**UNIVERSITY OF NOTTINGHAM**

Department of Classics and Archaeology

# An investigation of zootherapy in the Roman world

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Supervisors: Dr Holly Miller and Professor Will Bowden

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# 1 Introduction

## 1.1 Introduction

Zootherapy is the practice of using animals, their parts and their products to treat or prevent human illnesses (Miller and Sykes 2016, 257). Although practised across the world and throughout time (Lev 2003, 107), a post-Enlightenment, 'Western' aversion to 'unscientific' and 'irrational' medical methods has hindered our understanding of zootherapy both past and present. This has caused archaeologists to be less aware of, or less receptive to, the possibilities of identifying the evidence of zootherapy in the Roman archaeological record. To counter this, this dissertation will promote zootherapy as a valid interpretation of zooarchaeological material, and outline methods that could be used to identify the archaeological evidence of zootherapy from the Roman world.

## 1.2 Context within the literature

Studies of the archaeology of Roman medicine are not new. Baker, for example, gives a thorough introduction to the subject in *The Archaeology of Medicine in the Greco-Roman World* (2013), covering theory, texts, images, small finds, sites, and archaeological science. However, she notes that there has been little research conducted on the animal materials of Roman medicine (2013, 9), a point which is illustrated by the absence of archaeological zootherapy in her own work. It is more common for researchers to focus on medical texts (e.g. King 2001), botanical remedies (e.g. Riddle 1987), or anthropocentric modes of healing (e.g. Cruse 2004) than the uses of animals in medicine.

On the whole, Cruse's *Roman Medicine* (2004) provides a good general overview of Roman medicine. However, although a whole chapter is devoted to *materia medica* – the materials of medicine – the involvement of animals in medicine is touched on only very briefly. Despite suggesting that there is "no shortage" of textual sources that refer to animal and insect ingredients, only the textual and archaeological evidence for plant cures is explored in depth (Cruse 2004, 56). For example, the proposal that the Roman army might have imported seeds and plants for medicinal use in Britain is not paired with a similar suggestion that they may have done the same with animals

or their parts (Cruse 2004, 74). In fact, it is likely that the Romans did import animal parts to use in medicine, as Miller and Sykes (2016) have demonstrated in the case of certain deer parts.

*Roman Medicine* can also be questioned for its definitions of medicine: medical practice which seeks a disease's cause before prescribing treatment is defined as "rational medicine", while magic and superstition are labelled "irrational" (Cruse 2004, 13). The Oxford English Dictionary defines an "irrational" act as one "not endowed with reason" (OED 2022b) which implies that "irrational" Roman medicine is illogical. However, without a 21st century grasp of human biology, the Roman remedies based on 'like cures like' follow their own kind of logic. The concept of rationality is not fixed, and modern, Western perceptions of rationality in regards to medicine contrast with that of the ancients, as van der Eijk points out (2004, 4)**.** If wearing an amulet was considered a rational cure in the Roman world, we should not view it as an "irrational" practice; we can research without applying value judgements to culturally relevant practices. In this study I will not judge remedies based on their proven effects.

Cruse is not the only scholar who is more interested in flora than fauna. King's *Greek and Roman Medicine* (2001) covers Roman medicine's roots in Greek medicine, well-known figures like Galen, humoral theory, and the intersection between food and medicine, but pays little attention to the role of animals. The section on diet does highlight the importance of food in medicine, but the links between animal-based foods and their connections with medicine could be emphasised further. While King notes that some substances were not usually eaten or not consumed as part of meals, assigning these the label "drugs" (2001, 47), she then focuses predominately on plant ingredients. More beneficial to this study is Jones-Lewis' chapter on pharmacy (2016); with a narrower scope than Cruse and King, she is able to write about animal pharmaceuticals in more detail. In her presentation of Roman pharmacy and the processing of different medicines, Jones-Lewis gives equal space to plant and animal ingredients; for once, plant-based remedies are not given precedence over animal-based cures.

Similarly, Miller and Sykes (2016) make a strong case for the use of fallow deer in Roman zootherapy in Britain, while Thumiger's animal chapter in *A Cultural History of Medicine in Antiquity* (2021) has a section that considers how animal materials were used in medicine. However, while Miller and Sykes' comprehensive argument for the medical uses of fallow deer draws on archaeological evidence, there is a lack of archaeology in both Thumiger's and Jones-Lewis' work. The current literature demonstrates that there are opportunities to learn more about zootherapy in Roman archaeology, and this dissertation aims to address this.

## 1.3 The missing animals

The frequent neglect of animals in research into Roman medicine derives from several factors. Part of the problem stems from approaching medicine with a post-Enlightenment, 'Western' lens (Miller and Sykes 2016, 261). If zootherapy is to get the attention it deserves, our perception of medicine must be more accommodating. The absence of zootherapy in the literature is also attributable to the difficulty in identifying archaeological remains, which stems from the overwhelmingly perishable nature of animal-derived medical materials. Hurcombe addresses the problem in a different time period in *Perishable Material Culture in Prehistory* (2014). Organic material culture is notoriously difficult to recover from the archaeological record because it relies on such specific conditions to be preserved. But this "missing majority" (Hurcombe 2014, 2) of organic material culture should not be interpreted as evidence of absence (as the lack of animal-focus in modern research might lead one to believe). Interestingly, this missing archaeological evidence has not stopped researchers from delving into the use of medicinal plants.

Similarly, live animal-human interactions are unlikely to leave much physical evidence. Miller and Sykes state that "the expectation has to be that most human-animal relationships in the past had the potential to be viewed therapeutically" (2016, 269). This poses a challenge for the archaeologist. The interaction with an animal could be fleeting, as in the case of a cure for headache that relied on the touch of an elephant's trunk (Plin. *H.N.* XXVIII.XXIV). Such contact with animals will be lost to archaeologists unless otherwise recorded, so it is important that when approaching

human-animal relationships, the zootherapeutic potential that Miller and Sykes identified is recognised. In this dissertation, it is this zootherapeutic potential that will be investigated, not evidence or proof of zootherapy. Instead, I will be considering zootherapy as a possible interpretation, and will suggest where evidence might profitably be found.

## 1.4 Outline

This dissertation aims to shed light on the practice of zootherapy in the medicine of the Roman world. Here, "medicine" denotes many kinds of healing, and not simply the 'Western' concept of drugs and surgeries, while the "Roman world" indicates times and places where people lived under Roman leadership. Additionally, although humans are often distinguished from other species with the terms "human" and "non-human animals" in zooarchaeological literature (as in O'Regan *et al.* 2020), in this study non-human animals will be referred to simply as "animals". It should also be noted that many zootherapeutic treatments have veterinary applications, both now and in the past (Plin. *H.N* XXVIII.LXXXI; Alves 2009). Although this is an important part of understanding zootherapy, it is beyond the scope of this study, so only human medicine will be explored.

I will begin by grounding my research in zootherapy from around the world. By using case studies from Asia, South America, Africa, the Middle East and Europe, chapter 2 will demonstrate the continued globality and relevance of zootherapy. The use of animals in modern medicine is so common that one would expect to see similar levels of zootherapy in the past. By highlighting shared features in the processing of ingredients, the ways animals are used, and the motivations behind different treatments, chapter 2 will show what we can expect of zootherapy if we were to see it in the Roman world.

Chapter 3 will then explore the current state of our knowledge of Roman medicine, and will demonstrate the prevalence of anthropocentric forms of healing. It will draw on a range of evidence, from textual sources like Pliny the Elder (henceforth, "Pliny" refers to Pliny the Elder unless otherwise stated) to medical instruments. Most importantly, the intersection of medicine, magic,

religion and food will be explored, supporting the argument for an expanded, open-minded definition of “medicine”.

Chapter 4 focuses on animals in Roman medicine, highlighting the areas where zootherapy can be found. These areas include temples, amulets and diet, so reinforce the overlap between the spheres of magic, religion and food. Finally, potential methods for identifying archaeological evidence of Roman zootherapy will be outlined in chapter 5. I will draw my conclusions in chapter 6.

# 2 Current Zootherapy

## 2.1 Introduction

Zootherapy is still very much a part of today's world – according to the World Health Organisation (2019, 10), 88% of the WHO Member States use traditional and complementary medicine, and this includes zootherapy. This chapter will demonstrate the continued globality and relevance of zootherapy by investigating modern examples from around the world. A general overview of the zootherapy of China, India, Brazil, Nigeria, the Middle East, Europe and the UK will be presented alongside some of the processes, methods and animals used. This overview will indicate shared practices, and these commonalities can be used to indicate the likely methods of Roman zootherapy.

## 2.2 China

China is perhaps one of the most well-known countries to practise zootherapy (Alves and da Silva Policarpo 2018, 237); with the Covid-19 pandemic raising awareness of China's medical use of animals, articles on the subject are frequently in the popular press (for example, Standaert's 2020 article in the Guardian). At the end of the 20th century, it was estimated that a quarter of the world's population used medical practices based on Traditional Chinese Medicine (TCM) (Still 2003, 118). According to Eigenschink *et al.* 2020, TCM is believed to have originated over 4000 years ago; the evidence that this statement is based on, however, is not made clear. Its practices were first compiled textually in *Huangdi Neijing* – 'The Yellow Emperor's Inner Classic' (Eigenschink *et al*. 2020, 260). One of the core features is the concept of *qi*, the essential life force of all living things (Lo and Stanley-Baker 2011, 154). Along with the other humours of blood, moisture and essence, *qi* plays an important role in balancing the energies yin and yang in the body. If yin and yang become unbalanced, disease develops, and steps must be taken to restore the body's harmony (Patwardhan *et al.* 2005, 466). Such steps involve physical treatments, such as acupuncture, or medicines in the form of plant, animal and mineral remedies. These remedies are described by the WHO as "herbal medicines" (WHO 2019, 8). This somewhat misleading term appears to imply that the remedies involve only botanical substances, but animal ingredients are common. It has been estimated that over 1500 different animal species are utilised in TCM, from domestic species like chickens and

donkeys to wild animals such as tigers, rhinoceroses, pangolins, bears and seahorses (Kumaravel *et al*. 2012; Alves and da Silva Policarpo 2018, 237). This wide range of animals has raised conservation concerns, with the medical use of rare species resulting in a threat to population numbers (Anyinam 1995, 326). Nevertheless, TCM remains popular.

Deer antler is a particularly common ingredient in TCM, and it is believed that when made into a drug called *pantui* it can strengthen muscles, bones, eyesight, and hearing, and it eases rheumatism and lessens male impotence (Scarpa 1981, 318). Deer antler is thought to be especially important in enriching vital energy and staving off old age, and scientific studies have shown some positive medical effects (Kang *et al.* 2006; Wu *et al.* 2013). Of more interest to this dissertation is not the physical effectiveness of deer antler, but the processes it undergoes to become an administrable medicine. An awareness of how animal substances are processed and administered will improve our understanding of techniques which are common to many different societies, and this knowledge will be useful when it comes to investigating Roman methods. Kawtikwar *et al*. (2010) describe how after the antler is harvested from deer farms, it is usually thinly sliced or ground to a powder, and this can then be eaten by the patient or applied topically (Figure 1).

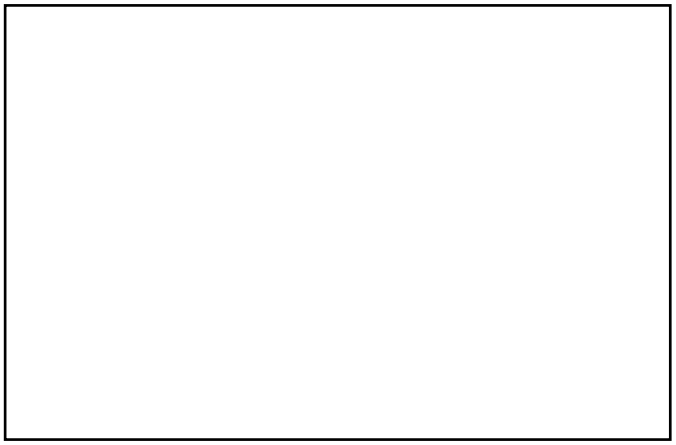


*Figure 1: Sliced deer antler (Kawtikwar et al. 2010, fig. 4).*

Antler can also be boiled to create antler gelatine, a substance which is mixed with other herbs and consumed, or powdered and taken directly (Kawtikwar *et al*. 2010, 247). Alternatively, the processed antler can be administered in pill form (Wu 2005, 170).

As deer shed and regrow their antlers each year, antlers are a renewable resource in TCM. An equally renewable ingredient – though more controversial – is bear bile. The bile is produced in China's bear farms, and is collected via catheters inserted into the gallbladders of live bears (Kikuchi 2012). It can then be dissolved into milk for infant consumption, used externally or orally by adults, or dissolved in a water solution for an eyewash (Feng *et al.* 2009, 2). Bear bile is therefore similar in application to deer antler, as both can be made into liquid medicines for oral or external use. In terms of humoral theory, bear bile is thought to be cold and bitter, and is used to treat fatigue, rheumatism, and problems with the liver, gallbladder, heart, stomach and intestines (Aniyam 1995, 326; Feng *et al.* 2009). Hence, like deer antler and many other ingredients in TCM, bear bile can be used for many different illnesses. The versatility of different animal ingredients is common in zootherapy, as this chapter will show.

## 2.3 India

China may be the most well-known country to use zootherapy, but according to Oyebode *et al.* (2016), it is not where zootherapy is most commonly practised. In fact, the researchers found that the use of traditional medicine as a primary treatment was highest in India, with 11.7% of people there resorting to traditional remedies as their most frequent source of care (2016, 984). The researchers compare this number to one found in a 1980s WHO publication, which stated that 80% of the world's population use traditional medicine as their primary source of healthcare (Bannerman 1983, 320). 11.7% in India is much lower than one might expect, and Oyebode *et al*. suggest that the WHO claim of 80%, though often cited (for example, Alves and Rosa 2005, 1; Sykes 2014, 129; Miller and Sykes 2016, 257), is unreliable and out of date. They conclude that traditional medicine is not as commonly used as some assume. However, the number of people using complementary and alternative medicine (CAM) in general – not only as their *primary* course of action, but perhaps after other initial treatment has proved unsuccessful – is likely to remain high.

As in China, traditional medicine in India has a long history and is recorded in ancient texts. India's traditional medicine is documented in the *Charaka Samhita* and the *Ayurveda*, with the latter

giving its name to the most widely practised form of Indian traditional medicine (Dargan *et al*. 2008, 465; Alves *et al*. 2013, 16). According to Unnikrishnan (2004, 12), true Ayurveda, with its codified and structured knowledge, is separate to but intertwined with the traditional medicine such as that studied by Chakravorty *et al.* (2011). Ayurveda is based on a five element theory in which all living organisms are composed of three humours: *vata* (ether and air), *pitta* (fire) and *kaph* (water and earth). The balance of these three humours, or *doshas*, is believed to be the cause of disease, and exercise, diet and medicines are used to restore harmony (Alam 2008, 13). In contrast to 'Western' medicine, where treatment might only be sought when a person feels unwell, Ayurveda is seen as a way of life (Unnikrishnan 2004, 12; Alam 2008, 9). Ayurveda itself, as opposed to less codified traditional Indian medicine, is perhaps more common in urban areas than rural, and remains an important source of healthcare in India and beyond. India has over 12,000 Ayurvedic colleges and hospitals, with as much as 80% of the population using Ayurveda and other traditional medicines to meet some of their health needs (Dargan *et al*., 2008, 465). Following research conducted between 2002 and 2003, Nisula (2006) found that in the city of Mysore, South India, Ayurveda was often the favoured course of treatment when 'Western' medicine had been unsuccessful. For Patwardhan *et al.*, Indian healthcare follows a path of "medical pluralism", with Ayurveda remaining dominant compared to "modern medicine" (2004, 792). "Modern" is perhaps an inaccurate term to use to describe 'Western' medicine; Ayurveda may have ancient roots, but it remains just as active in modern India as 'Western' medicine.

Zootherapy plays an important role in Ayurveda, and it has been estimated that 15-20% of Ayurvedic medicine involves animal-derived materials (Costa-Neto 2004, 35). Drugs obtained from animal sources are grouped under the term *Jangama dravya* (Rastogi and Kaphle 2011). Common materials include teeth, horns, faeces, and bodily secretions (Unnikrishnan 2004, 24), and can sometimes be very specific; for example, one aphrodisiac is based on milk from a black or red cow fed on particular plants (Rastogi and Kaphle 2011, 3). In traditional Indian medicine, cows are especially important. The Hindu religion has long used cattle products for purification, and they are

utilised for a similar purpose in medicine (Mahawar and Jaroli 2006). Milk, urine, dung, curd and the clarified butter ghee are used in Ayurvedic Pancha-Gavya therapy for purification treatments, and cow urine in particular has been studied for its biopurifactory properties (Rastogi and Kaphle 2011).

In addition to cattle, the varied geography and habitats of India have resulted in a long, diverse list of wild and domestic animal species used in medicine (Chakravorty *et al.* 2011). The parts of the animals used and how they are processed can vary between different population groups. For example, the Nyishi and Galo people consume porcupine flesh to combat tuberculosis. Members of the Andhra Pradesh also utilise porcupines, but they use the dried stomach rather than the meat and treat digestive problems instead of TB. Despite such difference in parts used and illnesses treated, there are similarities in the ways the animal ingredients are processed by the people studied: cooking the body parts – especially by boiling – and grinding them to powder are common methods to all groups (Chakravorty *et al*. 2011, 9).

## 2.4 Brazil

Asia is not the only continent where zootherapy plays an important role in people's health. Zootherapeutic treatments remain active in South America, particularly in Brazil, as the extensive work of Alves illustrates (Alves and Rosa 2005; Alves and Rosa 2007; Alves *et al.* 2007; Alves 2009; Alves *et al.* 2011; Alves *et al.* 2013). Similar to China and India, the roots of modern zootherapy in Brazil are believed to reach back far into the past (Alves *et al.* 2007, 949). The existing indigenous practices were later affected by the practices of others, as the European colonisation of Brazil in the 16$^{th}$ century resulted in the imposition of the European system of medicine on traditional Brazilian medicine. It also brought African influences through the practices of imported African slaves (Birn 2011, 246), and this led to a broad and varied medical system. Traditional, indigenous medicine continues to this day, and there is a thriving market for the plant and animal species used for healing (Alves *et al*. 2007) (Figure 2).

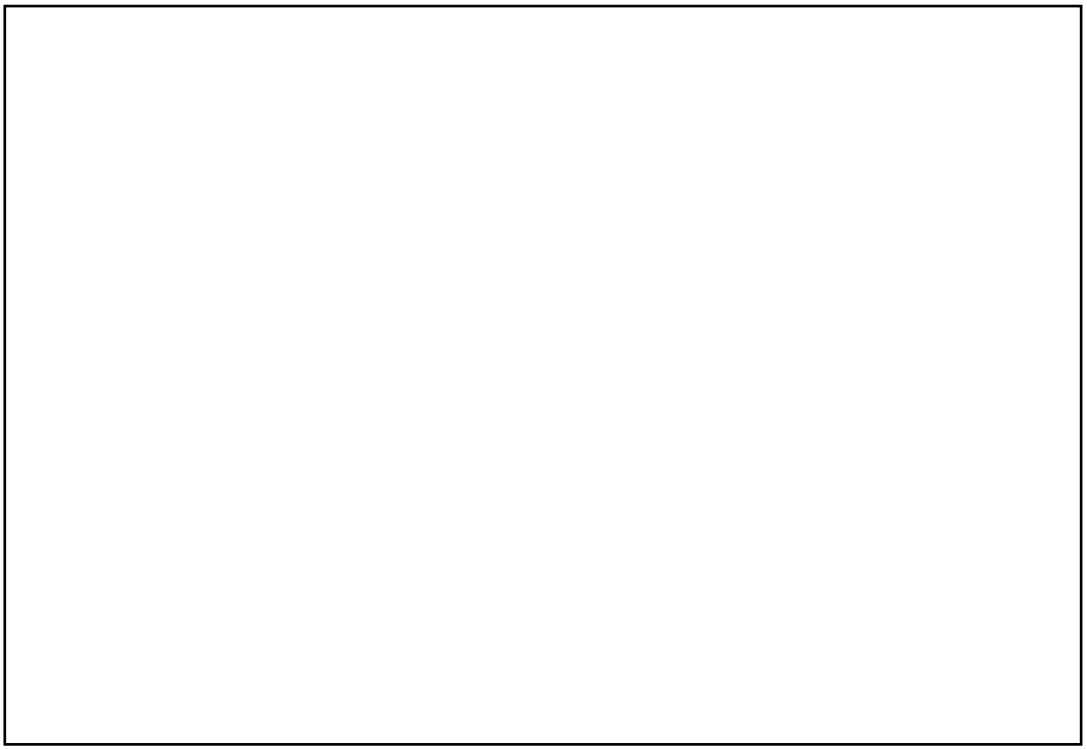


*Figure 2: Animal materials intended for medicinal use for sale in Brazilian cities (Alves and da Silva Policarpo 2018, fig. 13.5).*

Many studies of zootherapy in Brazil focus on market traders and the wide variety of animal products they sell (Costa-Neto 1999; Alves and Rosa 2007; Alves *et al.* 2007; Alves 2009). Such studies demonstrate the extent of the animal species used medicinally. Costa-Neto collated results from 23 different papers and found that in the Brazilian state of Bahia alone, 180 animal species were used as medicinal resources (Costa-Neto 2004). In a more recent study, Alves (2009) found that at least 250 species are used medicinally in northeast Brazil. Most of the animals are caught from the wild and some are protected species, and this raises similar conservation issues as those found in Chinese and Indian traditional medicine (Alves and Rosa 2007, 541). Within this wide range of different animals, some are more frequently used than others: in their study of five north Brazilian cities, Alves and Rosa (2007) found that seahorse, rattlesnake, caiman and boa constrictor were most common.

Common animal-derived ingredients include body parts, blood, bones, honey, milk, eggs, urine, faeces, shells and whole animals (Costa-Neto 2004, 164; Alves *et al*. 2007). Mammals, fish, reptiles, birds, amphibians and insects are used for a wide range of conditions, from earache and

sore throats to epilepsy and tuberculosis (Alves *et al.* 2011). Unlike in 'Western' medicine, where there are usually only a few courses of action for a specific condition, in Brazilian zootherapy a single illness can be treated with a myriad of remedies. These often approach the problem from wildly different angles, and asthma is a good example of this. It can be treated using tea from the powdered animal part – be it a pit viper's rattle, a brocket deer's hooves, or a caiman's hide (Costa-Neto 1999) – or by inhaling the smoke of a burning green turtle shell (Costa-Neto 2004). Alternatively, live animals can be used; fishermen from the Siribinha community spit into the mouth of a swamp eel and release it back into the river in the belief that the eel will take the asthma away. Other illnesses do have a far narrower range of remedies. Rheumatism, for instance, is frequently treated by rubbing animal fat onto the affected joints (Alves and Rosa 2007; Alves *et al.* 2011). Some of the treatments involve a 'like affects like' approach. This is the case with powdered coati penis, which is mixed into food to combat male impotence (Alves and Rosa 2007). Similarly, adding powdered brocket deer femur to an infant's food is believed to make the child learn to walk sooner (Costa-Neto 2004, 171). Out of all the Brazilian zootherapeutic treatments, ingesting the animal part – especially when brewed in a tea – is one of the most common ways of administering the medicine (Costa-Neto 1999).

## 2.5 Nigeria

The practice of zootherapy can also be seen in Nigeria. Traditional medicine is viewed as an integral part of Nigerian culture, and this inspires its continued use by Nigerians (Soewu 2013, 350). Just as in Brazil, a wide variety of animals and their parts are used to treat a range of illnesses, and again, one illness can be treated with multiple remedies (Adeola 1992; Soewu 2013; Ajagun and Afolayan 2017). Both domestic and wild animals – many of which are threatened or endangered species – are used in zootherapeutic practices, which can include sacrifices to appease deities, witches and spirits (Soewu 2013, 356). Just as in Chinese, Brazilian and Indian traditional medicine, consuming animal ingredients is a common treatment method. This can be seen in several medicines for improving female fertility, although the processing which the ingredients undergo before consumption differs

according to the animal part used. For example, the liver of an African elephant can be cooked and eaten with little prior preparation, whereas the spines of the crested porcupine must be ground to a powder before they can be added to food (Sodeinde and Soewu 1999, 38).

Maclean (1971) recorded a variety of different healing practices in Ibadan, Nigeria. The location of the first Nigerian medical school (Maclean 1971, 61), the city is also home to what Maclean terms the "barber-surgeons" of the Hausa community (1971, 65). In this case, it is the tools rather than the medicine which are zootherapeutic in nature, for patients can be treated for aches and pains by bloodletting and cupping with animal horns. The practitioner makes small cuts on the surface of the affected area, then selects an animal horn of appropriate size to place on top. Via a small hole in the horn's apex, they suck the air out to create a vacuum and seal it with wax. This is then left in place for several minutes. The practice of cupping with animal horns is not restricted to the Hausa people, but is also practised by other groups in Nigeria (Bentley 2017, 41) (Figure 3).

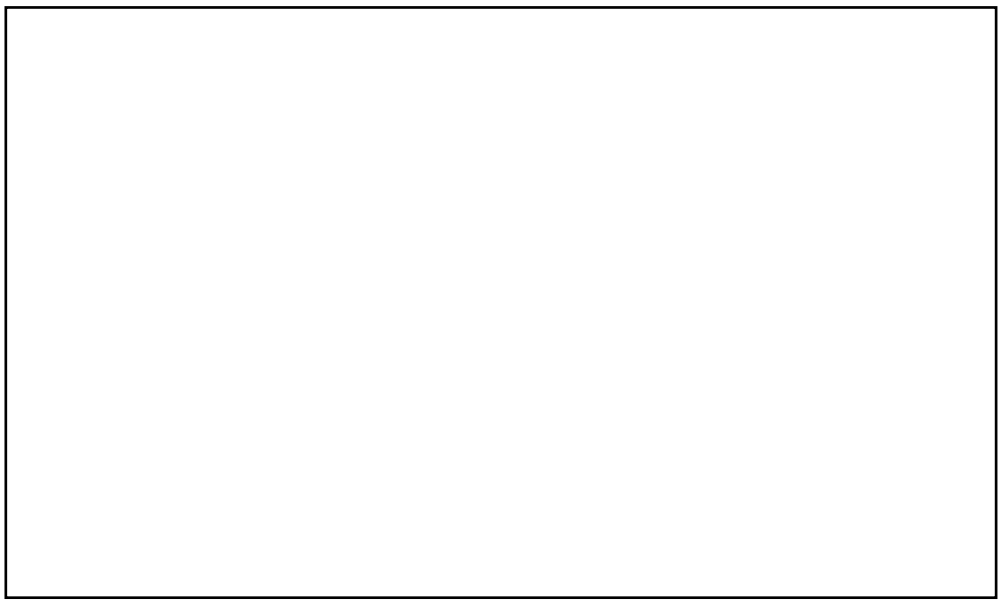


*Figure 3: Left – A horn used by a Hausa healer to perform cupping (Maclean 1971, fig. 13). Right – In this Tanzanian example, a healer applies an animal horn to the patient's skin by creating a vacuum (Bentley 2017, 38).*

Traditional Yoruba medicine can also be found in the city of Ibadan, and materials can be bought at the nearby market, with plant, mineral and animal substances – snake eyes, tortoise shells and monkey paws, for example – all available for purchase (Maclean 1971, 69). In recent years Yoruba medicine has undergone some "modernisation", with machines being used to sort

ingredients, and herbal remedies now available in bottles or sachets (Borokini and Lawal 2014, 29). Oyekalin opposes the idea that Yoruba medicine might be integrated with what he terms “orthodox medicine” (2009, 73) because the two healing systems are quite different in the way they approach illness. Yoruba medicine focuses not only on physical healing but also on spiritual healing, and according to Oyekalin it takes a much more holistic approach to health than ‘Western’ medicine (2009, 74). With this in mind, he recommends that the two continue as separate but complementary systems.

However, despite the apparent differences between traditional medicine and ‘Western’ medicine, traditional healing methods can in fact be seen in hospital settings. In Ezeome and Anarado’s (2007) study of 160 cancer patients at the University of Nigeria Teaching Hospital, they found that 65% of them had used CAM at some point during their illness. In terms of animal products, none of the patients interviewed claimed to have used “animal extracts”**.** However, this does not mean that they did not use zootherapy. The researchers recorded that the use of products sold by the Forever Living company was the fourth most commonly utilised form of CAM, with 16.3% of 160 patients using them. A brief search of Forever Living’s website reveals many products containing animal ingredients, with a variety of bee products using honey, royal jelly, propolis and pollen (Forever Living n.d.a), and supplements containing fish oil (Forever Living n.d.b) or eggshell membrane (Forever Living n.d.c). With this in mind, the cancer patients in the study may well have resorted to zootherapeutic remedies to treat or ease their illness, even if these were not recognised under the heading “animal extracts” by Ezeome and Anarado. The researchers also found that CAM use did not appear to be influenced by socioeconomic factors such as age, education, or religious beliefs. Interestingly, this contrasts with the findings of Alves and Rosa; the merchants they interviewed in Brazil believed that people with a low income were the most common buyers (2007, 552). Perhaps by interviewing patients already in hospital, Ezeome and Anarado limited the range of responses they could receive from the outset.

## 2.6 The Middle East

Beyond Nigeria, the continued use of zootherapy can be seen among the Bedouin people. Traditionally nomadic tribes, the Bedouin follow a Muslim faith and live primarily in the Arabian Peninsula, the Middle East and North Africa, mainly in the Negev Desert with a smaller population in the Galilee (Lev 2006). Amongst the Bedouin, complementary and alternative methods of medicine are common, and Ben-Arye *et al.* (2009) found that Bedouin patients had a higher expectation of receiving CAM care at the primary health clinic than the non-Bedouin Muslims who were surveyed. Traditional Bedouin medicine involves both plants and animals, and is based on the belief that good health and illness are determined by Allah, so faith and patience are required to bring healing (Abu-Rabia 2015, 8). It is important to note that the term "Bedouin" encompasses several different groups who live in different places, which means access to different medical ingredients and different approaches to illness. For example, the Bedouin of the Southern Sinai use a soup made from rock rabbit or the smoke of a burnt bat to cure fever, whereas the Bedouin of the Syrian Desert use the gall bladder or teeth of the hyena (Abu-Rabia 2015, 88). At the same time, much of the general Bedouin understanding of sickness is common amongst the groups. Great attention is paid to the patient as an individual, and when using 'Western' medicine, the Bedouin patient places great importance on the doctor's attitude towards and interest in the patient (Abu-Rabia 2015, 12).

An invaluable source for understanding how the Bedouin approach medicine and healing is Abu-Rabia's *Indigenous Medicine Among the Bedouin in the Middle East* (2015). A Bedouin himself who has been treated for illnesses using Bedouin medicine, Abu-Rabia studied Bedouin groups in the Negev, Galilee, the Gaza Strip, Sinai and Jordan to create a comprehensive collection of illnesses and Bedouin treatment methods (Abu-Rabia 2015, xv). He notes that although the treatments may not exist today amongst all the Middle Eastern Bedouin for all age groups, "even educated people turn to traditional medicine for a remedy" when faced with a serious illness (Abu-Rabia 2015, xv).

Both wild and domestic animals are used in Bedouin zootherapy, and the species involved demonstrate how the Bedouin utilise the animals which are most accessible to them; camel milk, for example, appears to be used more regularly than cow (Abu-Rabia 2015). Zootherapeutic remedies can contain whole dead animals, whole live animals, animal parts, or animal products, often with other natural ingredients and with elements of faith involved in the process (Lev 2003; Abu-Rabia 2015). Elements of ritual can be important, and the slaughter or sacrifice of animals at a holy site sometimes plays a role (Figure 4).

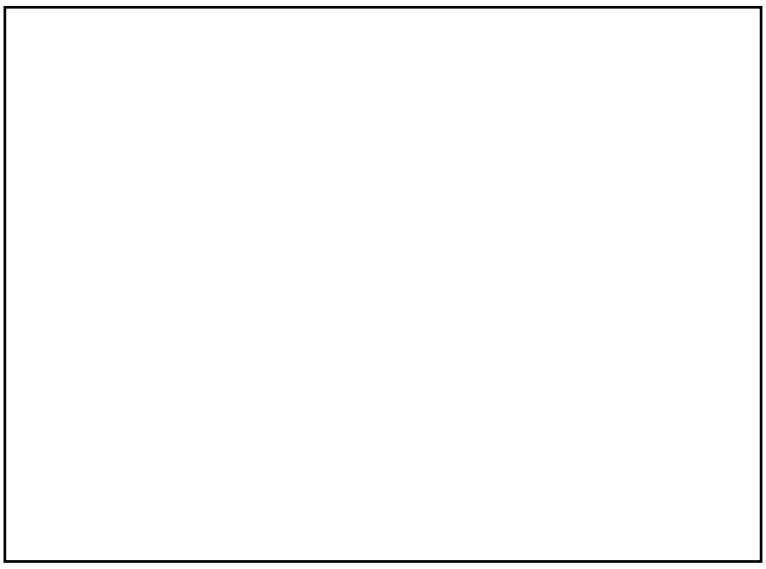


*Figure 4: A slaughter stone for supporting an animal's head at the holy Jamayin Tomb (Abu-Rabia 2015, fig. 2.4).*

As with the traditional medicine of the other countries discussed in this chapter, drinks made of animal parts are common, as is the topical application of animal fats. For instance, honey and milk are both used in drinks to cure coughs (Abu-Rabia 2015, 75), while rendered camel fat is applied to boils and wounds (Abu-Rabia 2015, 97). Milk, eggs and honey are regularly occurring materials in the remedies for Abu-Rabia's catalogue of ailments, and are usually eaten and drunk or, in the case of eggs, used to make a cast for broken bones. Honey is frequently prescribed and according to Abu-Rabia is considered a "holy medicine" by the Bedouin (2015, 132); a line of the Qur'an describes how bees produce a healing liquid (16:69).

Animal products and animal parts are not the only sources of healing to the Bedouins; live animals are also utilised. Using live animals is not unique to Bedouin medicine, but it is in this

category of ‘ingredients’ that there appears to be the most diversity between countries in the species and methods used. Some Bedouin treatments require the animal’s direct involvement, such as in the treatment for a dislocated hip. The patient straddles the back of a thirsty donkey, which is then allowed to drink. As the animal’s stomach fills with water and the sides of its abdomen expand, the patient’s legs are forced further apart until the dislocated hip pops back into place (Abu-Rabia 2015, 81). In contrast, other live-animal cures are based on the absence of the animal. This was the case for a man suffering from facial paralysis; alongside other treatment, he was instructed to avoid looking at cats and dogs. In the end, the patient recovered (Abu-Rabia 2015, 86).

## 2.7 Europe

Beyond the Bedouin, we can see the continued use of traditional medicine and zootherapeutic remedies in Europe, particularly in rural areas. Like other researchers (Scarpa 1981, 318; Alves *et al.* 2011; Sykes 2014, 141), Quave *et al.* note that when it comes to traditional medicine the existing research into zootherapeutic remedies is low, especially when compared to the number of studies conducted on botanical treatments (2010, 92)**.** Lack of previous research may create a false impression of lack of zootherapy, but this is not the case. In the Mediterranean, knowledge of traditional medicines has been passed down orally through families and is more pervasive in rural areas where access to ‘modern’ healthcare is limited (Quave *et al.* 2010, 318; Ceríaco 2013) (Figure 5).

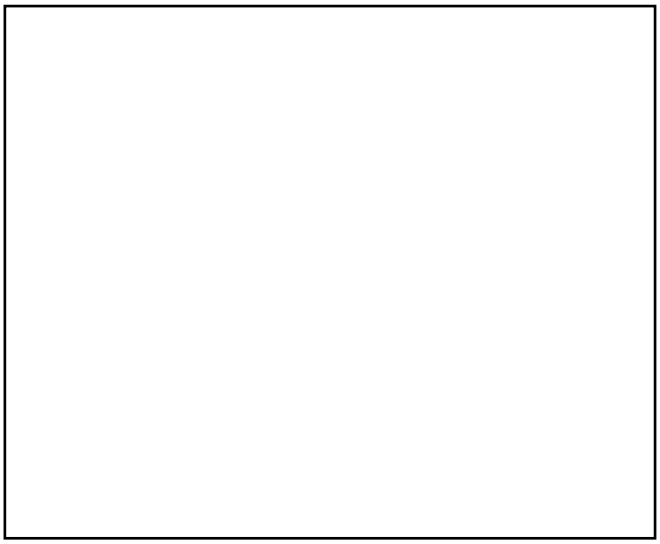


*Figure 5: Filtering drinking water through a wolf gola (the dried trachea) to cure respiratory problems has a long tradition in Portugal, and some families own golas that are over 150 years old and have been passed down through the generations (Ceríaco 2013, fig. 15.2).*

In his review of zootherapy in Portugal, Ceríaco states that bar the larger cities, human settlements are in close contact with natural areas (2013, 318). This closeness with the natural world and the agricultural nature of many settlements may account for the high number of zootherapeutic remedies in use in rural areas, as different animals are more readily available.

In Europe, it appears that countries vary more in the wild fauna they use but commonalities can be found in the domestic animals utilised. This is understandable given the differences in countries' ecosystems compared to the relative uniformity of agriculture and animal-keeping. Quave *et al.*'s (2010) study of zootherapeutic remedies found that the study areas in Albania, Italy and Spain all utilised donkeys, sheep, pigs, goats, chickens, dog, medicinal leeches and honey bees in their traditional medicine. Additionally, the researchers discovered that even where the same animal was used by all three countries, the part of the animal used and the way it is applied or processed differed. Take the pigeon, for instance: pigeon faeces are used to treat ingrown toenails and acne in Spain, but in Italy the meat is eaten to increase breast milk and aid in postpartum healing. One universal cure involves honey, which is drunk or added to tea as a remedy for colds and sore throats by people from all the areas in the study (Quave *et al.* 2010, 119).

Quave and Pieroni (2013) explore the long tradition of zootherapy in the Mediterranean by considering the similarities between historic and current zootherapeutic practices, looking

particularly at the work of the ancient Greek physician Dioscorides. While many of the remedies are no longer in use, some do continue relatively unchanged, particularly those involving domestic animals and those which overlap with food use (Quave and Pieroni 2013). In some cases, the animal involved in both ancient and modern treatments is the same, but the part used and its application had changed. This is the case for dog bites, where a literal 'hair of the dog that bit you' treatment is applied to the wound in the modern day. Dioscorides' remedy was slightly different, with the victim consuming the dog's roasted liver and wearing its tooth as an amulet (Quave and Peironi 2013, 308).

Using examples from other countries, this chapter has highlighted how common the consumption of animal ingredients is in zootherapy. The distinction between substances eaten specifically as medicines and those which are consumed as part of an ordinary diet can be a blurry one, and perhaps making any such distinction in the first place is unnecessary as both aim to fulfil the same purpose of providing good health. Still, the distinction is made by researchers like Ceríaco (2013). Of the 226 remedies recorded in his Table 15.1, 9.3% are viewed as medicinal food. This category is not simply medicines which are eaten; an earthworm, for instance, can be eaten as a cure for jaundice, but Ceríaco labels this 'M' for 'medicine' rather than 'MF' for 'medicinal food' (Ceríaco 2013, 321). Pieroni *et al.* (2002) also distinguish their catalogue of medicines by 'food' or 'non-food', with a column in their Table 1 identifying the two. Of the 37 animal remedies recorded from the Lucca and Pistoia provinces in Italy, they judged 14 of them to be 'food-medicines' (2002, Table 1). Food and its consumption are clearly an important aspect of zootherapy.

## 2.8 UK

Thus far, this chapter has shown that a wealth of zootherapeutic practices exist across the globe. Traditional medicines and zootherapy also exist in the UK, although they are less widely known than in countries like China or India. A lack of awareness of CAM in the UK may stem from reluctance to discuss it; Thomas and Coleman found that 52% of the CAM users in their survey had not told their GP that they had used CAM in the past year (2004, 152). Any assumption that CAM is only used by those who lack the UK's high level of education should be questioned. Bishop and Lewith's review of

CAM studies in the US, Canada, UK, Australia, Israel, Turkey, Scandinavian countries, Asian countries and South Africa suggests that CAM treatments are actually more common amongst the well-educated (2010, 15).

Zootherapy in the modern age is not new. Pig heart valves, to name one example, have been used since the 1960s to replace faulty heart valves in humans (Hilal and Erikson 1981, 48), and the first pig-to-human heart transplant was recently performed in America (Sade and Mukherjee 2022). The idea of zootherapy in the UK may conjure up visions of the sorts of medicines in Walker's *How to Cure the Plague & Other Curious Remedies* (2013): blood-sucking leeches, drinkable concoctions made of boiled cockerels or powdered fox lungs, and various animal parts bound to the skin are all cures which can be found within its pages. However, these remedies are not as distant from modern medicine as one might imagine. Invertebrates have seen a revival in use, with leeches used in some plastic surgeries to salvage blood flow in tissues (Whitaker *et al.* 2004), and maggots applied to wounds and ulcers to clear necrotic flesh (Courtenay 1999). Powdered fox lungs might have fallen out of fashion, but chicken soup is eaten as a cure for colds (Al-Haddad *et al*. 2016)), and bandaging up wounds with animal parts has proved very successful in the case of burns. Patients with extensive burns may not be able to use grafts of their own skin to temporarily cover the damage, and skin from other humans or pigs have their own health and ethical problems. Instead, Alam and Jeffrey (2019) used the skin of the Atlantic cod to treat the burns of 10 patients in Birmingham's Queen Elizabeth Hospital (Figure 6).

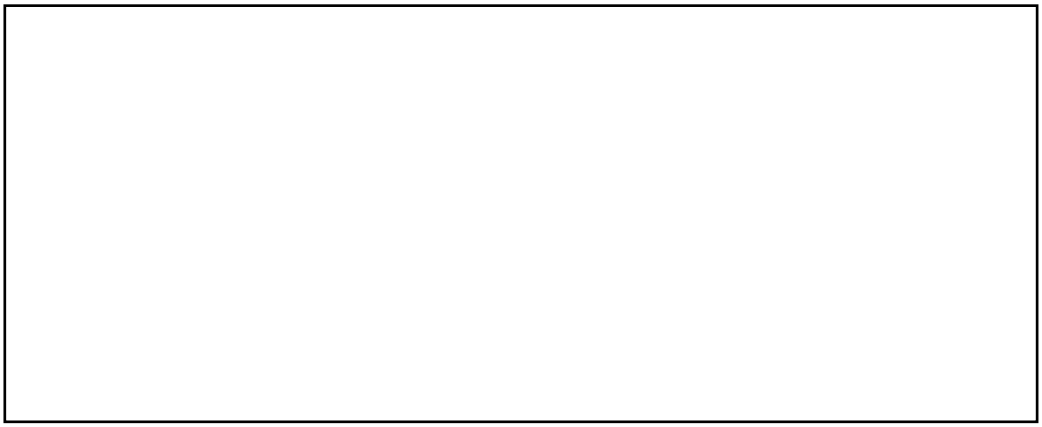


*Figure 6: The recovery of a burnt thumb showing the initial burn, the first application of fish skin, the burn after a week of healing (and prior to the reapplication of fish skin) and the burn after two weeks (Alam and Jeffrey 2019, fig. 4).*

The skin was soaked in saline and then applied to the burn, and the whole area was wrapped in dry gauze. This dressing was changed every few days. Although only a very small study, there were promising results: none of the wounds became infected, the fish skin was easy to apply, and the healed skin showed minimal scarring and discolouration. Research has shown that fish skin grafts can also be used on ulcers and other wounds (Fiakos *et al.* 2020).

Just as in the zootherapy of the other countries discussed above, live animals can also be used in UK medicine. In animal-assisted therapy, animals are used to treat both psychological disorders and physical weaknesses. This can take place in a hospital setting or in the patient's own home. Dogs are the most common animals used, and mental health concerns are the most treated illness, but physical illnesses can be treated too; for example, playing fetch with a dog or brushing a cat can improve muscle strength and fine motor skills (Nimer and Lundahl 2007). Animals can also have a positive effect on people's health even when they do not fall under the heading of 'medicine'. A study in April 2020 – conducted at the height of UK Covid-19 lockdown – found that people with a companion animal experienced a lesser increase in loneliness and poor mental health (Ratschen *et al.* 2020). Most people are unlikely to consider pet ownership a type of medicine, just as they may not view certain supplements or foods as particularly zootherapeutic. But many people take honey to soothe a sore throat, or buy products from companies like Holland and Barrett to either improve their health or prevent illness occurring in the first place. The Holland and Barrett website has a range of products which contain honey or fish oil (Holland and Barrett, n.d.a., n.d.b), much the same as the Forever Living products used by Nigerians in Ezeome and Anarado's (2007) study. Dairy products like yoghurt are eaten not just for enjoyment, but because they are known to contain calcium which strengthens bones (McKinley 2005). In this way, people in the UK engage in zootherapeutic practices far more than they may realise**.**

## 2.9 Conclusion

By giving a brief overview of zootherapy in several different countries and communities, this chapter has demonstrated that a wide understanding of zootherapy is relevant. From the more structured

systems of Traditional Chinese Medicine and Ayurveda through to the folk medicine of Europe, zootherapy remains an important form of treatment to many. It has also highlighted certain similarities between the zootherapies of different countries; consumption of the animal part, particularly in tea, is very common. Burning, scraping or grinding materials to a powder are common methods of preparing the medicines to be administered in food and drink. From an archaeological perspective, it is important to be aware of these methods. While the powder itself is highly unlikely to be preserved in the archaeological record, evidence of hard biological substances such as bones, shells or antlers being burnt or scraped could indicate ancient zootherapeutic practices (for example, Miller and Sykes 2016, 264). Re-evaluating evidence of consumption could also provide new evidence of suspected zootherapy. Similarly, the topical application of animal fats is another common remedy, so it may be profitable to investigate biological residues in vessels. Aspects of ritual and sacrifice can also play a role in zootherapy, so a review of Roman sacred spaces – especially those already known as healing sanctuaries – will be conducted. The use of animals in medicine is so common in the modern age, often with reference to much earlier origins, that one would expect to see similar practices occurring in the past.

# 3 Roman Medicine

## 3.1 Introduction

This chapter will review our existing knowledge of Roman medicine and highlight the lack of attention paid to zootherapy in current discussions. It will begin by exploring the origins of Roman medicine in Hippocratic medicine, and how authors like Galen and Pliny have contributed to our understanding of Roman medical practice. The intersection of medicine, religion and magic will also be investigated. This chapter will then review how evidence from anatomical votives, artistic representations, certain contexts, surgical tools, and medicines can be used to infer healing activity.

## 3.2 Ancient authors and medical texts

Roman medicine was partly influenced by Greek medicine, including one of its most famous physicians – Hippocrates, the so-called Father of Medicine (Cruse 2004, 10; van der Eijk 2011, 21; Nutton 2013, 71). The Hippocratic Corpus comprises around 60 works in Ionic Greek from c.530 BC to c. 330 BC, and it is likely that the texts were first assembled in the Ptolemies' library at Alexandria around 250 BC (Cruse 2004, 39; Nutton 2013, 61). Which texts were authored by Hippocrates himself and which were written by contemporaries is unclear (Craik 2018, 29), but what is certain is that the Hippocratic texts had a strong influence on Roman medicine. The foundation provided by Greek medicine can be seen in works like those of Celsus (25 BC-AD 50). A Roman encyclopaedist who preserved knowledge of classical Greek medicine in his *De Medicina* (Lawrence 1993, 963), Celsus covers dietic medicine, prophylaxis, disease, pharmacology and surgery (Jackson 1988, 8). The Greek physicians Dioscorides (c. AD 40-90) and Soranus of Ephesus (c. 100 AD) are similarly informative on the subject of Roman medicine: Dioscorides' *De Materia Medica* is a useful source for Roman pharmaceuticals, and Soranus made prominent contributions to the field of gynaecology. Additionally, Cato the Elder (234-149 BC) – though better known for his agricultural writings – can be useful for understanding Roman medicine in the Republic through the context of diet (Scarborough 1969, 54; Cruse 2004, 59).

One of the most important ancient authors in terms of understanding the role of animals in Roman medicine is Pliny the Elder (c. AD 23-79). A polymath rather than a physician, he is rarely

afforded much interest by modern scholars of Roman medicine, especially compared to the likes of Galen (for example, see Cruse 2004). This is unfortunate because Pliny wrote extensively on the medical effects of plants, animals and minerals, with books 28-32 of his *Natural History* focusing specifically on animal-related remedies (Scarborough 2010). Pliny himself may not have been a medical practitioner, but this does not devalue his contribution to our understanding of Roman medicine, particularly the kind of medicine performed by people in their homes. It may be that less attention is paid to Pliny's writings because they have been relegated to the category of 'low' medicine. With practical advice and content which focuses on remedies rather than an understanding of the body's systems, Pliny's work has been viewed as a type of 'folk medicine' which is overshadowed by the more theory-rich texts of professional physicians like Galen (Fagan 1999, 100; Draycott 2011, 3).

Pliny's *Natural History* is especially pertinent to this dissertation because it is packed with prescriptions containing animals, their parts, and their products as ingredients (Thumiger 2021, 100). Just as in the modern cures explored in chapter 2, there were a myriad of ways in which animals could be used. Again, ingesting the recipes appears to be the most frequently used method, with grinding or burning used to make the ingredient digestible. Milk, honey and eggs remained common. There are both curative remedies and prophylactic treatments. An application of fox fat was recommended for sores on the scalp, for instance, while wearing an amulet of hyena bone marrow would prevent hallucinations (Plin. *H.N*. XXVIII.XLVI; XXVIII.XXVII). Some treatments would have been widely accessible and simple to perform, such as inserting goat urine-soaked wool into the ears to cure earache, or drinking cow's milk in cases of consumption (Plin. *H.N.* XXVIII.XLVIII*;* XXVIII.XXXIII). Others posed more of a challenge to patients, who might perhaps have preferred to suffer their illness rather than risk their health further in preparing a cure – one remedy for gout involved taking a wolf and boiling it alive in oil, which cannot have been an easy task (Plin. *H.N*. XXVIII.LXII).

We cannot know how closely the advice of Pliny and other authors was followed, especially when one considers that they were writing with different motivations, and not solely with the health

of a patient in mind. One of the reasons Pliny wrote was to encourage Romans to return to a simpler lifestyle and shun the medicine of the Greek physicians (French 1994, 196 and 247). It should also be remembered that most of these authors came from and were writing for the upper classes. It is likely that there are numerous remedies used by other members of society which have not been preserved in these writings, and there may be several cures recorded here which in reality saw little use – there cannot have been many, after all, who had access to elephant ivory shavings to mix into their honey as a blemish remover (Plin. *H.N*. XXVIII.XXIV). Additionally, as with so many other aspects of the Roman world, the Empire was not homogenous, and the medical treatments used would have depended on availability of ingredients, wealth, access to knowledge, and existing local customs. However, Garnsey warns against taking too critical a view of the textual sources (Garnsey 1999, 54). These treatments did not spring from a vacuum, and would have reflected what the medical authors were seeing and experiencing.

Useful as Pliny's work is to the modern scholar, it did not impact Roman medicine as much as that of Galen of Pergamon (129-216 AD). The so-called "Prince of Physicians" (van der Eijk 2011, 21), Galen has been described as "the leading Roman authority on medicine" (Davies 1970, 101). Born in the Eastern Greek world, he studied at Alexandria before practising medicine in Rome, eventually becoming physician to the emperors in 169 AD (King 2001). With his work influencing medicine as recently as the nineteenth century, it is difficult to downplay the impact of Galen's work and legacy (van der Eijk 2011, 21). However, it should be remembered that Galen's self-promotion has resulted in a rather Galen-centric view of Roman medicine in which his writings dominate over those of his marginalised rivals (van der Eijk 2011, 28).

Galen's concept of medicine and the body adopted the Hippocratic theory of the four humours, one of the most contradictory topics in the collection of Hippocratic texts (Cruse 2004, 40). Human health was believed to rely on the four fluids – or humours – of the body, each with its own characteristics. Blood was considered to be hot and wet; phlegm, cold and wet; black bile, cold and dry; and yellow bile was hot and dry (Jones *et al*. 2016). The combined work of the Hippocratic

authors, Galen, and their various contemporaries and successors linked the humours of the body with the elements of the universe to create one interconnected system (King 2001, 42). The cosmos and all physical matter were thought to be composed of four elements each with its own particular attributes: earth was cold and dry, water was cold and wet, air was hot and wet, and fire was hot and dry (Jones *et al.* 2016, 177). Based on the view that the human body acted as a microcosm to the universe's macrocosm, the four elements of the cosmos were reflected in the four humours of the body. Black bile was linked to earth, phlegm to water, blood to air and yellow bile to fire, with each humour exhibiting the same characteristics as its corresponding element. The humours varied according to individuals and their point in the life course, which was linked to the seasons (Figure 7)**.**

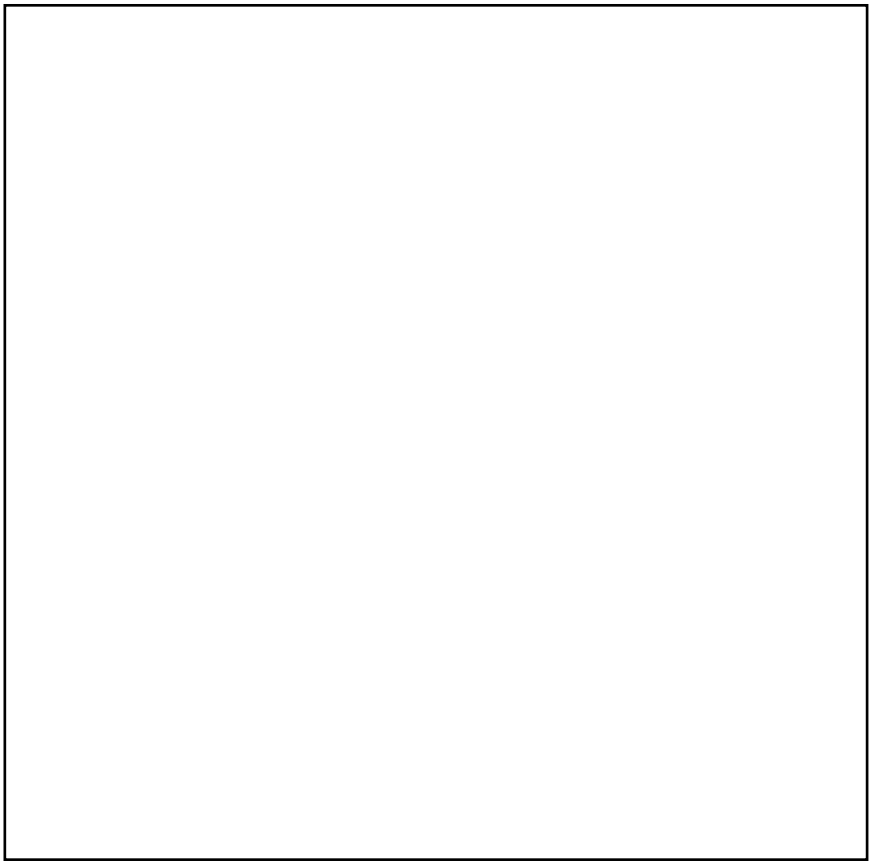


*Figure 7: A diagram showing how the elements, humours, cardinal points, life stages and seasons were linked to each other (Jones et al. 2016, fig. 2).*

Warm, wet infants – who bore the lingering characteristics of their mother's womb – were equated with the equally warm, wet and fertile spring. Young adults were linked to warm, dry summer; more mature adults to cold, dry autumn; and the elderly to cold, wet winter (Jouanna 2012, 339; Jones *et al.* 2016). In this way, a person was inextricably linked with the environment around them and the

Earth as a whole. Humoral theory is not unique to the Greeks and Romans, and chapter 2 has already demonstrated that similar theories exist around the globe (for example, in Chinese Traditional Medicine and in Ayurveda). Nutton writes that the "few" similarities between ancient Mediterranean humoralism and that of ancient Asia "may well be fortuitous" (1993, 281). However, with some similarities in medicine between the two places – as in the case of the 'spotty' deer (see Miller and Sykes 2016, 269) – this view may benefit from a fresh approach in the future. In any case, humoral theory was certainly a key part of Roman medicine.

## 3.3 Medicine and food

For Galen and his contemporaries, dealing with illness was often a case of identifying the unbalanced humours and acting accordingly to restore them. Ill health occurred when the balance of a person's humours was upset; a patient with a winter cold and a runny nose, for instance, was thought to be suffering from an excess of cold wet phlegm (Hippoc. *VM,* XVIII; Baker 2013, 112). To maintain a healthy balance of humours, a person should carefully regulate their diet, exercise and lifestyle (Wilson 1993, 382; King 2001, 43). Diet was particularly important because foods had their own differing qualities of hot/cold and wet/dry, so could affect the temperature and moisture of the body (Thumiger 2021, 95). The Roman categories of "food" – sustenance for survival – and "drug" – a substance for healing or prophylaxis – are difficult to distinguish from each other, and perhaps it would be wrong to do so. A poor understanding of how food and medicine intersect can cause evidence of the latter to be overlooked, and this will be discussed in more detail in chapter 4**.** In terms of zootherapy, meat and edible animal products that are traditionally viewed as food should also be considered from a medical perspective. Researchers should be careful about designating evidence for consumption as strictly food or medicine when the two are so closely linked. As Garnsey puts it, "food was thought of as medicine" (1999, 45).

## 3.4 Medicine and magic

The overlap between food and medicine demonstrates that Roman medicine is a complex and multifaceted affair. This complexity continues when it comes to distinguishing between medicine,

magic, and religion. Magic and religion both have supernatural elements which contradict the modern, 'Western' perception of medicine, but they played important roles in health and healing in the ancient world (Gregory 2016; Petridou 2016). Magic itself is difficult to define because definitions change according to context – indeed, Gregory refuses to provide a definition of magic at all, instead pointing out that the Romans themselves had no consistent definition of the term (2016, 518). Pliny describes magic as "detestable, vain, and idle" (Plin. *H.N.* XXX.VI) and is scathing of the Magi's cures**,** yet many of the remedies he dismisses are indistinguishable in nature from those he recommends. Take, for example, his description of the Magi treating malaria by fixing a patient's fingernail cuttings to another man's door – this he shuns, yet in the very next sentence, he advises using fingernails and ants to create an amulet which will cure the disease (Plin. *H.N.* XXVIII.XXIII). Many of Pliny's remedies reflect the concept of sympathetic magic, an idea which is discussed in detail in Frazer's *The Golden Bough* (originally published 1890). Frazer divides sympathetic magic into homeopathic magic, where "like produces like" (Frazer 1994, 26), and contagious magic, where contact between two objects imbues one with the other's qualities (Frazer 1994, 27).

Examples of both can be seen in Pliny's *Natural History*, despite his suspicion of magic. For instance, one of his many remedies for toothache requires the painful tooth of the patient to be touched with the corresponding tooth from a hyena (Plin. *H.N.* XXVIII.XXVII). This follows the homeopathic principle that like affects like, and perhaps functions on the idea that the hyena tooth is capable of drawing ill health from the patient's tooth because they are similar in form. In terms of contagious magic, Pliny recommends wearing an amulet of wolf tooth or wolf skin to prevent "childish terrors" in babies (Plin. *H.N.* XXVIII.LXXVIII), possibly because of the animal's protective role in the Romulus and Remus founding myth, or perhaps because of their fierceness as a predator. From these and many other remedies found in Pliny, it is apparent that he saw magic and medicine as a grey zone rather than discrete categories. Therefore, animal-shaped or animal-derived amulets – though not usually viewed as 'medicine' today – may prove to be profitable areas of study in this dissertation's exploration of animals in Roman medicine**.**

The overlap between medicine, magic and religion has been acknowledged by authors past and present; as Janowitz (2001, 16) writes, "Pliny did not even hint at a distinction between magical and religious cures; this distinction carries no valence for him." Yet as this dissertation has shown, Pliny *did* attempt to distinguish between some kinds of magical cures, even if his distinctions were then unclear. It follows that researchers should be mindful of the dangers of attempting to place cures into different categories, especially categories conceived from a modern viewpoint. An openess to the interpretation of medicine in a variety of contexts will be key in furthering our understanding of how animals were involved. One man's magic could have been another man's medicine, and both should be recognised as valid interpretations.

## 3.5 Medicine and religion

The boundary between medicine and religion is similarly hazy. The Romans, like many other societies throughout history, generally believed that the gods had power over human wellbeing, and could bestow health or cause disease (Petridou 2016, 533). Petridou notes that literary, epigraphic and archaeological evidence all indicate a "close correlation between secular and temple medicine" (2016, 534). There was no opposition between temple medicine and Hippocratic medicine; indeed, Horstmanshoff (2004) views temple medicine as integral to Greek medicine, a view which could just as readily be applied to Roman medicine. The Romans recognised a variety of healing gods. Apollo, Asclepius, Isis and Serapis originated in the Greek and Egyptian parts of the Empire. Mystery cults like that of Mithras and of Cybele, a fertility goddess with the ability to cause or cure disease, were also popular. Other deities had more precise spheres of influence, such as Dea Febris, goddess of fever, or Partula, goddess of childbirth. There are over 100 healing shrines known in Italy alone; many linked to Asclepius, but also to other deities (Cruse 2004, 109-110). Plutarch notes that such temples were usually built in high, airy spaces (Plut. *Quaest. Rom.* 94), and water was a key feature of Asclepius' cult in particular. Just as bathing was thought to be hygienic and healthy in the Roman world, so too was the cleansing water found at temples and sanctuaries (Israelowich 2021). The poetic and musical performances which occurred at such sanctuaries were not only for honouring

the gods, but had their own therapeutic properties (Melfi 2010, 334). Another important aspect of temple medicine was sleep, or 'incubation'. This healing sleep allowed patient and god to commune, and the required treatment would be communicated in a dream (Melfi 2010, 318; Mylonopoulos 2012; Petridou 2016, 535). Animals would have been present in temples and cult spaces in the form of sacrifices and food, but also as symbols (such as the snake-entwined Staff of Asclepius) (Figure 8) and as bestowers of health in their own right; the licks of both snakes and dogs were thought to have curative properties (Cruse 2004, 136; Thumiger 2021, 111).

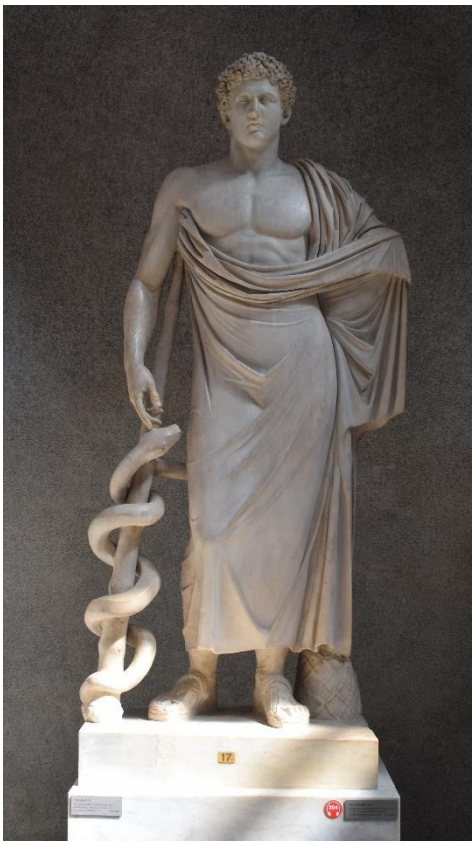


*Figure 8: Statue of Asclepius with his staff and snake, believed to be a 2nd century AD Roman copy after a 4th century BC Greek original. Currently on display in the Vatican Museums. (Photo by the author).*

The role that temples, sanctuaries, and other places of religion played in medicine was an important one, and so animal material from such sites should be reassessed in terms of possible medical interpretations. However, it is also important to be aware that gaining medical help from the gods could be woven into everyday ritual activity (Flemming 2021, 162), and it may be challenging for the archaeologist to connect material culture with religious healing if it is not associated with an overtly religious site.

## 3.6 Medicine and anatomical votives

Anatomical votives provide further insight into Roman healing activity. These take the form of a variety of human body parts, from hands and feet to genitalia and wombs, and are often deposited in water, though some have holes which suggest they were mounted for public display (Figure 9).

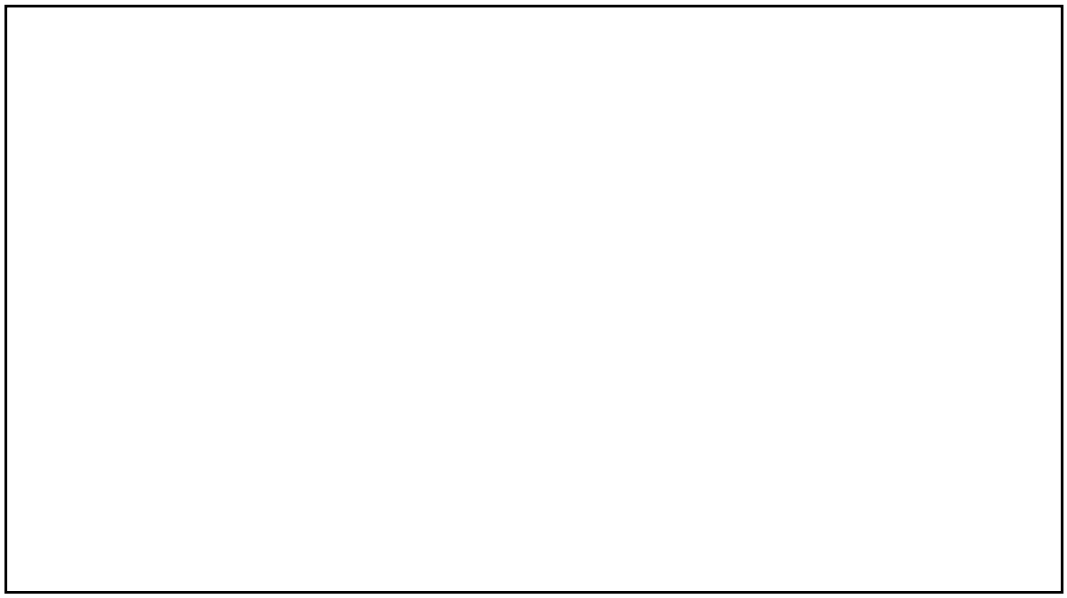


*Figure 9: 3rd/2nd century BC terracotta votives from a healing deity shrine at Ponte di Nona, 9 miles east of Rome. They represent a womb, a foot, a breast, an eye, ears, a hand, and male genitalia (Warrior 2006, fig.19).*

In Italy, the practice of depositing anatomical votives had largely died out by the end of the Republican period (Cruse 2004, 115). The precise meaning of the individual objects can be unclear (Schörner 2015, 399). Take the foot, for example – does it illustrate a plea for relief from a twisted ankle, or a blister on the heel, or a thorn in the sole? Perhaps it represents a desire to walk more steadily, or indicates walking in a wider sense, such as trespassing. Or perhaps it is not a plea from a sufferer, but a token of thanks from a satisfied patient. In other words, in the rather transactional world of Roman religion, it is difficult to distinguish a votive object (that is, an object which could represent both a request for aid or thanks for aid received, though the former is more likely) from an ex-voto (a gift to the deity for aid already received) (Cruse 2004, 111). Occasionally anatomical votives are depicted with deformities and symptoms, while others appear to have had a secondary use. Schörner describes hollow uterus models from Republican Central Italy could be used as rattles thanks to the addition of a small clay ball (2015, 403). It may be that the ball was also intended to symbolise a foetus inside the womb, and so shaking the rattle would encourage or celebrate the

movement of the child. Statuettes of animals and animal parts have also frequently been found alongside human votives (Söderlind 2002, 278), and Schörner suggests that this reflects the intertwining of human and animal health problems and treatments (2015, 407). The possible zootherapeutic properties of animal votives will be discussed further in chapter 4.

## 3.7 Medicine and art

Another source of evidence for Roman medicine can be found in art. The practising physician can be seen in various settings, from wall paintings to tombstones. Figure 10 depicts an episode from the Aeneid in which Aeneas, after being wounded by Turnus, received attention from both the doctor Iapyx and the goddess Venus (Niscoll 2001, 191).

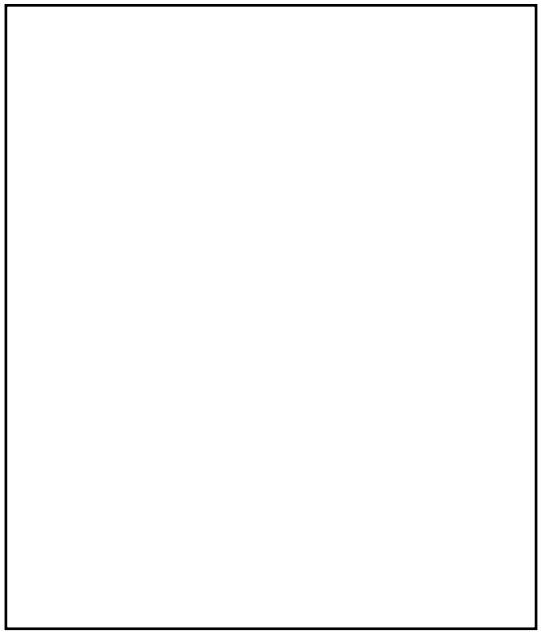


*Figure 10: A wall painting from the House of Siricius in Pompeii depicting Iapyx tending to Aeneas (Le Blay 2016, fig. 23.1).*

Suregon's tool in hand, Iapyx is shown paying careful attention to Aeneas' injury, and although the setting is mythological, the soldiers in the background strengthen the links between medicine and the military. In another example, a physician is shown reading from a medical scroll in front of an open cabinet (Figure 11).

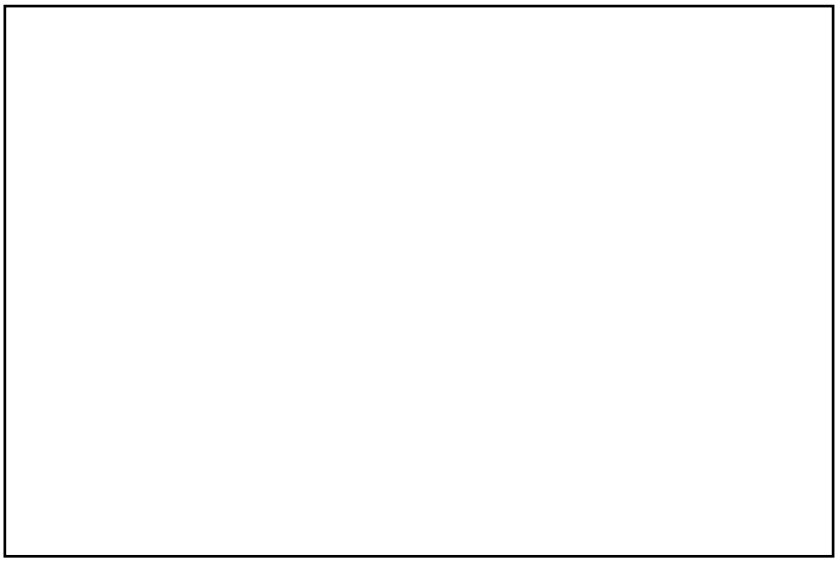


*Figure 11: A marble sarcophagus from Ostia decorated with a scene showing a physician reading a scroll in front of his medical equipment. Stacked scrolls and a bowl can be seen inside the cabinet, while the open box on top displays a set of surgical instruments (Jackson 1988, fig. 17).*

On the top of the cabinet, a hinged box stands open to display a set of surgcial instruments (Jackson 1988, 73). Such depictions illustrate how the Roman perception of the physician had progressed. Initially, physicians were viewed with wariness – as Pliny put it, "only a physician can commit homicide with complete impunity" (Plin. *H.N.* XXIX.V) but this suspicion and outright dislike of Greek physicans developed into respect for the medic. Even women were commemorated as medical practitioners, though it is likely that most were restricted to treating female diseases (Jackson 1988, 86).

The representation of Roman medicine in art does not appear to extend to animals. Aside from images of healing gods with their associated animals, there is a conspicuous lack of Roman zootherapy imagery. In Baker's (2016) assessment of images of doctors, not one of the 5 Roman images contained reference to an animal; all the physicians were recognised as such by their surgical implements. Perhaps the absence of zootherapy in art reflects a difference in perception between the divine healing bestowed by the likes of Asclepius and the more rough-and-ready, 'country' medicine recommended by Pliny the Elder.

## 3.8 Roman patients

As for the patients themselves, palaeopathology can provide insights into their experiences. Evidence of surgery can be seen in remains like those from Cirencester, where trepanned skulls

exhibit some degree of healing, and researchers believe the individuals would have survived for a few weeks after the operation took place (Tullo 2010, 166). An even more fortunate individual from Foggia, Italy, is thought to have survived for several years after undergoing trephination, perhaps because, unlike the Cirencester skulls, there is no evidence of separate injury (Scattarella *et al.* 1996). Lucky amputees might be able to find support in prosthetic limbs like the copper and wood leg from Capri, Italy (c. 300 BC) (Thurston 2007). Pliny recounts how the general Marcus Sergius was able to capture enemy camps, raise sieges, and become praetor after replacing the hand he had lost in battle with a hand of iron (Plin. *H.N.* VII.XXVIII). Trephination and prosthetic limbs are just two instances of evidence which show Roman medical intervention. Evidence for intervention in the form of animals, their parts and their products will be discussed further in chapter 4.

## 3.9 Medical instruments

Additionally, the presence of a physician's kit is a good indicator of medical activity. For instance, the House of the Surgeon in Pompeii is so named because of a deposit of surgical tools found in one of the rooms (Mau 1902, 280). Unfortunately, the building was uncovered when excavation techniques were more rudimentary than they are today, and the exact position of the instruments was not recorded. Similary, as the method of injecting plaster into cavities in the ash was not yet in use, any evidence from wooden tools or other organic materials has been lost. Nevertheless, the building has been interpreted as a private residence in which a physician treated patients (Jackson 1988, 66). With no indications of which room might have acted as a surgery, it may be best not to place too much faith on this interpretation. Physicians did have their own surgeries (for example, Plin. *H.N*. XXIX.VI) but they also travelled to attend patients, particularly when the patient in question was in the upper classes of society (Jackson 1988, 65)**.** Thus the presence of the instruments in the Pompeiian house do imply the presence of a physician, but not necessarily a physician's practice. More convincing is the surgeon's house at Rimini with its vases for medicinal herbs and bundles of over 150 medical tools (Gerrie 2008). However, Baker points out that as ancient sources do not provide a clear descprition of healing spaces, they were probably not standardised, and a desire to

label specific structures or even rooms as surgeries or hospitals can be both difficult and unhelpful to understanding Roman practice (2013, 113).

That said, there are some military structures which are associated with medical use. Soldiers were stationed in legionary fortresses or auxiliary forts which often included a *valetudinarium* – a form of military infirmary – for the injured or sick. These were usually rectangular buildings with a courtyard in the middle and rooms opening off a corridor (Figure 12).

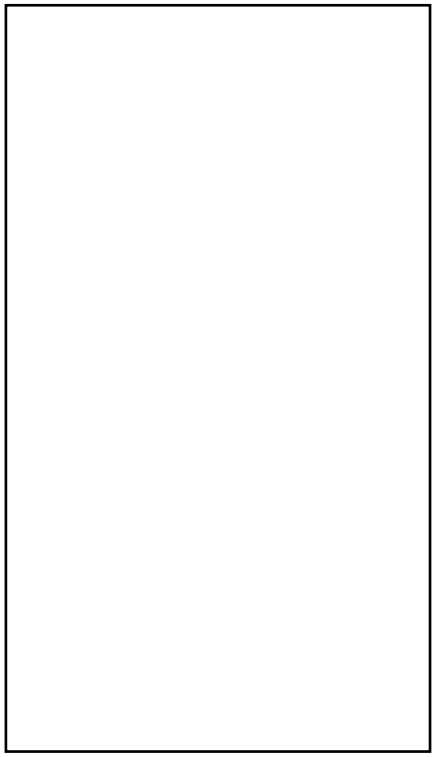


*Figure 12: Plan of the valetudinarium at Novaesium, Germany, built from stone in c. AD 50 and measuring 50m x 89m. Note the courtyard and the small rooms opening off the long corridor (Nutton 2004, 180).*

The larger rooms of such buildings may have served as operating theatres, storerooms and kitchens, with sick soldiers sleeping in the smaller rooms off the corridors. Physicians like the medical orderly (or *medicus ordinarius*) Anicis Ingenuus at Housteads fort in Britain would have been stationed at the *valetudinaria* to treat illnesses and battle wounds (Allason-Jones 1999, 133). For example, Celsus describes how missiles lodged in the body should be extracted with the Spoon of Diocles (Celsus *Med.* VI.3; Majno 1975, 359; Karger *et al*. 2001).

The Spoon of Diocles was just one of the many implements the physician had at their disposal. Celsus divides the art of medicine into three areas: “that which cures through diet, another

through medicaments, and the third by the hand" (Celsus *Med.* I prooemium). In his descriptions of surgical procedures, Celsus mentions various different surgical tools; take, for example, his explanation of treating urine retention in which he mentions bronze catheters of different sizes and shapes to suit different patients, and scalpels and ear scoops for if more invasive intervention is necessary (Celsus *Med.* VI.26). Such texts paint a detailed picture of the surgeon's craft, but even more compelling are the material remains themselves.

A full physician's kit could be extensive, as illustrated by one of unknown provenance from Italy (Figure 13).

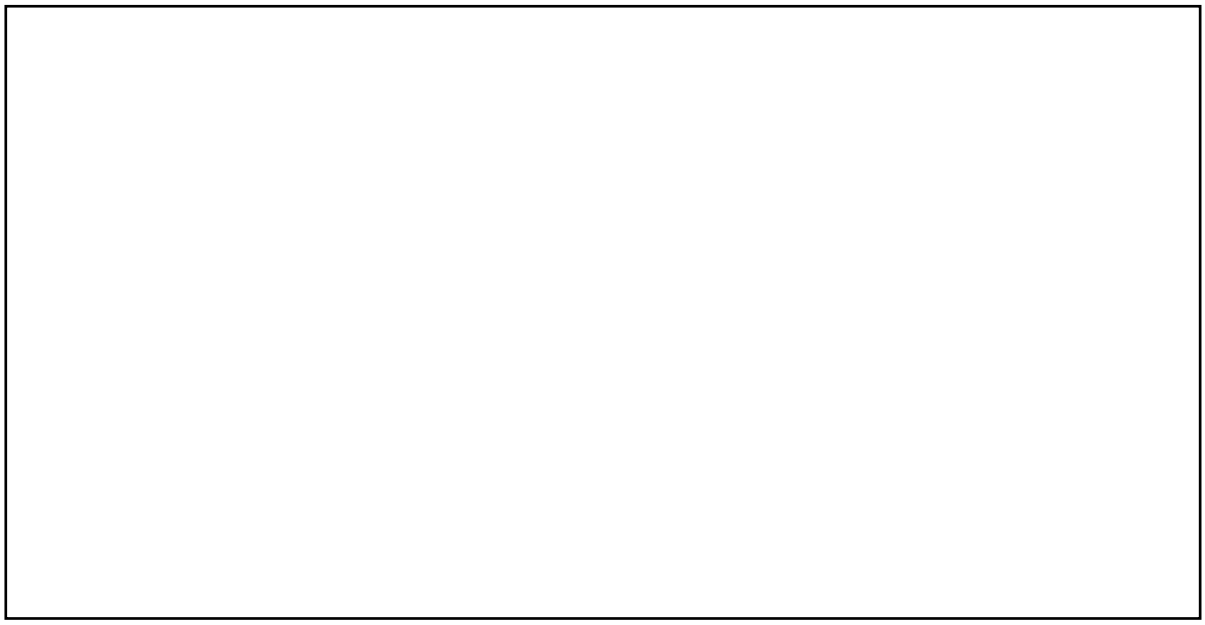


*Figure 13: Roman physician's kit from Italy containing catheters (a), an anal speculum (b), a set of four cylindrical stacking boxes (c), smaller cylindrical box (d), spatulae (e), spoon (f), probes, scoops (g), cataract needle (h), needle/cautery holder (i) forceps (j), sharp hooks (k) double blunt hook (l), bone chisels (m), stone palette (n), cautery (o), stylus (p), folding knife (q) and scalpels (r) (adapted from Jackson 1986, Plate XI).*

Containing metal instruments to cut, scoop, and probe, as well as an unusual set of stacking medication boxes, the collection illustrates the broad range of tools available to some physicians (Jackson 1986). As medical authors were not always precise in their descriptions of equipment, the identification of objects relies to a certain extent on comparisons with modern medical tools (Baker 2021, 124), and it should be remembered that their original owners may not have used them in the ways identified by Jackson (1986) (who does not explain his identification methods). Items in the

physician's kits were not exclusive to physicians or to medical use; some are also found as personal toilet and cosmetic items.

Even though surgery might appear to be one of the most anthropocentric areas of medicine, animals were still involved. Some surgical instruments were made from organic material which is less likely to be preserved in the archaeological record. One rare example of a tool made from animal material is the short, straight bone catheter from Roman Anatolia (Güner *et al*. 2019) (Figure 14).

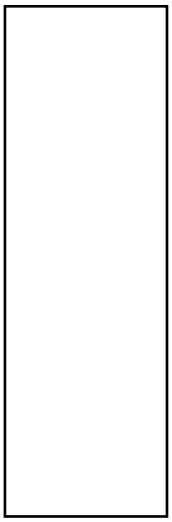


*Figure 14: Bone catheter (125.4mm in length) from Roman Anatolia, currently displayed in the Private Museum of Haluk Perek in Istanbul (Güner et al. 2019, fig. 1).*

Whether the bone was used because it was an easily available material or because of certain associations with the animal it originated from is not discussed by the researchers. Knowing the source of the bone could give further insight into the connections between animals and medicine, as it may be that particular species were chosen because of their connections to healing.

## 3.10 Physical medicines

The boxes found in the Italian kit (shown in stacked form in Figure 13), which still contain remnants of a powdery substance (Jackson 1986, 159), hint at the drugs and medicaments available to physicians. Dioscorides' guidance on drug storage provides further insight into the boxes; flowers and seeds could be protectively wrapped in papyrus or leaves and stored in limewood boxes, while animal fats and marrows should be kept in tin containers (Jackson 1988, 74). In Pompeii, the remains of bottles and jars alongside medical equipment suggest the presence of *tabernae medica*, a medical

surgery and shop (Jackson 1988, 66)**.** Plant, animal and mineral products were used to create a vast array of cures and treatments like the kind recorded in Pliny's *Natural History.* Physicians – or indeed, anyone with access to the right materials **–** could produce a range of medicaments, from fish glue for sealing wounds (Scarborough 2015) to *collyria* for cleaning the eyes (Baker 2011, 164), all by using a mixture of plant, animal and mineral materials. Both professional physicians and the *pater familias* would have been familiar with various recipes; the *pater familas* with the kind found in Pliny's *Natural History*, passed down through the family, and the physician with those detailed in medical texts and perhaps involving more exotic substances.

Ingredients usually required some sort of processing before they could be administered as a drug, and this often took the form of boiling, smoking, or grinding (Jones-Lewis 2016, 507). Some recipes were relatively simple, while others – like the panacea *theriac* – required many ingredients and years of maturation, something Pliny is particularly disimissive of (Plin. *H.N.* XXIX.III). Oral medicines could be eaten, drunk as teas, or taken as a lozenge or pill, with honey acting as a common base in the form of *hydromel* (water and honey) or *oxymel* (water, honey, vinegar and salt) (Thumiger 2021, 97) (Plin. *H.N.* XIV.XX-XXI). Medicines could also be applied through topical ointments, washes, pessaries, suppositories and even fumigation, in which smoke from burning ingredients was inhaled or channelled into various orifices (Jones-Lewis 2016, 509). The preparation tools, storage containers, and the contents of vessels will be explored further in chapter 4**.** While animal ingredients were just as important as the others used, it is the plant ingredients which receive most of the attention from modern researchers.

## 3.11 Conclusion

This chapter has demonstrated that Roman medicine is a diverse topic. Its origins in Hippocratic medicine and humoral theory have led to a blurring between the categories of food and medicine, while the use of temples and amulets point to overlaps with religion and magic. This chapter has also demonstrated that ancient texts, anatomical votives, artistic depictions, particular contexts, surgical tools and medicines are informative forms of evidence when it comes to understanding healing in

the Roman world. Despite a tendency for scholars to only touch upon the animal aspects of these forms of evidence, there are opportunities here for more in-depth research, such as animal-shaped votives or medicines made from animal products. Pliny is particularly clear on the importance of animal remedies, and now that the basics of Roman medicine have been outlined, the next chapter will explore Roman zootherapy in more depth.

# 4 Roman Zootherapy

## 4.1 Introduction

This dissertation has thus far established that animals are difficult to identify in our view of Roman medicine, despite the fact that ancient textual sources are clear on zootherapy's existence. This chapter will explore the areas in which animals *were* present in Roman medicine, and will begin to consider some of the archaeological evidence for these practices. Firstly, the roles of animals in healing spaces will be considered, and then the medical properties of animal amulets. The overlap between animals and food will also be reviewed, as will mortaria, medical residues, and the use of animals in human surgical equipment. This chapter will demonstrate that there is plenty of potential for Roman zootherapy.

## 4.2 Animals in healing spaces

Chapter 3 established an overlap between medicine and religion, and I will now explore this further in relation to animals. Live animals were present in temples, and some – especially dogs and snakes – were healers in their own right: both animals were associated with Asclepius, god of medicine, and their presence at Asclepions is demonstrated by cult imagery, texts and inscriptions. Asclepius was originally a mortal hero but following his deification he was recognised as the god of medicine and the son of Apollo, who also had healing powers (Wilcox 2003, 673). His most recognisable symbol is his staff and snake. Several myths exist to explain this, but the most popular tale relates that while examining the body of Glaukos – who had been killed by Zeus' thunderbolt – Asclepius was surprised by a snake that he then killed with his staff. When a second snake revived the dead one by placing herbs in its mouth, Asclepius took inspiration and restored Glaukos to life by the same method. Out of respect, the snake and staff subsequently became his emblem as the Staff of Asclepius (Wilcox 2003, 673).

According to Pausanias, the sanctuary at Epidaurus was adorned with a gold and ivory statue of the god with his animals. Asclepius was seated with a staff in one hand, a snake in the other and a dog lying by his side (Paus. II.XXVII), and although the original statue is now lost, its influence can be recognised in the design of the coin shown in Figure 15.

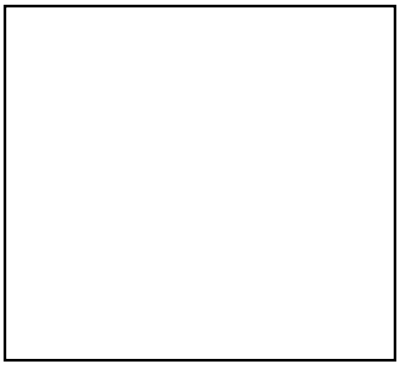


*Figure 15: Reverse silver coin of Epidaurus depicting a seated Asclepius with dog and snake. It is probably a copy of Thrasymedes' statue at Epidaurus (Paus. LOEB Plate 93).*

Serpents were viewed as either indicators of Asclepius' presence or zoomorphic manifestations of the god himself (Petridou 2014, 294). They and dogs were imbued with the healing powers of Asclepius, and at Epidaurus the cures they bestowed are recorded in inscriptions. A sleeping patient's ulcer was healed after being licked by a snake (Stivala 2020, 111), and the licks of dogs cured one boy of blindness and another of a growth on his neck (Serpell 2010, 22). Non-resident animals who were nonetheless present at the shrine also acted therapeutically; the bite of a goose cured gout, while even a venomous viper healed a suffering visitor (LiDonnici 1995, 119; Stivala 2020, 112)**.**

One wonders whether animals took on healing functions when outside temples, or whether their association with Asclepius was only recognised in the vicinity of healing sanctuaries. Did every interaction with a slobbery dog have the potential to heal, or did this only occur in recognised healing spaces? Knowledge of the association between dogs and healing could improve our understanding of the two dog figurines found in LLyws Awel, Wales (Figure 16).

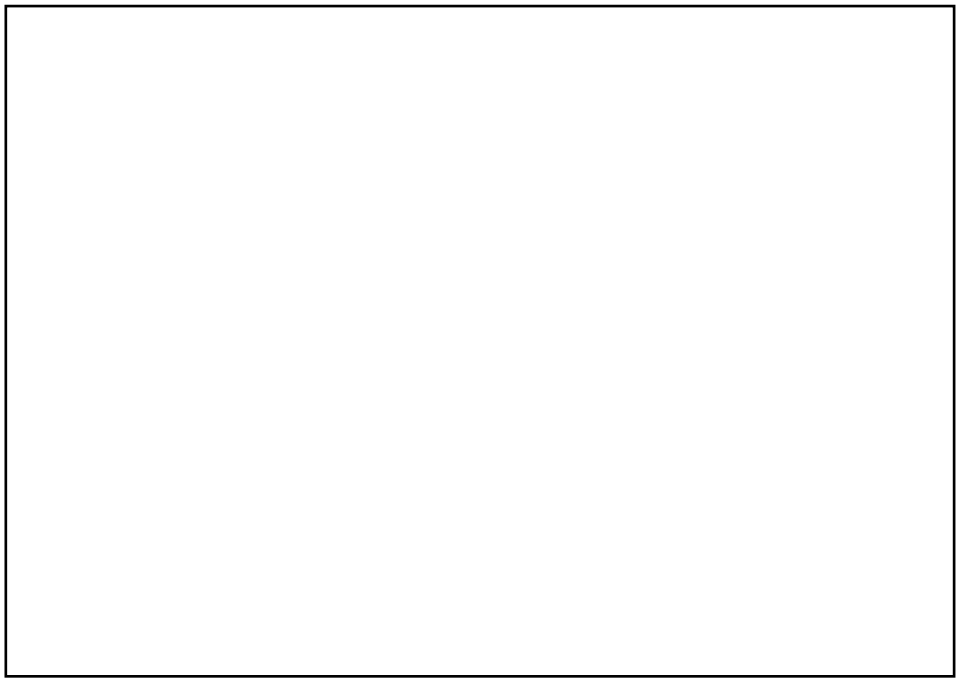


*Figure 16: Overhead and side view of two metal dog figurines from Llys Awel, Conwy. Fur is implied through incised cross-hatching and both display a protruding tongue (Durham 2014, fig. 10).*

With open jaws, ragged coats, and dorsal ridges, the figurines have been interpreted by Durham as "dog-monsters" (2014, 207). Durham touches on the canid connection to medicine but does not give this interpretation much weight. Yet the association between healing and dog licks is well-documented, and as both animals are shown with their tongues protruding, perhaps a medical interpretation should be given more consideration. In addition to dogs, various other animal species are present as figurines in sanctuaries. In Italy, the majority of these date to the 4$^{th}$-1$^{st}$ century BC, and include both domestic and wild animals. Human and animal votives frequently appear together in the same deposits and in the same sanctuaries, suggesting that they functioned in similar ways (Söderlind 2002, 278). The figurines can depict whole animals or, occasionally, animal body parts, just like the human body parts described in chapter 3. Söderlind suggests that the animal votives had religious, veterinary and sacrificial functions, but does not consider whether they might exist to serve human health needs – they are only considered in a veterinary capacity. Perhaps it is more likely that the animal figurines represent a desire to improve animal health just as the human votives represent a desire to improve human health. Alternatively, the animal votives may represent ingredients used in human remedies. Similarly, Ekroth questions the inclusion of 'unusual' faunal

remains in both Greek and Roman sanctuaries, stating that of animals like dogs, sea shells, snakes and wolves, "it is too simplistic to dismiss these remains as intrusions or rubbish, which has often been the case" (2014, 337). She asks how the unusual animals fit, wondering if they represent animal sacrifices or something else entirely, and this is a good opportunity to suggest a zootherapy interpretation.

In other spaces, unusual, unexpected and unexplained assemblages are sometimes explained away with the label "ritual", a divisive term which has been criticised in the past (Insoll 2004, 11; Sykes 2014, 115)**.** Some deposits that are assigned to the category of "ritual" could have medical explanations. This is something to consider in the case of deposits of oysters at the UK temple sites of Chanctonbury Ring, Lowbury Hill and Laymatt Beacon (King 2005). King interpreted the faunal remains from Chanctonbury Ring and Lowbury Hill as either evidence of ritual meals or a votive offerings (2005, 345)**.** In contrast, he found it difficult to determine the nature of the Laymatt Beacon deposit, stating "their significance as a possible ritual deposit could not be determined" (2005, 346). Justifications for different interpretations of seemingly similar evidence is not discussed. To move beyond the "ritual" explanation – especially as the reasoning for this is unclear – we could instead consider instead a medical interpretation. Oysters were known for their therapeutic properties and are prescribed in Pliny for complaints ranging from lost appetite and streaming colds to swellings and sores (*H.N.* XXXII.XXI)**.** Davies recorded the presence of oysters alongside eggs and meat at the *valetudinarium* at Novaesium (Neuss, Germany), and described the foods as a special diet for the sick (1970, 101). With this evidence in mind, it is possible that the oysters at the temple sites of Chanctonbury Ring, Lowbury Hill and Laymatt Beacon were used medicinally or involved in a healing rite.

Similarly, in Roman Britain, Serjeanston and Morris found that ravens and crows – which have also been found in several structured depositions of the Iron Age – are buried with puppies and dogs more often in the Roman period (2011, 96). Associated with prophecy, shape-shifting, magic and chthonic offerings (Serjeantson and Morris 2011), perhaps the strong symbolism of corvids

made them the ideal animals to be associated with dogs, which were connected to protection, healing and the underworld in Roman thought (Serpell 2010, 22; Autengruber-Thüry 2021, 295 and 344-345). An association between corvids and dogs is also found in a cistern at the Roman Sanctuary of Poseidon at Kalaureia, Poros. Alongside the crow, puppies and adult dogs were several snakes, eggshell, murex shells, food animal remains and glass vessels (Serjeantson and Morris 2011, 96). Together, the animals in the cistern could indicate healing activity. Serjeanston and Morris suggest functional reasons for corvid inclusions, such as food and feathers, and a further healing aspect could be considered too.

In short, animals were very much present in alive, dead and figurative form at temple sites and healing spaces. Textual evidence, epigraphy, votive offerings and faunal remains all illustrate the overlap between zootherapy and religion.

## 4.3 Animal amulets

As demonstrated in chapter 3, medicine and magic overlap, with magic being used alongside religion to maintain good health and prevent illness (Porto 2020, 492). For Roman zootherapy, this is best demonstrated by the use of amulets – objects that are worn to prevent evil, mischief, disease and witchcraft (OED 2022a). A well-known form of Roman amulet is the *bulla*. In Latin, the term *bullae* includes any round object, but it is specifically used to refer to round capsule amulet which had protective properties (Szilágyi 2005, 9). *Bullae* are usually associated with children, and for boys at least would be removed when they reached manhood and donned the toga (Szilágyi 2005, 20). However, findings in Roman Pannonia suggest that they continued to be worn into adulthood by females, which could indicate that as the supposed inferior sex, women – like children – had more need for protection than men (Szilágyi 2005, 22). Women also experienced increased health risk due to the dangers of childbearing, and this could further explain their continued wearing of *bullae*.

What is interesting about the *bullae* described in Szilágyi's (2005) article is that some contained ancient plants and textiles. When Romans wore amulets for protection, they often took

the form of pouches containing plant or animal materials, and were usually worn around the neck (Szilágyi 2005, 16). Szilágyi mentions that some of the *bullae* she researched contained plant materials and pieces of cloth. None are recorded as containing animal materials. However, it is possible that the fragments of fabric were used to hold animal products in remedies similar to those described by Pliny; the foam of an ass after copulation could be collected in a red cloth and enclosed in silver to provide an aphrodisiac (*H.N*. XXVIII.LXXX). A similar interpretation could be applied to the scraps of cloth found in the Pannonian *bullae*.

Despite professing some doubt for the Magi and magical cures (Ogden 2014, 296), Pliny describes some 33 zootherapeutic amulets in Book 28 of his *Natural History*. Many take the form of sympathetic magic (see section 3.4), particularly in the case of dental problems. Compared to other forms of healing, amulets appear to involve a larger range of wild and exotic animals, including chameleon, crocodile, elephant, hyena, hippopotamus, gazelle and wolf materials (Plin. *H.N.* XXVIII). An archaeological example can be found in the amulet of a pair of breasts carved from ivory from the sacred spring at Bath. The whiteness recalls milk, and may symbolise a mother's wish for continued milk supply (Cruse 2004, 138). The ivory itself – an exotic and expensive material – is likely to have increased the amulet's power, because it would have travelled many miles to reach Bath, and distance increases the perceived power of an object (Helms 1993; Miller and Sykes 2016, 260). Another example of animal materials possessing power can be seen in deer antler. Thought to have therapeutic properties, it is likely that the deer antler pendants found across the Roman world had healing functions (Greep 1994, 82; Miller and Sykes 2016, 267). Similarly, pierced canid teeth found in Roman Britain infant burials could be linked to healing and protection because teeth are common amuletic objects. Albarella calls the inclusion of dog teeth at Ivy Chimneys, Essex, "bizarre" (2019, 149) – the teeth were arranged in a line, and one was pierced – and assumes some sort of chthonic or votive function. Smith recognises the likelihood that the deposit was "symbolically charged" (2006, 27). Given that pierced teeth are suggestive of the tooth amulets recorded by Pliny, and with

the knowledge that dogs held healing roles, the teeth described here should be reconsidered with medicine in mind.

Ekroth mentions pierced bear teeth in sanctuaries as possible jewellery (2014, 338), but we might also consider these as 'amulets'. There are similarities between omnivorous bear and dog teeth, but bears – a symbol of motherhood (Bevan 1987, 19) and Artemis (Bevan 1987; Crummy 2010, 56), goddess of childbirth and childrearing – may represent a zootherapeutic practice in their own right. Given that Diana is Artemis' Roman parallel, it is possible that there are also connections between Diana, bears, and childhood protection, though Crummy believes this is not certain (2010, 77). Miller and Sykes (2016), however, do suggest similar zootherapeutic connections between Artemis, Diana and fallow deer-related products in the Roman world. Small jet bears found in infant burials are likely to have had a protective function (Crummy 2010). One from Bootham appears to have been designed specifically to be worn as an amulet (Figure 17), strengthening the argument for zootherapeutic interpretations.

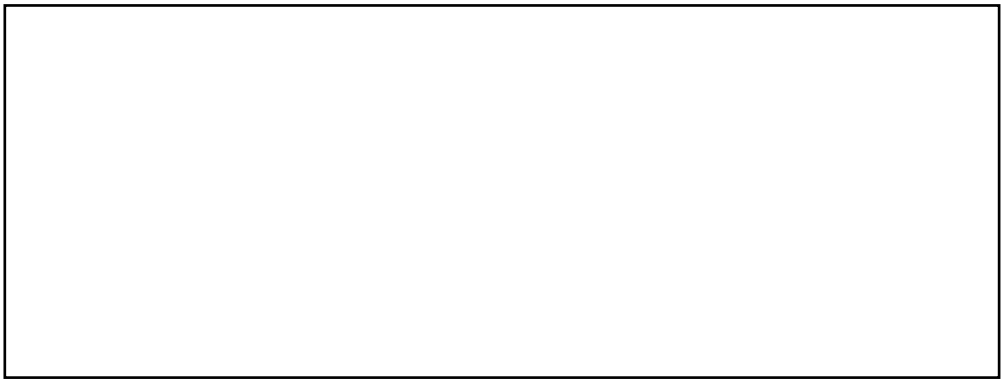


*Figure 17: Drawing of the jet bear from Bootham, York, by the antiquarian Llewellyn Jewitt in 1899. The hole between the legs (shown in the drawing on the right) would have enabled the bear to be strung on a cord and worn as an amulet (Crummy 2010, fig.6).*

Other amulets not made from animal products but animal in shape or decoration include talismanic rings and bracelets which often took the form of a snake (Bird 2011, 290). Harlow believes that the form the jewellery took was important and suggests that the encircling nature of rings and bracelets – which allowed the snake to wrap around a body part – was necessary for implementing the protection they provided (2021, 110). Similarly, hares, also found in burials, have been linked to chthonic actions and rebirth (Crummy 2013). It might be beneficial to review these protective and

regenerative amulets to consider whether they could also have had therapeutic uses; as objects which are intended to prevent harm, they could be considered a form of prophylactic treatment.

## 4.4 Animals and food

When searching for evidence and discussing the use of foods in the Roman world, we should be aware that all foods had the potential to be used therapeutically. This does not negate the fact that animals and their products were sustenance, but it is important to recognise the healing properties of food, and to realise that any form of eating could have carried multiple meanings, as discussed in various Roman sources.

If excavators recover animal bones with butchery marks in the vicinity of a place of food preparation, the conclusion usually reached is that they were ingested. It is easy to label faunal remains as food with no evidence that it was actually consumed. But animals can be more than just food, as Maltby *et al.* (2018) have begun to argue in the case of chickens in Roman Britain. Chicken and chicken egg consumption increased in Britain after the Roman conquest. As well as appearing in rural, villa, urban and military contexts, chicken remains are present at religious and burial sites, leading the authors to suggest that they were used as food for the dead and as votive offerings (2018, 1009). They outline the links between chickens and the gods Mercury and Mithras, and conclude that the birds held several roles, "from deity companions to luxury goods" (2018, 1013). The researchers have therefore demonstrated the importance of looking beyond the most obvious, culinary functions of animals. In this case it might also be possible to consider medical uses too; Galen, for instance, recommended soft boiled eggs for a sore throat (Gal. *De Al. Fac.* III.21).

It should also be recognised that the ways in which animal parts were processed for food, medical or other use could look very similar to each other. This is illustrated by marrow; Miller and Sykes (2016) point out that thanks to the modern Western perception of food and medicine, studies of marrow extraction usually focus on its culinary role rather than its uses in healing. Yet they identify 9 medical uses of deer marrow in Pliny the Elder, who describes the substance thus: "all marrow is emollient, filling, drying, and warming. The most highly valued is that of deer, next of

calves, and then of goats, male and female" (Plin. *H.N.* XXVIII.XXXIX). Book 28 alone has 28 marrow-related remedies, and most of these utilise domestic animals rather than wild. Illnesses treated are predominately dermatological, and include cracked lips, sores, and burns. Archaeologically, marrow extraction for food will look identical to marrow extraction for medicines**.** In De Cupere *et al.*'s (2015) assessment of bones at Sagalassos, the authors record that the majority exhibited butchery marks, some of which indicated marrow extraction. They suggest that the fatty substance would have been appreciated for its dietary value, its use in leather treatment, and for producing cosmetics and soap. Medicine is not mentioned, but Pliny indicates that the marrow of domestic species – including cattle – were popular pharmaceutical ingredients (*H.N.* XXVIII.XXXIX). Scholars are beginning to recognise that marrow was used for more than food or glue (see Maltby 2007, 72), and this is important for understanding the use of marrow in zootherapy. Additionally, previously inexplicable fragmentation patterns in 'non-food' animal bones could be understood if medical marrow use is considered (Miller 2022a, pers. comms).

Furthermore, the integration between food and zootherapy can be seen via the animals that were *not* utilised. This could be a complete abstinence or an avoidance subject to certain conditions, as in the case of oysters. The traditional advice is to only eat oysters in months with an "R" in them; in other words, avoid the summer months of May, June, July and August (Marchese *et al.* 2019). In hot climates where oysters could not be stored somewhere suitably cool – especially if they were being transported long distances overland – this would help consumers avoid food poisoning. Abstaining from summer oysters is a long-established tradition; researchers found that harvesting oysters in non-summer months was practised at least 4,000 years ago off the coasts of Florida, Georgia, South Carolina and Mississippi (Cannarozzi and Kowalewski 2019). It is likely that at the very least, oysters were not transported far in the summer in the Roman world (Marzano 2013, 191). Archaeological instances of oyster shells could be investigated to determine whether Roman people were also avoiding eating oysters in the summer months. Avoiding the consumption of animal materials in this way can be seen as a form of prophylactic zootherapy.

## 4.5 Mortaria

As mentioned in chapter 3, ingredients for animal-derived medicines usually needed some degree of processing before they could be administered. However, it is unlikely that the tools used to create these medicines were exclusive to the preparation of remedies. Instead, the tools used probably had multiple functions, such as cosmetics and food production. This can be seen in the case of mortaria. Predominately found in Britain, mortaria are robust, wide bowls with a thick rim and spout. Bumpy, raised grits on the interior would have allowed for the grinding of materials (Figure 18) (Cramp *et al*. 2011).

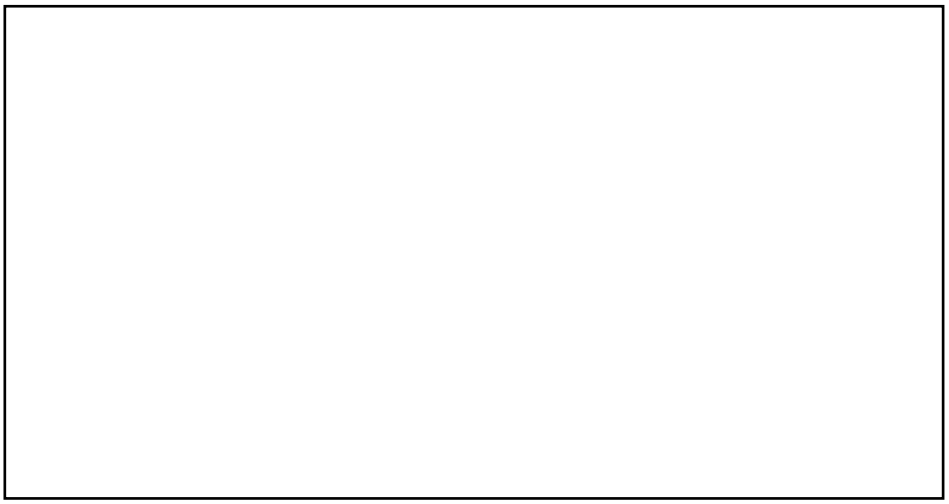


*Figure 18: Drawing of a typical mortarium found in Roman Britain (Cramp et al. 2011, fig. 1).*

Roman sources refer to mortaria in culinary contexts and describe their use in mixing and kneading different foods together (for example, Cato's recipes for *libum* and *placenta* (*Agr*. LXXV, LXXVI – cakes for religious services – use ingredients prepared in a mortarium). Several mortaria sherds are affected by sooting (Peacock 2016, 23) and the heating of mortaria brings to mind the many instructions in Pliny to use the ash of a substance in medicinal recipes: oyster shell ash for rash in babies (*H.N.* XXVIII.XVIII), camel dung ash for epilepsy (*H.N.* XXVIII.XVI), deer horn ash for dandruff (*H.N.* XXVIII.XLVI), and so forth. The use of ash in a recipe does not necessarily imply heat in the mixing process, but it is possible that the mortaria were used to create ashed substances before the mixing began. Additionally, Cramp *et al.*'s (2011) residue analysis indicated they were used to process a much wider range of ingredients than simply herbs and oil, as had originally been thought

(Peacock 2016, 23). The presence of animal fats (including dairy fats) and plant residues suggest a wide range of use. The authors acknowledge that distinguishing between culinary, cosmetic, and pharmaceutical uses is difficult, so it is important that mortaria are not viewed solely in a culinary light. Recognising the flexibility of mortaria strengthens the possibility that they were used to make medicines. The fact that they are predominately found in Roman Britain (particularly in the case of stamped mortaria, as Symonds (2012, fig. 1) notes) implies that in other parts of the Roman world, their functions were being fulfilled by other objects. Again, this suggests a flexibility and multifunctionality to both mortaria and other equipment that could be used to process ingredients.

Similarly, cosmetic grinders may have been used for more than just make-up. These small two-piece kits allowed the owner to create a small quantity of powder by grinding a substance between a pestle and a curved, grooved mortar (Jackson 2010, 10). Although cosmetics are usually thought of as substances which are intended to improve appearances rather than health, in reality it is possible that the boundaries between cosmetics, hygiene and medicine were blurry ones. For instance, it is likely that the dentifrices described in Pliny were predominately for giving teeth an appealing whiteness, but the act of cleaning could also have resulted in improved dental health. Given the overlap between cosmetics and medicine, so-called cosmetic grinders should also be viewed assessed from a medical perspective. Those with animal decoration – common among the zoomorphic sets are bovid and bird heads (Jackson 2010, 22) – or animal-product residues could provide more insight into the preparation of zootherapeutic medicines.

## 4.6 Medical residues

Having explored the sort of equipment which might have been used to convert animal ingredients into medicines, we can now turn to the evidence for those medicines themselves**.** The remains of plants and animals found in vessels can help in identifying medicines (Baker 2013, 154). A compelling example is found in Ciaraldi's (2000) article on Villa Vesuvio, an AD 79 *villa rustica* near Pompeii. All seven of the *dolia* found in the cellar contained organic deposits, but the contents of *dolium* 2 was particularly intriguing. Underneath a layer of peach stones and walnuts lay an organic deposit that

comprised a mixture of plant, animal and insect remains. It contained a large number of plant specimens that were known to have medicinal properties in the Roman world (2000, 93). Opium poppy was used for pain relief, henbane was given in wine for asp-bites, nettle was prescribed as an antidote to poison – in fact, almost all the plants recovered had some medicinal use and it is possible that this is the residue of the cure-all *mithridatium* or *theriac*. With a small cooker found nearby, the materials suggest pharmaceutical, soap or dye production. The argument for medicine over other interpretations is strengthened by the associated faunal assemblage; there is a significant number of lizards, frogs and toads, all of which had medical properties according to ancient authors (Ciaraldi 2000, 94). Interestingly, no snakes were found, and this correlates with known *theriac* recipes because snakes and lizards were never used at the same time (Ciaraldi 2000, 95). Ciaraldi's paper demonstrates that seeking examples where pharmaceutical plants and animals exist in the same contexts could indicate that zootherapy is present.

Occasionally, the medicine itself is found, as illustrated by the recovery of a wax-filled box. Beeswax was utilised for topical applications, and was also a useful ingredient in forming ingestible capsules of other medicines (Plin. *H.N*. XXII.XLIX). Pliny believed Punic wax to be the best type of medicinal wax, and describes how it was created by boiling wax in seawater (*H.N*. XXI.XLIX). Remarkably, researchers believe this very substance is contained in a bronze medicine box from the British Museum's collection. Analysis of a sample of Punic wax created in the laboratory showed good correlation with the ancient residue (Stacey 2011, 1756), strengthening the argument that the ancient material is indeed medicinal Punic wax.

Even when the actual ingredients of medicines are lost, the remains of the materials used to produce those medicines can occasionally be recovered. As previously mentioned, ashes and powders were common in ancient medicines, probably because hard items like horn, teeth or antler would be otherwise indigestible. Although the powders themselves would be extremely difficult to recover from the archaeological record (and it is unlikely they would be preserved in the first place if they were ingested), the animal product the powder came from might remain. Miller and Sykes have

suggested that fallow deer antlers with signs of cutting, sawing and scraping are indicative of the production of antler powder for medicines because the antlers are too brittle for antler-working (2016). Deer antler recovered from Roman sites could therefore be reassessed, with medical interpretations considered for antler remains with evidence of shaving. The same concept could be applied to other worked animal materials, and is illustrated by cattle bones from Saglassos, Turkey. Many of these exhibit shaving marks (Figure 19).

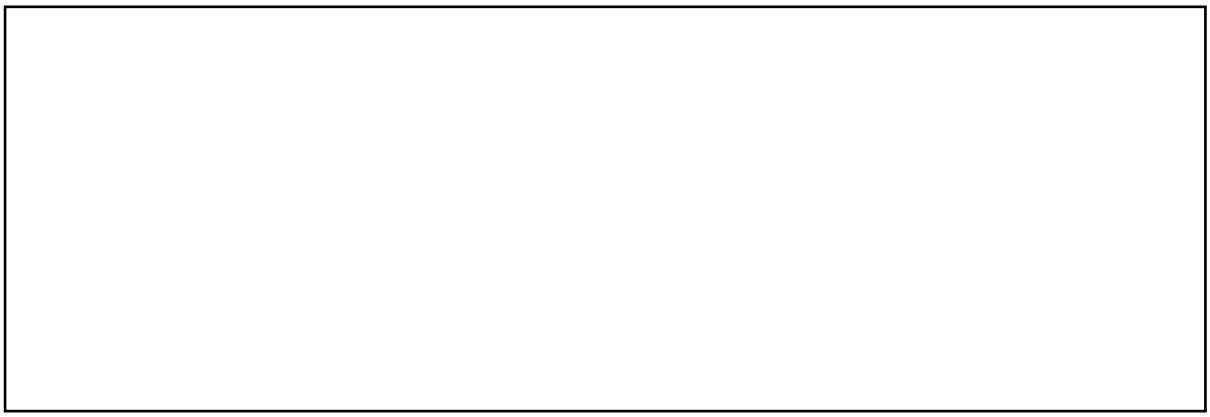


*Figure 19: Shaving marks on cattle long bone from Sagalassos, Turkey (De Cupere et al. 2015, fig. 3).*

De Cupere *et al.* believe that these marks indicate where small flakes of the bone were cut away with the meat during the defleshing process (2015, 180). However, the marks appear to be fairly large and numerous, and most butchers would strive to avoid chopping the bone in this way; not only would it leave unpleasant chips of bone in the meat, it would also blunt the knives (Bunn 2001, 207). In this instance, it might be wise to reassess the interpretation that the marks are the product of an unskilled butcher, and instead consider other explanations, including zootherapy.

## 4.7 Animals and surgical equipment

Most surviving Roman surgical implements are made of metal; usually, iron or copper alloy. However, Jackson points out that Celsus also records the use of organic materials like wood, leather, bone, textiles and feathers (Jackson 2011, 250). Leather and bone were used to make pouches and cases for storing surgical tools (Jackson 1997a, 228; Miller and Sykes 2016, 263), wool would have formed dressings and bandages (Cruse 2004, 147), and feathers were used to insert medicines into various orifices (as shown by Celsus *Med.* VI.8, in which a treatment for a polyp in the nose was

placed in the nostril via a feather). The survival of instruments made from more resilient organic materials like bone is rare, but does occur; a medical kit from Stanway contained a surgical saw that had a composite handle of bronze and wood or bone (Jackson 1997b, 1473), and there is the example of the bone catheter shown in chapter 3. While it is possible that specific animal bones were used because of symbolic associations, it is more likely that it is the versatility of bone as a workable and readily available material that leant itself to surgical equipment. Either way, there is no doubt that animals were involved even in surgery, which is arguably one of the most anthropocentric disciplines in Roman medicine.

Additionally, cupping – which is commonly depicted in illustrations of Roman doctors (Baker 2016) (Figure 20) – could be practised using animal materials rather than metal, much in the same way that cupping is still practised with animal horns today (see section 2.5).

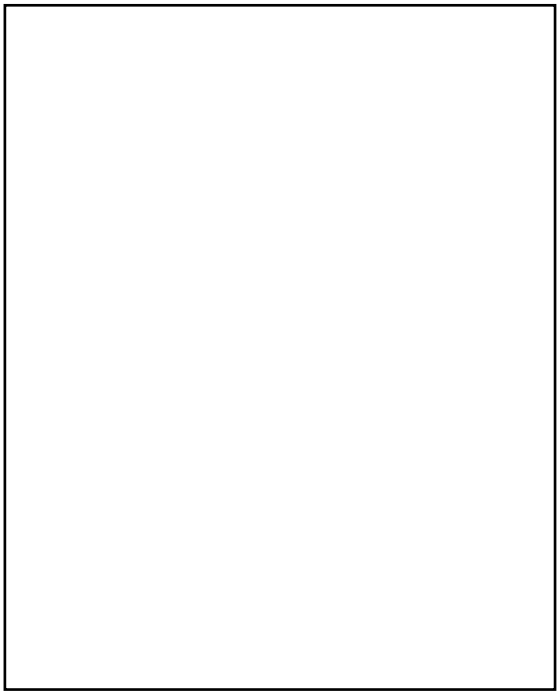


*Figure 20: 2nd century AD relief showing a doctor examining a patient's eye with cupping vessels in the background. Image available from https://ludwigheinrichdyck.wordpress.com/tag/roman-physician/ [Accessed 22nd June 2022].*

Recommended by Galen, cupping was a popular form of treatment in the Roman Empire (Turk and Allen 1983, 128). Vacuums were created in the bell-shaped objects by using a flame or by sucking the air out with the mouth, and they were then placed on the patient's body. Wet cupping (where an incision was made in the skin before placement of the cup) and dry cupping (where no cut was

made) were used to correct an excess of humours and draw out infected matter. Surviving medical cups are made from copper-alloy, but ancient sources do record the use of animal horn (Baker 2016, 367). Archaeological examples of horn cups are currently proving hard to find, but they remain a viable suggestion.

## 4.8 Conclusion

This chapter has explored Roman zootherapeutic practices and has begun to consider the possible archaeological evidence for these. It has established that some will be easier to identify than others; the substance which matches the recipe for Pliny's Punic wax is more readily associated with medicine than archaeologically undetectable human-animal interactions. This chapter has also furthered the argument in support of the overlap between zootherapy and other aspects of Roman life, such as religion, diet, and magic, and therefore demonstrates the importance of being open to several interpretations when reviewing evidence from these contexts. The next step is to assess which methods would be useful in identifying archaeological evidence of Roman zootherapy.

# 5 Identifying Zootherapy

## 5.1 Introduction

Having demonstrated that zootherapy was an integral part of Roman medicine, this dissertation will now outline the methods that could be used to identify zootherapy in the archaeological record. These methods include organic residue analysis, analysis of dental calculus, oxygen isotopes, ZooMS, and bone fragmentation patterns. The need to consider the context in which animals are found will also be discussed, and the chaîne opératoire of medicines will be briefly touched upon. Most importantly, it will be argued that taking an open-minded approach to medicine will be of great benefit in improving our understanding of zootherapy.

## 5.2 Organic residue analysis

Where physical medicines survive in containers, animal ingredients can be detected via organic residue analysis (Evershed 2008). This is illustrated by the case of Punic wax discussed earlier in section 4.6; the researcher used gas chromatography-mass spectrometry (GC-MS) to show that the composition of their lab-manufactured Punic wax matched that of the ancient medicine, which used beeswax (Stacey 2011). Techniques such as GC-MS, especially when combined with isotope ratio analysis, can be used to identify lipids that indicate different animal groups such as ruminant species or marine creatures (Mottram *et al.* 1999; Cramp and Evershed 2014). In some cases it is possible to be even more specific in terms of genus identification – as Colonese *et al.* (2017) have demonstrated with poultry – although this does have its challenges (Whelton *et al.* 2021, 4). Because organic residue analysis can identify the presence of animals and animal-products in ancient vessels, it has the potential to highlight Roman zootherapy. This will be especially apparent in cases where the animal involved is not typically used for food, or where the residue can be matched to textual recipes (as with the Punic wax).

## 5.3 Dental calculus

Many medicines were ingested, and the crossover between food and medicine has been well-established (see sections 3.3 and 4.4). Identifying which animals people were eating – especially if they were not typical food animals, or they have a known connection to healing – will be important

in establishing whether zootherapy could have taken place. Dental calculus, a mineralised plaque biofilm found on teeth (Mackie *et al.* 2017, 74), holds clues to consumed substances. Proteins contained within the plaque can indicate the presence of animal products such as meat and milk (Hendy *et al.* 2018). While Mann *et al.* (2020) urge care and caution, they do note that DNA studies of dental calculus can, in principle, identify items consumed by the person. It may be possible to suggest a medical interpretation, especially if there are additional signs (such as osteological evidence) that an illness was present, or if the animals were not easily available or typically used as food. Medicinal usage has been suggested for plant remains (D'Agostino *et al.* 2019; Gismondi *et al.* 2020; Fiorin *et al.* 2021) so the possibility of future studies which focus on medicinal interpretations for animal remains is promising.

## 5.4 ZooMS

Objects made from animal materials – particularly those with a connection to medicine, such as amulets or physician's tools – are further evidence of zootherapy. Knowing precisely which animals these materials are from and going beyond the more general categories of 'bone' and 'leather' could illuminate which species were being targeted for human healing. For instance, Miller and Sykes (2016) have already identified fallow deer's connection to healing, and suggest that choosing fallow deer bones and antlers for objects like surgical instrument cases and protective amulets was significant. In cases where the origin of the material is not known (for example, the bone catheter discussed in section 3.9), the animal could be identified through zooarchaeology by mass spectrometry (ZooMS). This is a less destructive, more cost-efficient method than aDNA analysis which uses collagen from organic substances such as bone, antler and leather to discern the material's provenance (Richter *et al.* 2022).

## 5.5 Oxygen isotopes and shellfish

Section 4.4 raised the possibility of identifying prophylactic zootherapy via what is not eaten, or more specifically, *when* items are not eaten. In the case of shellfish, this can be done through studying the parasitic snails on the oysters or, more commonly, through stable isotope analysis

(Cannarozzi and Kowalewski 2019, 2). By studying the oxygen isotope ratio of the last area of growth in a mollusc shell, researchers are able to suggest the likely harvesting time of the shellfish (Colonese *et al.* 2009). This often follows the pattern of avoiding harvesting in the summer months. Conducting similar analyses on Roman shellfish would allow us to identify whether people in the Roman world harvested in the same manner, and so would illustrate how the animals could be avoided to preserve good health.

## 5.6 Bone fragmentation

Paying more attention to patterns of bone fragmentation and fractures could improve our chances of recognising zootherapy (Miller 2022b pers. comms). As Peres points out, numerous studies show that it is possible to identify bone fat extraction from faunal remains, but such investigations are not carried out to their full extent at many sites (2018, 107). Outram (2001) clearly outlines the damage one would expect when investigating remains for evidence of marrow extraction. Once evidence for marrow extraction has been found and it is clear that people were utilising marrow, it is important that interpretations do not focus only on its culinary uses. Fats and greases are important in many medicines, and marrow provides an easy way to access these. Increasing our awareness of marrow exploitation for fats and greases in medicine is especially important for non-typical food animals as this could enable us to understand why these animals may be included in these processes.

## 5.7 Animals in context

Excavations sometimes unearth faunal material which does not appear to 'fit' with the site or with the archaeologist's expectations. This could be due to the occurrence of an uncommon species, an unusual treatment of an animal, or an unexpected prevalence of a particular species. It is important that these cases are recognised as unusual within the context of the site, as illustrated in section 4.2 by King (2005) and Ekroth (2014); both pointed out a specialness to the remains they were discussing. For these remains – which are so often labelled 'ritual' – zootherapy should be included among the various explanations suggested. This is especially pertinent in cases where the animal in question has known links to healing, as with the oysters described in King (2005, 345).

Further research into the healing roles of particular species should be conducted in a similar manner to Miller and Sykes' study of fallow deer (2016). The presence of some animals sparks an instant association with a particular role in the archaeologist's mind – horses, for instance, evoke transportation and the military (Hyland 1990). Improving our understanding of which animals were considered particularly zootherapeutic will add medicine to the researcher's immediate arsenal of interpretations instead of leaving it as an afterthought. Our increased knowledge of a species' healing role can then be used to reassess contexts where that animal appears, especially in conjunction with humans. For example, studies of dogs in human burials are usually accompanied by references to dogs as companion, guardian or chthonic animals (Smith 2006, 44-45). But dogs should also be recognised for their roles in healing, even when not found in healing contexts. A dog in a burial could signify that an attempted act of healing took place (one of the Pliny the Elder's cures (*H.N.* XXX.XIV) involves the disembowelment and burial of a puppy), and this does not have to negate the other interpretations.

Similarly, animals in structured deposits and associated bone groups (ABGs) could be re-evaluated to consider whether there are medical explanations for their existence. Morris recommends that animals in such groups are not studied in isolation but in relation to the other material culture present (Morris 2008, 94). Such an approach could be profitable in cases like the Kalaureia cistern where zootherapeutic animals were found alongside glass vessels (Serjeantson and Morris 2011, 96). Expanding on existing interpretations of structured deposition could establish new links to zootherapy. Serjeantson and Morris (2011) have already suggested that the inclusion of corvids in Iron Age and Roman Britain deposits could represent food waste, scavenger control, companion animals, offerings and prophetic messengers. Given that Pliny the Elder describes several corvid remedies – crow flesh for chronic diseases (*H.N.* XXX.XXX) or raven dung for babies' coughs (*H.N.* XXX.XLVII) – zootherapy should be added to the list of potential interpretations.

Furthermore, the zooarchaeology at places of healing should be reconsidered to ensure that the possibility of medicine is being examined. Some researchers identify faunal remains at hospital

sites or healing temples and assign them to the category of food – and not in a way which acknowledges the overlap between food and medicine. King (2005) illustrates this by switching between labelling bones as the remains of sacrifices or the remains of feasts, and does not consider healing purposes. Instead, there is scope here for future study into animal remains where researchers acknowledge how animals and their parts were used in the creation of medicines, as the remains could reflect such recipes.

## 5.8 Chaîne opératoire

Another aspect to consider is the processes through which a medicine is formed – its chaîne opératoire (Sellet 1993, 106). Many medicines involved everyday ingredients like dairy products that are unlikely to have been produced by the prescribing physicians themselves. It is more likely that these were purchased or produced by the patient's family. Some remedies required very specific ingredients, as in Pliny's remedy for splenic disease which depended on the milk of a goat that had fasted for two days and eaten ivy on the third (*H.N.* XXVIII.XXXIII). This would necessitate a relationship with not just the owner of the dairy herd, but with the herdsman who controlled the animal's diet. Exploring the different relationships involved and the processes which medicines underwent before becoming a finished product could be beneficial in improving our understanding of zootherapy (Miller 2022b pers. comms).

## 5.9 Expanding our definitions

Section 5.7 emphasised the idea of using occurrences of 'unusual' animals and animal treatment to suggest therapeutic interpretations. But not all evidence of zootherapy will be unusual. One of the most important steps an archaeologist can take towards understanding zootherapy is to rethink the categories of 'food', 'religion', 'magic', and 'medicine' itself. Here, instead of searching for the odd, researchers should recognise how normal, everyday practices could fall into the category of Roman medicine. Throughout this dissertation, I have stressed that 'medicine' is not restricted to a pill or an operation. Food was eaten to maintain a healthy balance of bodily humours (Baker 2013, 112), gods were asked to bestow relief from afflictions (Petridou 2016), and amulets were worn to ward off ill

health (Szilágyi 2005). Diet, regimen, humours, religion, animal sacrifice, magic, protection – all of these fields overlap with medicine, healing and health, and recognising this will be instrumental in searching for archaeological zootherapy.

## 5.10 Conclusion

This chapter has outlined potential methods for identifying zootherapy in archaeology. Ultimately, it is clear that searching for zootherapy will require an interdisciplinary approach. Lab-based analyses, zooarchaeological evidence and ancient textual sources should be utilised alongside each other in order to increase our chances of detecting zootherapy. Additionally, widening our expectations for what sort of evidence falls into the categories of food, religion, magic and medicine – or better yet, recognising that such categories did not always exist in the ancient world – will enable us to be more receptive to the prospect of zootherapy. An open-minded approach to the meaning of medicine will be an asset in the search for evidence.

# 6 Conclusion

This dissertation set out to improve our understanding of zootherapy in the Roman world. This necessitates a firm grasp of what zootherapy means today, and my exploration of this shows that zootherapy is a widespread practice that reaches from rural communities in Brazil to urban hospitals in the UK. The ubiquity of zootherapy suggests that animals were also used in medicine in the past, and therefore validates the search for it in the Roman world. Some of the shared features of modern zootherapy (such as humoral theory-based practices, the concept that 'like affects like', and remedies which require ingesting or topically applying a medicine) can also be found in Roman zootherapy. In the future, using ethnographic examples to provide points of reference for Roman zootherapy could be beneficial in the pursuit of archaeological evidence.

A good understanding of the Roman concept of medicine is equally important. I have shown that contrary to the rather narrow, 'Western' perception of medicine, Roman medicine was far more fluid and overlapped with food, magic and religion. Any action that resulted in healing could be viewed as medicine; careful diets, amulets of protection, and votives at religious sites are no less valid as acts of healing than surgical intervention and pharmaceutical drugs. Additionally, all involved animals, despite the absence of zootherapy in reference literature that might indicate the opposite. Scholars are aware that the organic nature of animal remains can hinder their recovery from the archaeological record, but this challenge should be viewed as one which provides exciting opportunities for further study. Organic residue analysis, dental calculus, ZooMS and oxygen isotopes are just some of the methods and sources of evidence which could be exploited to improve our understanding of organic zootherapeutic materials. It should also be remembered that animal remains are not the only indicators of zootherapy. Textual sources and zoomorphic objects can also contribute to our understanding of how animals were used, and demonstrate the importance of taking an interdisciplinary approach. Drawing from many sources of evidence will be key for improving our understanding of Roman zootherapy.

Several opportunities for future study have emerged from this dissertation. Firstly, a reassessment of existing research where scholars consider re-evaluating their evidence could reveal more archaeological examples of zootherapy. This is illustrated here by examples such as marrow exploitation and unusual animal deposits; De Cupere (2015) did not consider the medicinal use of bone marrow, despite textual sources indicating the importance of animal fat in medicines, and King (2005) ascribed unusual oyster deposits to the category of ritual without considering possible links to healing. Revisiting such evidence could provide insight into zootherapeutic practices. Another important step will be in-depth research into individual species to investigate those with particularly strong therapeutic connections. Dogs, snakes, bears and bees are likely candidates for this. Additionally, conducting new research using techniques such as organic residue analysis and ZooMS will allow the identification of animal products that can then be considered from a medical perspective. Most importantly, embracing zootherapy as a common practice in the Roman world will be invaluable in searching for the evidence it left behind.

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