, with dedicated units and nursing staff becoming the norm.
CHAPTER THREE:
DEVELOPMENT AND GROWTH OF LEPROSARIA INTO THE MEDIEVAL PERIOD

As leprosy continued to spread, and larger numbers of individuals became susceptible to the disease, evidence in the archaeological record becomes more frequent. Historical records discussing the disease also increase in number as time progresses, and art depicting leprosy sufferers became a not uncommon theme. Religious scenes in particular became popular, many of which depicted Jesus curing sufferers, or showed members of monastic or clerical communities providing care; secular images and portraits of sufferers can also be found. Despite the growing awareness of the disease throughout Europe, social stigmas and prejudices continued, with many of the negative biblical connotations associated with leprosy being retained. In some extreme cases, leprosy sufferers were punished due to the belief that they must have sinned in order to contract the disease, and segregation from the community continued. This occurred for two main reasons; the stigma and need to segregate those considered impure from the rest of the community, and for medical treatment in isolated wards aimed at making treatment of multiple sufferers easier, with some awareness of effective containment and preventative methods. During this period, many religious institutions were founded with the express reason of caring for leprosy sufferers, providing them with dedicated provision of care tailored to their needs. Alongside these dedicated institutions, we find cemeteries dominated by remains of leprosy sufferers, demonstrating that many sufferers would be buried within the institution complex they
had received treatment in following their death. Funding continued to come from religious sources, as well as from wealthy patrons, who provided funds to support the running of these institutions. An important movement, especially in the Holy Land and Western Europe, was the number of institutions founded by orders similar to the Knights Templar to provide for leprosy sufferers.

As institutions developed and became more formally organised, we see a rise in the number of monastic community members with increased levels of medical training, and more formal treatment provided regularly by physicians and Medieval doctors. While many ineffective treatments continued to be used and developed, better understanding of disease control and a basic knowledge of how to prevent the spread of disease became common; we see evidence of effective attempts at curbing the disease. In the later Middle Ages, cases of tuberculosis increased, and while the correlation may have not been fully understood at the time, today we know that this probably had a direct impact on the number of new leprosy cases, resulting in a significant drop in prevalence of leprosy. The drop in the number of sufferers resulted in the closure of many leprosaria throughout Europe, or alternatively, saw many leprosaria opening their doors to sufferers of other conditions.

THE SPREAD OF LEPROSY

Numbers of leprosy sufferers increased toward the middle of the Medieval Period. The disease that had originally entered the Middle East and Europe with the return of Alexander the Great’s troops, continued to spread throughout Europe during the expansion of the Roman Empire. In the following years, it became particularly dominant in Britain, Gaul, Hungary, and Scandinavia.\(^{181}\) However, prior to the Norman Conquest of Britain, little exists in historical records regarding

\(^{181}\) Sheldon Watts *Epidemics and History: Disease, Power, and Imperialism* (New Haven: Yale University Press 1997) p. 44.
leprosy. The only explicit evidence we have of leprosy being present in Britain before 1066, is found in the archaeological record.\(^{182}\) There is evidence of an increase in cases of leprosy in Britain following the Conquest, but notably, during the same period, Britain became more urbanised, populations became more densely packed, and the shift toward poorer living conditions, with many people living in close quarters, is likely to have contributed to the increased number of cases in Britain at that time.\(^{183}\)

In Britain, the sudden increase in the number of leprosaria occurring after the Norman Conquest has been attributed to a number of things; a simple increase in cases, a general growth in disease in general, and a shift in society, with the wealthy in particular, becoming more charitable and concerned for the sick and needy.\(^{184}\) The Crusades were likely to be another cause of increased cases of leprosy during the Middle Ages, the increase in travel to and from the Holy Land undoubtedly had an impact on the spread of the disease.\(^{185}\) This would have impacted countries such as Britain, Italy, France, Germany, and elsewhere in Europe where a large number of individuals travelled from, in order fight in the Crusades on behalf of the Roman Catholic Church.

**Geographic Considerations**

Prior to the Norman Conquest, as few as 20 examples have been positively identified. This could be due to lack of textual evidence, which is scarce from the pre Conquest period, but this also supports the theory that while leprosy was present in Britain before the Norman Conquest, it


\(^{184}\) Manchester and Roberts (1989) p. 269.

became more common in the years after 1066.\textsuperscript{186} Leprosaria were usually located in rural areas, or just outside the limits of major towns and cities. Often, the leprosarium was not completely isolated, and patients may have had some involvement with the local community, even if only on a very basic level.\textsuperscript{187} Evidence of one such isolation unit on the outskirts of York, was documented by Archbishop Eanbald II of York in 796.\textsuperscript{188} While its existence is evidence that leprosy was present to such a degree that a house for sufferers was required, from what is known about the size of these institutions, it may have been so small that it housed less than a dozen patients. Other isolated infirmaries existed in England prior to the Conquest, but evidence is not sufficient enough to confirm that the reason for isolation was due to patients with leprosy. The decision to build isolation units could have been a result of a number of unrelated reforms made at the time.\textsuperscript{189} Around 300 leprosaria have been confirmed in England alone in the post Conquest period, although the true number may in fact be higher.\textsuperscript{190} A Medieval cemetery in Norwich, England yielded a high percentage of remains with signs of leprosy, indicating that at that time, the instances of leprosy in the area were much higher than would normally be expected. With such a large number of remains identified with leprosy found in the same location, one would expect to find evidence of a leprosarium close by, but to date none has been located.\textsuperscript{191} Institutions were located outside city limits or near coastal regions. The leprosarium on the Isle of Wight, off the south coast of England, is a good example of this. It would be easy to reach from a number of mainland cities, and its location ensured segregation of patients once on the island (Figure 3.1).

\textsuperscript{187} Bruno Tabuteau ‘Historical Research Developments on Leprosy in France and Western Europe’ \textit{The Medieval Hospital and Medical Practice} ed. Barbara S. Bowers (Burlington: Ashgate 2007) p. 44.
\textsuperscript{188} Roffey (2012) p. 209.
\textsuperscript{189} Roffey (2012) p. 212.
\textsuperscript{190} Roffey (2012) p. 203.
\textsuperscript{191} Tabuteau (2007) p. 48.
By 1220, there were at least 45 leprosaria in and around Paris.\textsuperscript{192} This does not take into account the number of institutions that cannot be easily identified as being used for the sole purpose of treating leprosy sufferers. In reality, the number is likely to be much higher, not only in the area around Paris but elsewhere in Europe and the Middle East. Numerous leprosaria have also been confirmed in Northern France; most notably, sites at Aizier, Bayeux, and Rouen have been excavated.\textsuperscript{193} Individuals were likely to be treated in regular hospitals where care was offered to individuals suffering from a range of diseases. Some chapels previously associated with

\textsuperscript{192} Miller and Smith Savage (2006) p. 17.  
\textsuperscript{193} Roffey (2012) p. 203.
leprosaria have survived and are still in use at Mont-Saint-Aignan and Petit-Quivery in France; others have been repurposed and are now used as homes or barns.\textsuperscript{194}

**CONTINUED SOCIAL STIGMA**

As the Middle Ages progressed, views of leprosy sufferers polarised further. Many believed they could contract leprosy by association, and therefore felt there was no place in the community for sufferers, preferring them to be isolated, along with other sufferers, to form their own segregated communities.\textsuperscript{195} Some have gone as far as comparing the treatment of leprosy sufferers, and the attempts to identify sufferers within communities, to the witch hunts that occurred in the Middle Ages; suggesting that the unknown elements of infectious disease scared communities in a similar way as the suspected cases of witchcraft.\textsuperscript{196}

Furthermore, early witch trials often had underlying political motives to rid a community of a particular individual.\textsuperscript{197} Individuals suspected of witchcraft were often accused of being sexually promiscuous, as leprosy sufferers often were too.\textsuperscript{198} Similarly, identification of an individual as a leprosy sufferer, and the practice of expulsion from the community, may have also had underlying motives in some instances. Notably, in the twelfth century, the majority of individuals diagnosed with leprosy were among the poor and lower classes. Those with wealth and power were usually the ones responsible for making diagnoses and accusations; the same was often the case in witchcraft accusations.\textsuperscript{199} In both instances, individuals were often seen as being guilty of religious crimes, and not practicing traditional Christian values such as celibacy outside of marriage.

\textsuperscript{194} Roffey (2012) p. 213.
\textsuperscript{195} Herbert C. Covey ‘People with Leprosy (Hansen’s Disease) During the Middle Ages’ *The Social Science Journal* Vol. 38 (2001) p. 318.
A number of Medieval texts, contain narratives of individuals becoming infected with leprosy following sinful acts, promiscuity, or simple vanity. One twelfth century German story tells of a knight who was inflicted with leprosy by God because of his arrogance and pride. The knight was instructed that the only cure was the blood of a virgin who would willingly give her life for his. The story concludes when the knight falls in love with a virgin who loves him in return; God cures the knight when it is clear that his love for her outweighs the value he places on his own life. This, and similar stories, demonstrate one way in which the connection between leprosy and sin, originating in the Old Testament, continued to manifest well into the Middle Ages and beyond.

By some, leprosy sufferers were considered as opposite to a saint, as a man is to a woman, whereas others believed they suffered from some kind of holy disease, and ought to be lavished with Christian charity. Kissing a leprosy sufferer was seen as an act of redemption, and held other heavy connotations too; the kiss in the Middle Ages was often used as a sign of submission, for example a vassal kissing the hand of his master. Kissing someone with leprosy could be viewed as an extremely pious act.

Records exist of officials in England serving sufferers with separation writs forcing them out of their communities, and officials in France sprinkling dirt over the heads of sufferers in a form of ceremonial burial. These acts symbolised their exclusion from, and figurative death to, the rest of the community; demonstrating some of the extreme levels of social stigmatisation that some leprosy sufferers endured. The stigma associated with leprosy was so extreme in some

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societies in the Middle Ages, that many individuals sought to obtain documentation stating that they were not suffering from leprosy.205

**PUNISHMENTS**

In some areas of France, individuals were often denied property rights if they suffered from the disease, forcing many sufferers into poverty.206 In Scotland, attitudes varied depending on the community; sufferers could be hanged, some were banished, while others had no restrictions imposed on them at all.207 A common requirement forced on sufferers, was the wearing of specific clothing designed to cover any wounds that may be present. Common requirements included gloves and facial masks in order to cover as much of the body as possible. The colour, and specific details, such as embroidered crosses or other symbols, differed depending on the community. But the purpose was simple; to prevent the spread of the disease and act as a sign to others, indicating the condition of the individual.208

In the seventh century, King Rothari the Lombard ruled that sufferers of leprosy were required to leave urban areas and were forced to live in isolation. They were legally treated as if they had died, and any property they owned would pass on to their heirs. The only property rights they retained, were the rights to any income in the form of revenue from their estate. This would be managed by their heirs, and passed on to them, in order to provide them with some form of financial sustenance.209 In the eighth century, Charlemagne legislated similar laws, in particular, ensuring that leprosy sufferers ought to remain isolated from the rest of the community.210 A thirteenth century Welsh text, referring to an early tenth century law set by Prince Hywel Dda,
details how a man could abandon his wife if she was found to be leprous. However, this kind of rejection was common in cases of other diseases and in some instances of disability; it was not simply restricted to leprosy. Despite this and similar local laws being in place, these laws were in direct contradiction to Church practices, and abandonment of a sick or disabled spouse would be looked upon unfavourably by the religious establishment.

Often leprosy sufferers were blamed for a number of misfortunes that affected communities, from bad crop harvests, to poisoning water supplies. Both King Philip V and King Charles V of France ordered that leprosy sufferers ought to be burned alive as punishment for famines that plagued the country. Sufferers were used as scapegoats when blame was avoided elsewhere, when other explanations were not evident, or when the misfortune was the result of what we would term today as a natural disaster or act of God.

Some sufferers admitted to dedicated institutions were denied sexual relations with their spouses as one of the terms of admission. The spouses of patients were expected to either join the monastic community as a monk or nun, or elect to remain chaste for the remainder of their life. This in essence punished the healthy spouse for the misfortune of their husband or wife who had contracted the disease, as well as the patients themselves. In one example from 1380, a patient was expelled from the St Lazare hospital at Andelys for a year and a day for having sex with his wife.

However, while sufferers would undergo severe stigmatisation, punishment, and loss of rights in some geographic locations, their rights and status were protected in others. In Jerusalem in the

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twelfth century, their rights were protected, and many of the stigmas associated with the disease such as sinfulness and immoral activity, had been all but eradicated.\textsuperscript{215} The fact that Baldwin IV, a known leprosy sufferer, was the King of Jerusalem during this time, undoubtedly had a significant influence over the normalisation of attitudes towards the disease. The situation in Jerusalem can be considered the exception, rather than the rule, and the vocal condemnation of Baldwin by Pope Alexander III makes this evident.\textsuperscript{216}

In the thirteenth century in Saxon Germany, laws stated that leprosy sufferers could not inherit property, but they could retain any property they owned prior to becoming infected with the disease.\textsuperscript{217} Similarly, under thirteenth century English Common Law, sufferers could keep anything they owned prior to infection, but could not inherit after they became sick, they were also not allowed to enter into contracts of any kind. Commenting at the time, Henry of Bracton noted that leprosy sufferers experienced similar legal treatment as those who had been excommunicated from the Church.\textsuperscript{218}

Often, secular laws were in opposition to the views of the Church, and in many cases, the laws or rules imposed on a sufferer were dependant on a number of factors. Some restrictive laws were more heavily enforced by some rulers more than others, while in some communities, religious charity and assistance was more common than legal or social punishment. Sometimes, the treatment of a sufferer depended on their social standing and position in society; wealthy sufferers were more likely to experience legal freedom than poor sufferers. Some have argued that restrictive laws generally have a foundation in Germanic legal history, whereas Christian

\textsuperscript{216} Douglas (1991) p. 724.
rules and practices, tended to support those in need and rules regarding segregation where aimed at providing for the comfort of sufferers, rather than punishment.\textsuperscript{219}

**FORCED SEGREGATION WITHIN THE COMMUNITY**

Throughout history, leprosy sufferers have been ordered to live in segregation. Segregation could be for prescribed periods of time, or for the remainder of their life. Some were legally required to live in isolation, while others were allowed to remain within the community so long as they followed particular rules. Sometimes, the segregation was socially forced upon individuals, despite them retaining the same legal rights as healthy individuals. However, it must be noted that in many areas in Europe, vassalage was a major part of society meaning those at the lowest level of society had few legal rights, healthy or not. In other cases, the segregation units were simply a place where care could be provided for sufferers and although they were encouraged to stay, they were not imprisoned and were free to leave if they chose to.\textsuperscript{220}

Those allowed to remain within the community were often isolated in some way, for example, individuals could be required to receive permission in order to enter busy public places such as taverns, market places, and churches.\textsuperscript{221} In other instances, individuals were required to alert others in the community to their presence through the use of clappers, bells, or other such instruments (Figure 3.2). Many locations, especially churches, had bells installed so that sufferers could ring the bell in order to receive alms, charity, and shelter.

\textsuperscript{219} Miller and Smith Savage (2006) p. 25.
\textsuperscript{220} Tabuteau (2007) p. 44.
\textsuperscript{221} Covey (2001) p. 317.
Pope Alexander III, in 1179, ordered under the Third Lateran Council that separate chapels and cemeteries should be used for leprosy sufferers to limit their contact with non-sufferers.\textsuperscript{222} In London in 1276, the Court of Assizes, a precursor to the Crown Court, ruled that sufferers could not live within the limits of the city, for fear of sufferers spreading the disease to others; the assumption being that the disease was far more contagious that it actually was.\textsuperscript{223} Further laws were passed in the fourteenth century by King Edward I, banning leprosy sufferers from the city. His reasoning was two-fold; his fear concerning the spread of the disease, and to minimise the number of beggars on the streets.\textsuperscript{224}

\textsuperscript{222} Covey (2001) p. 318.
\textsuperscript{223} Covey (2001) p. 317.
\textsuperscript{224} Covey (2001) p. 318.
One interesting consideration is that if individuals were banished from their small rural communities, they may have felt inclined to move to larger towns and cities where they could lead a more anonymous life. There is some evidence to suggest that leprosy sufferers migrated to cities like London and Paris because of their position as social outcasts within their own communities.\footnote{Manchester and Roberts (1989) p. 267.} As mentioned earlier, King Edward I of England and King Philip IV and King Charles IV of France banned leprosy sufferers from their capital cities, citing the problem of large-scale begging as one reason for this. While one must consider the other motives and scapegoating that may have been in play, it is possible that many leprosy sufferers did move to the cities in hope of receiving alms and charity while remaining on the periphery of society. Despite the belief in the Middle Ages that segregation was a successful way of containing the disease, we know today, that in the case of leprosy, the segregation practised at the time would have had little effect on the rate of infection. The practice of public diagnosis in front of a panel of designated experts, could expose numerous individuals to the disease who may not otherwise come into contact with a sufferer. Additionally, these panels often used ineffective diagnostic techniques that could lead to misdiagnosis in individuals not suffering from leprosy, and result in infected individuals either evading diagnostic testing or not being positively diagnosed.\footnote{Manchester and Roberts (1989) p. 268.}

**IMPROVED ORGANISATION AND STRUCTURE OF LEPROSARIA**

As leprosaria increased in number, they became better organised and structured. Many institutions became structured in a similar way to monastic institutions, demonstrating the link between the foundation of the leprosarium and their monastic origins.\footnote{Miller and Smith Savage (2006) p. 18.} Patients were expected to contribute to the running of the leprosarium, as much as their condition would allow; many
were expected to dress in habits much like monks of the time.\textsuperscript{228} Prayer, fasting, and punishments for disobedience were also common in the institutions that closely resembled the monastic organisation.\textsuperscript{229} It was common practice for leprosaria to have a dedicated chapel attached for the sole use of patients and staff.\textsuperscript{230}

**Isolation Units**

From the founding of the leprosarium at Saint Gallen in 759AD, a number of other dedicated units emerged providing shelter and care for sufferers throughout the Middle East and Europe. Institutions provided medical and spiritual treatments, but often concentrated on palliative care and easing the suffering of individuals. Units were usually outside of urban areas, included wards, chapels, common areas, and gardens. Importantly, despite being isolated, walled institutions, relatives of patients were welcome to visit.\textsuperscript{231} Patients were also often free to leave if they so wished in many cases.

Some isolation units were small ‘leper houses’ with less than a dozen patients, others were larger hospitals providing care for many more patients. Some units were built within a larger hospital complex, or within a monastery, however many developed independently with their own chapel, grounds, and cemetery. As cases of leprosy declined, many of these institutions, especially those owned and operated by the Church, became alms-houses, or continued to operate as a hospital but accepted patients suffering from a range of diseases.\textsuperscript{232}

\textsuperscript{228} Miller and Smith Savage (2006) p. 18.
\textsuperscript{229} Miller and Smith Savage (2006) p. 18.
\textsuperscript{231} Covey (2001) p. 320.
SEGREGATED CEMETERIES

Alongside isolated institutions providing care for sufferers, cemeteries were created for burial of those who succumbed to the disease. The vast majority of examples of human remains from Britain during the Middle Ages come from segregated cemeteries associated with dedicated institutions for the treatment of leprosy sufferers. Only a few examples of leprosy are found in non-segregated cemeteries from this period. In other areas such as Scandinavia, the most easily identifiable examples of leprosy in human remains are usually found in segregated cemeteries. This suggests that the sufferers with the most severe symptoms were being treated in dedicated leprosaria, whereas those with less advanced stages of the disease were not yet segregated or committed to these institutions.

Within segregated cemeteries, we do have examples of individuals buried there without any obvious signs of leprosy. It may be that these individuals did suffer from leprosy, but the signs are not easily identified from the remains. It is, however, quite likely that those who dedicated their lives to nursing and caring for those in the institutions would choose to be buried there following their own death; this could especially be the case with respect to monks and nuns who spent the majority of their life dedicated to the organisation and day to day running of the leprosarium. Additionally, some leprosaria may have admitted individuals suffering from other illnesses, or may have been treating patients with misdiagnosed leprosy, and were suffering from some other condition affecting the skin.

One cemetery in Chichester, England contained a skeleton that not only displayed signs of leprosy, but also of metastatic carcinoma. This particular example showed very clear signs of

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bone lesions, and remodelling of the mandible which had resulted in tooth loss.\textsuperscript{237} The phalanges, metatarsals, and long bones also show textbook signs of leprosy, especially the left femur which showed signs of reactive remodelling.\textsuperscript{238} Additionally, there was also clear damage to the vertebrae, scapulae, and clavicles, which is not in line with what would be expected in the case of leprosy.

In the case of these bones, the damage is more in line with metastatic carcinoma, and while a specific diagnosis is not possible from the skeletal remains, it is likely that the individual suffered from a tumour in the bronchial area that metastasised and spread to the bones in the surrounding areas.\textsuperscript{239} This skeleton is a good example of human remains displaying signs of more than one condition. While examples of coexisting conditions in the archaeological record are not uncommon, this is the only example to date where leprosy and cancer are present in the same specimen.\textsuperscript{240}

Of the 38 burials located at a designated leprosy cemetery in Winchester, England, 85\% of remains found had visual signs of leprosy; this large percentage of individuals with signs of the disease strongly indicates that the site was designated for the burial of remains of leprosy sufferers.\textsuperscript{241} The cemetery dates to the eleventh and twelfth centuries, and was connected to the nearby St. Mary Magdalen leprosarium.\textsuperscript{242} The age of individuals with signs of leprosy ranged from foetal, to mature adults. Visual signs of leprosy found among the remains include damage to the nasal spine and pyriform aperture, damage and remodelling of the phalanges, metatarsals, and metacarpals, collapsing of foot arches, signs of flexion contraction, and stunted dental

\textsuperscript{237} Ortner, Manchester and Lee (1991) p. 92.
\textsuperscript{238} Ortner, Manchester and Lee (1991) p. 94.
\textsuperscript{239} Ortner, Manchester and Lee (1991) p. 97.
\textsuperscript{240} Ortner, Manchester and Lee (1991) p. 97.
\textsuperscript{242} Roffey and Tucker (2012) p. 171.
development in the foetal, neonatal, and infant remains.\textsuperscript{243} Within the sample, almost all visual signs of leprosy known in the archaeological record can be identified, the foetal remains are particularly rare as congenital contraction is extremely rare. The dental signs are particularly rare due to the small number of known remains identified as infants or younger.

The early thirteenth century hospital of St Margaret on the outskirts of High Wycombe, England, had an associated cemetery that was excavated in 1986. Amongst the remains of around fifty individuals were twelve showing clear signs of leprosy.\textsuperscript{244} Comprising around 25\% of the discovered remains, the prevalence of leprosy amongst the individuals is much higher than would be expected in the general population. All remains found were of adults, a number of which displayed lesions on the skull consistent with leprosy.\textsuperscript{245} All but three of the skeletons displayed signs of leprosy in the distal ends of the long bones, and several showed classic damage caused by leprosy in the pyriform aperture and nasal spine.\textsuperscript{246}

**Purpose Built Facilities**

Between 1100 and 1250, upwards of 300 hospitals designated for leprosy sufferers were founded in England alone.\textsuperscript{247} Many of these designated institutions were probably a direct result of Pope Alexander III’s 1179 decree ordering segregation and provision of services for the sole use of leprosy sufferers. The Pope took the biblical view, that leprosy was caused by sin, and prior to the Third Lantern Council, went as far as referring to King Baldwin IV of Jerusalem as being immoral, and claimed that his leprosy, as a sign of his sins, would led to the fall of Jerusalem; an

\textsuperscript{244} Farley and Manchester (1989) p. 82.
\textsuperscript{245} Farley and Manchester (1989) p. 86.
\textsuperscript{246} Farley and Manchester (1989) p. 86.
\textsuperscript{247} Horden (2005) p. 380.
event that did occur in 1187, two years after Baldwin’s death. However, Baldwin died without an heir, and the political situation in Jerusalem was conducive to instability following his death. The institutions in England were likely to have been small in size. Perhaps caring for a few dozen patients in each, rather than the larger numbers of patients found in the hospitals we are familiar with today. The vast number of institutions founded in such a short period, demonstrates just how prevalent leprosy was in England at the time, or, could perhaps suggest an overestimation of the number of expected new cases.

This increase of institutions also demonstrates the trend of patronage. This was a time when not only was it a social practice for the wealthy to aid the poor by providing alms-houses and hospitals, but is also a time when knights returning from the First Crusade in the Holy Land invested in hospitals and other such endeavours primarily for their brethren. The latter perhaps having more devout reasons than the former for doing so. It is possible that supply outweighed demand, and that the drastic fall in the number of institutions providing care for leprosy sufferers a couple centuries later, was not only due to the drop in newly infected individuals, but also because the number of institutions available had always been far more than was strictly necessary. Nevertheless, cases of leprosy declined in the thirteenth century and beyond, resulting in the closure of many of the institutions suddenly deemed no longer necessary.

The Order of St Lazarus, an order made up of non-combatant knights, many suffering from leprosy, established hospitals throughout the Greek East and Latin West during the age of the Crusades. The leprosaria the order founded were committed to both religious devotion, and

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medical treatment, for leprosy sufferers in equal measure.\textsuperscript{252} The first hospital was founded on the outskirts of Jerusalem in the late eleventh or early twelfth century, but other hospitals were founded in quick succession.\textsuperscript{253} The aim was to provide palliative care, under the assumption that leprosy was not curable, and the best course of action was to make patients comfortable and provide strong spiritual support at the same time.\textsuperscript{254} Like monastic orders, the knights were required to submit to a life of poverty, remain celibate, and pray multiple times each day. Those too sick to attend services in the chapel would be aided by the more able, and on occasion, chaplains would visit the very sick at their bedside in order to allow them to take part in Mass.\textsuperscript{255} Members of the order were required to remain within the walls of the leprosarium, although the master in charge of the hospital could leave in order to carry out required administrative duties, or conduct necessary business in the nearby town or city.\textsuperscript{256} In later times, historical records indicate that members of the Order took up arms and fought alongside the Templars and French forces in the thirteenth century in Egypt.\textsuperscript{257} The reason for this is not completely clear, but it is likely that the lack of able bodied men required those whose symptoms were the least severe, to take up arms and fight alongside other Christian forces.\textsuperscript{258}

\section*{Funding and Provision of Care from Religious and Secular Organisations}

Christian charity prevailed in many areas, in England during the twelfth century, King Henry I and Queen Matilda, the Bishop of Exeter, and King John funded provisions for sufferers, and provided them with special privileges, in order to allow them to receive food and alms within

\begin{itemize}
\item \textsuperscript{253} Hyacinthe (2007) p. 211.
\item \textsuperscript{254} Hyacinthe (2007) p. 212.
\item \textsuperscript{255} Hyacinthe (2007) p. 214.
\item \textsuperscript{256} Hyacinthe (2007) p. 215.
\item \textsuperscript{257} Hyacinthe (2007) p. 218.
\item \textsuperscript{258} Hyacinthe (2007) p. 219
\end{itemize}
their communities.\textsuperscript{259} Despite his strong negative feeling towards leprosy sufferers, Pope Alexander III made some concessions when outlining the segregation of sufferers, such as exempting food grown within the leprosarium compounds from tithe payments.\textsuperscript{260}

The practice of providing funding for leprosaria and alms for sufferers persisted; many wealthy individuals continued to found and patronise hospitals and hospices. Waleran, Count of Meulan, founded the Leper Hospital of St Gilles at Pont-Audermer in the early twelfth century. Bernard of Clairvaux encouraged the wealthy to follow suit, citing the merit of such charitable acts, and spent much of his own time visiting leprosaria and tending to the sick.\textsuperscript{261} While a number of secular funders did emerge, most institutions were founded on Christian values to provide Christian charity.

Most importantly, many leprosaria required patients with means to leave their estate, or at least a significant portion of it, to the institution following their death, essentially creating a self-funded provision to some extent. This was also used in some cases to act as a deterrent to those who perhaps viewed the institutions as a source of free food and shelter.\textsuperscript{262} The fact that individuals with means would choose to be admitted to these hospitals for treatment, demonstrates a shift to the formalised and medicalised care offered by leprosaria, rather than the institutions discussed in Chapter Two where care was provided for those without any other option. In some exceptional instances, spaces were only available to patients with the means to pay for their care.\textsuperscript{263}

Many of the British leprosaria that emerged during and following the Crusades, were organised in a similar way to the communal practices of Templar farms and institutions common at the time. In order to join such an institution, an individual was required to donate all of their wealth.

\textsuperscript{259} Covey (2001) p. 319.
\textsuperscript{260} Watts (1997) p. 53.
\textsuperscript{261} Watts (1997) p. 54.
\textsuperscript{262} Watts (1997) p. 57.
\textsuperscript{263} Watts (1997) p. 57.
to the leprosarium; this wealth would be used to fund operation and running costs.\textsuperscript{264} One twelfth century leprosarium in Montpellier, France, required new patients to hand over their property when they were admitted to the institution. After a period of ten days, they could decide to remain at the leprosarium, or leave and receive their property back with no further obligation to the institution. Beyond this initial period, they were still free to leave, but whether they received back any of their estate or not is unclear.\textsuperscript{265} Other institutions, such as the St John’s hospital at Heytesbury in Wiltshire, England, required patients to provide their own bedding and cooking equipment, and the leprosarium at Lamford in Cornwall, England, began to require entry fees upon admission in the thirteenth century.\textsuperscript{266}

In the East, a number of hospitals had been established by the Templar knights. While the majority of the hospitals dealt with patients needing care following traumatic wounds sustained in battle, there is evidence to demonstrate that other maladies were also treated in these institutions; malaria, in particular, is mentioned specifically.\textsuperscript{267} Based on documentary evidence, it is likely that knights suffering from leprosy would have been treated here too; although the location of the Jerusalem hospital, under the current site of the Aqsa Mosque, means excavation is extremely unlikely at any point in the foreseeable future. Conversely, the destruction of the Templar infirmary in Acre, means valuable archaeological information from that site, is unlikely to be found.\textsuperscript{268}

Care was only provided to individuals who were members of the order. The running of the hospital would be overseen by the master, who would be a knight in the order, and a chaplain;

\textsuperscript{264} Tabutaeu (2007) p. 46.
\textsuperscript{265} Miller and Smith Savage (2006) p. 23.
\textsuperscript{266} Roffey (2012) p. 218.
\textsuperscript{268} Mitchell (2007) p. 231.
medical practitioners from outside of the order were employed to treat patients.\footnote{269} Ultimately, however, any important medical decisions such as authorising surgery, was the responsibility of the knight in charge of the hospital.\footnote{270} The organisation of these hospitals was almost identical to similar institutions operated by the Church or secular groups and individuals; patients were required to follow a programme of daily prayer, remain celibate, adhere to dietary rules, and confess their sins upon admission.\footnote{271} The only exceptions being that membership of the order was required, the focus was to nurse patients back to health so they were able to return to the battlefield, and alms and charity were not habitually given to the poor.\footnote{272} It is clear to see how these Templar hospitals inspired and were closely related to the hospitals operated by the Leper Knights.

Members of Baldwin IV’s court invested significant funds in the Order of St Lazarus. It has been speculated that the King may have indeed joined the order himself if he had an heir to take his place. However, politically and strategically, his presence was necessary in order to hold his kingdom together.\footnote{273} Another prominent leprosy sufferer, Eustache III Grenier, joined the order in the 1150s when diagnosed with leprosy, leaving his younger brother Hugh to inherit the Lordship of Cesarea from their father.\footnote{274} Other influential and wealthy individuals in the Holy Land contributed funds on a regular basis to the Order. Men who joined the Order were expected to pass on their wealth to their heirs or liege lord, and their wives, if they had one, were required to join a convent.\footnote{275}
MEDICAL CARE PROVIDED BY MONKS AND NUNS

A number of abbots, and other religious leaders on a regional level, saw the foundation of leprosaria within their jurisdiction as a way to provide additional chapels within their parish; perhaps in order to provide a vacancy to appoint a friend or relative taking holy orders into leadership roles at that chapel and institution. While some of these individuals may have had personal motives for founding these institutions, the fact remains that the institutions were founded and provided shelter, food, and care for those in need, throughout Europe from France and England, to Germany and Poland and were authorised by the Church.

In the East, a number of institutions were founded and maintained by an order of Leper Knights; individuals who were diagnosed with the disease. These leprosaria were independently governed outside of the Church, although, the idea of Christian charity still prevailed even though the institutions were independent of the Church. They were self-governed, by leprosy sufferers themselves, although outside carers and workers with medical experience of some degree, were employed in order to provide medical and nursing care and complete everyday tasks such as cooking and cleaning.

Both institutions organised by the Church and by secular groups maintained certain rules for patients. These obviously varied depending on the institution, but in the most part, patients would be expected to follow a routine of daily prayer, general segregation of the sexes, although some limited public social interaction could occur, and contribution to the community as a whole either through financial contribution, service, or both so far as their condition would allow. An

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Eleventh century monastery in Istanbul, Turkey admitted leprosy sufferers to its infirmary and provided nursing care and alms. Patients were generally not expected to adhere to rules that would be more restrictive than those that applied to individuals living in monastic communities, and often they lived their lives in a similar way to how they would if they took holy orders, whether they were male or female. In fact, there is evidence to suggest that in some cases, the sick received special privileges which could include feather pillows and other similar comforts, as well as exemption from observing fasting periods such as Lent. Those who received regular blood-letting treatment would be assigned lighter duties than normal and additional food rations in the days immediately following the scheduled procedure.

**Disease Control, Prevention, and Attempts at Treatment**

In many communities, in order for a patient to be diagnosed with leprosy, they would be required to undergo examination by a number of designated individuals considered to possess the skills required in order to make an accurate diagnosis. These individuals could include members of the Church, those already suffering from the disease, people in positions of authority, as well as physicians. The most inventive diagnostic techniques ranged from cracking an egg and mixing it with the blood of the suspected sufferer, a positive diagnosis would be recorded if the mixture set, to examining the patient’s face through a flame, if nodules appeared the patient was deemed to have leprosy.

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284 Covey (2001) p. 316.
Following diagnosis, sufferers were either embraced by societies and offered support, or forced into a life of segregation because of the perceived lack of morality present in the individual. Some have compared these panels of experts to juries, hunting out leprosy sufferers, confirming the presence of the disease, and using this proof as a reason to inflict punishment on the individuals.\textsuperscript{286} This does of course bring into question the motives, and effectiveness, of these diagnostic procedures, and opens up debate on the accuracy and legitimacy of them.

In the seventh century, Isidore of Seville differentiated between leprosy of the skin and leprosy that affected the entire body.\textsuperscript{287} In the ninth century, Rabanus Maurus also differentiated between different types of the disease.\textsuperscript{288} Although, in both cases, it is uncertain as to whether they agreed with Galen’s theory regarding the cause of leprosy, or whether they attributed it to some other cause. Numerous theories were suggested as the cause for the disease, many of which prevailed from early times, such as the incorrect claim that leprosy was contracted through sexual contact, or was the result of a poor diet.

Some, such as the twelfth century physician Henry of Mondeville followed the suggestion first made by Galen; that leprosy was caused by an imbalance of the bodily humours or an excess of black bile.\textsuperscript{289} Some treatments and suggested cures were in direct response to the presumed causes. Treatments such as bleeding patients in order to release the disease, or black bile, from the body were extremely common, not only in leprosy cases, but blood-letting was common practice in the treatment of other conditions too.\textsuperscript{290}

Mondeville went as far as suggesting that leprosy was more severe than cancer, because, unlike cancer, which usually remained localised in one area of the body, leprosy engulfed the entire

\textsuperscript{286} Watts (1997) p. 49.
\textsuperscript{287} Touati (2000) p. 186.
\textsuperscript{288} Touati (2000) p. 186.
\textsuperscript{289} Touati (2000) p. 185.
\textsuperscript{290} Yearl (2007) p. 179.
body. Improvements in diet, and other medicinal treatments such as herbal remedies, were also common; honeysuckle, nettles, and garlic were used to make topical lotions to treat skin lesions. More inventive treatments include Hildegard of Bingen’s twelfth century recommendations that the soil from ant-hills, and white lilies held curative properties. Historical records suggest that leprosy was much more accurately identified in the East than it was in the West. In France and England, misdiagnosis, whether intentional or unintentional, probably resulted in larger numbers of individuals suffering from other ailments with similar symptoms, such as eczema or psoriasis, being identified as suffering from leprosy, and as a result, were admitted to leprosaria. By extension, it is possible that a number of individuals accused of committing immoral acts, like those wrongly associated with causing leprosy, may have been committed to such institutions based on their behaviour, rather than exhibiting any visual symptoms of the disease.

Prayer was viewed as an important element of treatment, and sufferers were often encouraged to pray regularly; prayer would have been a prominent aspect of life in a leprosarium. Some sufferers would carry religious relics as talismans, believing that they held restorative properties and could prevent the disease from taking hold. The belief in the power of religious relics as curative instruments was so great, that individuals suffering from leprosy were often encouraged to go on pilgrimages to visit relics at various sites throughout Europe.

One of the most extreme suggestions includes the use of the flesh of dead infants for curative purposes, although these unusual and unconventional treatments were unlikely to have been

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commonly practiced. In fact, although historical records document treatments, preventative measures, and cures, there is no evidence to show how frequently these methods were practiced. It is likely that practices differed between institutions, depending on the individuals providing medical care, and beliefs held within communities.

Some leprosaria in England may have been purposely located near water sources in the hope that ‘taking the waters’ would aid in alleviating symptoms, water at sites in Bath, Breewood, and Burton Lazars had a high level of sulphur which could have been considered curative. Like the different attitudes towards and treatment of leprosy sufferers from punishment in the form of death sentences, to charitable social services, physicians were equally divided over the cause, treatment, and cures they associated with leprosy.

However, a number of physicians realised that they were unable to cure the disease, despite their best efforts. Bernard of Gordon and Bartolomeus Anglucus, both English physicians, believed that nothing short of divine intervention could cure leprosy. In the eleventh century, Constantine the African writing in Italy, realised that he could not identify the cause of the disease, and seemed to be aware that contraction of leprosy could occur quite some time before the onset of any symptoms. The thirteenth century physician Lanfrancus, observed that the disease could be transmitted between people, but also realised that a healthy individual could live in close quarters with someone with leprosy for protracted periods of time, without contracting the infection.

In 1348, the personal physician to Pope Clement VI, Guy de Chauliac, produced a text outlining some of the signs and symptoms of leprosy. His text was used as a reference guide in many diagnostic tests by expert panels, or juries, in order to aid in the identification of the disease.\textsuperscript{303} The text would have been a useful tool, and perhaps played a part in more accurately identifying leprosy in the later Middle Ages; this is particularly important when we consider the qualifications, or lack of, that those identified as physicians of the time possessed.

**SUMMARY**

A number of events contributed to the spread of leprosy throughout Europe, firstly the expansion of the Roman Empire, and secondly, the increase in travel following the Normal Conquest of Britain and during the period of the Crusades. This resulted in cases of leprosy occurring in geographic locations where it had previously not been present, or saw an increase in cases where it had previously been rare. Within a short period of time, a large number of leprosaria emerged, founded and funded by the Church, secular individuals, and groups such as the Order of Lazarus; the majority of institutions were founded on Christian values. These institutions were organised and structured in a way which was much more formal than had previously been seen. Commonly among these institutions, patients were expected to follow a daily routine of prayer, take vows of celibacy, and adhere to rules of obedience. In some cases, patients were required to surrender some or all of their belongings upon admission, and healthy spouses were required to take holy orders. Occasionally, institutions were reserved for specific groups of people. Men and women were treated separately, either within the same institution in different wards, or in institutions designated to one sex. Leprosaria usually had a dedicated refectory, gardens where crops could be grown, a chapel, and a cemetery.

\textsuperscript{303} Watts (1997) p. 49-50.
The social perceptions of leprosy became polarised, individuals continued to be stigmatised and accused of promiscuity or committing some other sin and in extreme cases could be condemned to death for becoming infected. Yet, in comparison, other individuals were given special care and support, were considered blessed because of their affliction, and their legal rights were protected. Care was provided by monks and nuns in monastic leprosaria, many of which would receive medical training and would dedicate their lives to such roles. In other organisations, medical professionals of the day would be employed to treat patients within leprosaria.

Physicians continued to suggest various remedies, treatments, and preventative measures, some of which were particularly extreme. Prayer was a particularly popular activity that was encouraged for a variety of reasons. Other suggestions, while not providing a cure for leprosy would have perhaps extended the life of some of the poorest sufferers simply by providing a decent diet and shelter. Some physicians conceded that a cure could not be found and made suggestions for palliative care.
CONCLUSION

INCREASED IDENTIFICATION AND UNDERSTANDING OF LEPROSY IN THE HISTORIC RECORD

From the time leprosy first emerged in the Greek world, to the time of its decline at the end of the Middle Ages, much was learned and understood about leprosy that was not previously known. Likewise with other diseases, physicians realised that basic levels of cleanliness and containment measures aided in preventing a disease from spreading. While these measures would have had a limited effect with leprosy, due to its difficulty of transmission, they would have been useful nonetheless.

As the medical profession developed, we also see evidence that a number of physicians were able to identify leprosy and differentiate between it and other diseases and conditions that would have presented with similar symptoms. Although, when we look at the percentage of remains identified with signs of leprosy in dedicated cemeteries, it is clear that a number of remains do not display signs of leprosy, perhaps suggesting that misdiagnosis did occur, as it still does to this day. However, while misdiagnosis may still have been problematic in the Middle Ages, it seems clear that leprosy was rarely confused with a host of other skin conditions as it was in the earliest times examined in this paper. While some of the negative connotations associated with the disease mentioned in the Bible persisted, many with medical knowledge were aware that true leprosy differed from accounts of the disease in the Old Testament. While much was still yet to be learned about leprosy in the late Middle Ages, it can confidently be claimed that knowledge of the disease had improved vastly.
REASONS FOR THE DECLINE AND FALL OF LEPROSY

A number of suggestions have been made regarding why cases of leprosy declined drastically from the late thirteenth century. The most commonly held belief is that increases in the number of cases of tuberculosis resulted in a decline of leprosy cases due to transferable immunity. Other theories suggest that the recorded number of leprosy cases were overinflated due to many cases of misdiagnosis and the building of many leprosaria that were simply not needed. Therefore, the decline did not in fact happen because the number of cases did not spike during the eleventh and twelfth centuries.

Less common theories suppose that outbreaks of plagues such as the Black Death in the fourteenth century and other epidemics affected the people susceptible to leprosy and therefore deaths due to other causes reduced the individuals within the population who were susceptible to leprosy. While this and the argument for overinflated numbers cannot be categorically discounted, the most likely reason for the decline of leprosy is the increase in the number of cases of tuberculosis.

INCREASED PREVALENCE OF PURPOSE BUILT INSTITUTIONS IN THE ARCHAEOLOGICAL RECORD

As medical care improved, and cases of leprosy increased, the number of institutions providing care for sufferers also increased. Initially small hospices attached to monasteries emerged, over time these increased in size and became independent institutions organised by the Church. Under the auspices of Christian charity, many private individuals founded and maintained leprosaria. At the height of the Middle Ages thousands of dedicated leprosaria were in operation, and while it is likely that many of these institutions also admitted sufferers of other ailments, it is clear from the
archaeological record that dedicated institutions for the treatment of leprosy increased in number and could be found over a larger geographic area.

**Geographic Locations**

As leprosy spread it became prevalent throughout Europe and the Middle East, as well as elsewhere in the world. Leprosaria have been identified in Israel, Turkey, Italy, Poland, Germany, France, Scandinavia, Britain, Hungary, and many places in between. Perhaps the best examples come from countries where archaeological excavations have unearthed the most significant evidence such as Israel, Britain, France, and Scandinavia. While there is still much to be learned from further excavation and examination of human remains using a range of different methods, it is clear that leprosy spread throughout the area, and far from being rare in peripheral areas, it became particularly prominent. With 300 leprosaria in England alone in the twelfth century, it is clear that leprosy not only spread to areas where it was previously unknown, but was something that would have affected the lives of many, especially at the height of the Middle Ages.

**The Multidisciplinary Approach**

The importance of using a multidisciplinary approach in this paper can be demonstrated by what can be learned from approaching a research question using evidence, material, and examples from various different fields. The value of using sources from other disciplines can aid archaeologists, historians, as well as those working in other fields to enrich their research by using information that may not be immediately available to within their given field.

For example, for the purposes of this and similar studies, a great amount of information can be gained that can aid in answering the research questions by examining medical texts, as well as
accounts of leprosy in the Bible. This has provided this study with the means of identifying and discussing such problems as the various references to leprosy in the Old Testament, the theory of the disease arriving in the area with troops of Alexander the Great and comparing the dates of the biblical texts to the first examples of leprosy found in the area in human remains. There is a discrepancy of several centuries between the age of the first identified remains, the time the biblical texts were written and the time Alexander’s troops returned to the area. It may be that in time, more archaeological or textual evidence emerges to bridge this gap.
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Philippa Juliet Meek holds a BA (Hons) in Egyptology and Ancient History from University of Wales, Swansea, a Graduate Diploma in Theology and Religion from University College, Durham University, and served in the Royal Logistics Corps of the British Army Reserves from 2006-2010.

While at Swansea, Miss Meek was awarded the 2006 Department of Classics, Ancient History, and Egyptology Travel Fund Grant to assist with the cost of visiting sites of archaeological interest relating to her degree in Turkey, Syria, Jordan, and Egypt. In 2012, she was awarded a Hockerill Educational Foundation Grant to help defray the cost of books and equipment for study at Durham University. Also in 2012, she became involved in Defence Archaeology Group, a British charity aiming to help and support injured service personnel and veterans during their recovery; between 2013 and 2014 she served on the Board of Officers for the charity. In 2016, she was awarded a Student Government Conference Presentation Grant Program Travel Grant from the University of South Florida to help cover the cost of presenting a paper at an American Academy of Religion conference in Boston, MA.

Miss Meek received invitations to join the Golden Key International Honour Society and The Honor Society of Phi Kappa Phi whilst studying at the University of South Florida, and is an alumna member of the Alpha Omicron Pi Sorority. She is a member of the American Academy of Religion, the Society for Biblical Literature, the Biblical Archaeology Society, and the Archaeological Institute of America.