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Descriptions of intestinal worms in European medieval medical texts

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Research Article

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Abstract

This article investigates medieval medical texts to discover what they have to say about parasites. The principal focus is on intestinal worms found in *practica* texts written from the 11th to the 15th centuries in Latin in Western Europe. *Practica* texts deal with illnesses of the human body from head to heel. The chapters on worms occur in discussion of illnesses of the intestines. These *practica* texts were used in medical education in universities as well as guiding medical practice. Islamicate writings translated from Arabic into Latin influenced western ideas about intestinal worms. *Practica* texts identify 3 or 4 kinds of intestinal worm depending on size and shape. They are thought to be generated in different parts of the intestine and rectum. Worms are made from matter associated with the humour phlegm which is cold and wet and putrefaction within the body gives life to them. Other parasites of the human body are found close to the skin surface but resemble intestinal worms in the ways they are generated. Areas of argument and dispute arose in learned medical literature. These arguments did not introduce new concepts or research findings but built on analysis of the doctrines of ancient and Islamicate writers. While humoral imbalance is understood to cause worms, recipes from the treatment section usually emphasize the aim of killing and expelling the worms from the body using bitter ingredients like *Absinthium* (wormwood).

Introduction

This article looks at a sample of medieval medical texts to investigate what they have to say about parasites. The principal focus will be on chapters in these works that deal with intestinal worms. The Latin terms *vermes* or *lumbrici* are normally used to describe these worms in the titles of these chapters. The works chosen for investigation date in time from the 11th century CE to the 15th and were compiled in Western Europe in the Latin language. They belong for the most part to the genre of practical guides to the identity and diagnosis of illness, accompanied by appropriate bodily regimen and treatment. These guides (known by the name of *practica*) were organized by the location of illness from head downwards to the heel (*a capite ad calcem*) with the chapter on worms falling in the section on illnesses of the intestines (Demaitre, 2013). Normally, the chapter on worms is short relative to others in the section.

The production of these guides was associated with medical education at schools and universities where they served as textbooks but also as guides to those who practised medicine (Siraisi, 1990; O'Boyle, 1998). Some *practica* texts were translated from Arabic into Latin in the 12th century CE and reflect the great prestige and influence of Islamicate authors who transmitted, systematized and supplemented the classical heritage of medicine from Greco-Roman antiquity (Jacquart and Micheau, 1990). These translations in turn impacted texts by 'modern' authors in the Medieval West. From the 13th to the 15th centuries, these 'modern' texts were subject to scholastic methods of logical analysis and commentary characteristic of medieval universities (Getz, 1998; Wallis, 2010).

In examining these writings, particular attention will be given to the identification of kinds of intestinal worms, their site of origin in anatomical terms and their relation to the medieval humoral system. Intestinal worms were particularly associated by medieval authorities with the humour phlegm, which manifested itself in different forms, each of which determined the kind of worm they were thought to produce. Predominantly, and following ancient precedent, the *practica* texts chose to identify 3 (or sometimes 4) kinds of intestinal worm.

Finally, this article will look briefly at some other forms of parasites described in these same medieval writings on medicine. These included kinds of worms manifesting themselves on or near the skin. While descriptions of other kinds of parasites have been noted in medieval texts, such as periodic fevers suggestive of malaria (Newfield, 2017; Reilly, 2022), they will not be covered in this article.

The objective of this paper is to give a clear summary of what medieval medical texts have to say about intestinal and other human parasites for comparison with bioarchaeological findings. The most common parasites identified appear to have been roundworm, whipworm and pinworm spread by poor sanitation, beef, pork and fish tapeworms spread by eating raw or

undercooked meat, and protozoan parasites that cause diarrhoea (Mitchell, 2015). At the same time, the gap between the descriptive language of the medieval texts and the precision of modern identification of parasites will serve to demonstrate the challenges inherent in modern 'interpretations' of medieval medical descriptions and concepts.

Findings

The earliest written of the texts under examination is the *Passionarius* of Gariopontus. He was a renowned physician and scholar active in southern Italy in the middle of the 11th century. He synthesized in a head-to-heel arrangement chapters on illnesses of all parts of the body compiled from earlier writings belonging to the time of Galen (2nd century CE) and late antiquity. Too early to benefit from translations from the Arabic, Gariopontus's work was nevertheless found useful by medical readers across Europe from his own era to the time of its printing in the 16th century (Glaze, 2005). His chapter on intestinal worms begins by stating baldly that there are 3 kinds of worms. The long and round worms are the ones properly called *lumbrici*, and they can grow up to 4 cubits (i.e. 4 fore-arm lengths). There are also broad worms resembling the seeds of gourds, called by the Greeks *ascarides*. Third, there are short worms which are less clearly described (*vermiculi*). Gariopontus does not differentiate the 3 worms in terms of anatomical sites in the intestines but describes patterns of symptoms found for the 3 kinds. He refers to 'bad humours', incomplete digestion and corrupt food as possible causes of intestinal worms in general (Gariopontus, 1526).

In 1127, Stephen of Antioch, working in Antioch, translated the *Kitab al-Malaki* of the Persian author 'Ali ibn al-'Abbas al-Mağūsī (d. 994, known as Haly Abbas by Europeans) into Latin under the title of the *Liber regalis* (Burnett, 2006). Another translation of the same work had already been made by the monk of Monte Cassino Constantine the African (d. by 1098–1099), known as the *Pantegni*, and both translations were to have a significant impact on Latin writing about intestinal worms (Burnett and Jacquart, 1994). Stephen's chapter has the title *De lumbricis et ascaridibus* and begins with a new consideration of how they are generated in the intestines. They come from a humour, moist phlegm and they cannot be generated from the other humours. This phlegm undergoes a rotting process in the intestines (putrefaction) producing an extraneous heat from which the animals are born (the Latin says no more than *calor extraneus unde hec animalia nascuntur*). It is most particularly an illness suffered by the young whose bodies are most susceptible to humid phlegm, exacerbated by their diet and regimen. It is at its worth in the autumn, the season of fruit. Again, 3 kinds of worms are identified. One is called a serpent because of its serpentine shape; it resembles the stems of the herb purslane. This serpent flourishes in the narrow intestine. When it grows long, it may 'flee' the intestine and sometimes goes up into the stomach and is vomited out. The second is broad and similar to a gourd seed. It grows in the large intestine. The third is small and is like those tiny creatures found swimming in vinegar. It grows in the rectum. Generally, all such worms should be treated with things which are hot and dry (the humoral system of medicine required that wet and cold things should be treated with their opposites) and will be expelled from the body once they are dead. This assertively humoral approach to the generation of worms, and to their location in different parts of the intestines, marks all subsequent descriptions of the subject (Mağūsī, 1492).

The *practica* written by Johannes Platearius, a master of the medical school of Salerno in the middle years of the 12th century, explicitly states its debt to Stephen of Antioch's translation of Mağūsī right at the beginning of the chapter on worms (Muñoz, 2016). Platearius refines, however, the role of the humour phlegm: salty phlegm makes long and round worms, sweet phlegm makes worms long and broad (*ascarides* or *cucurbitini*, i.e. shaped like gourd seeds), sour phlegm makes short and broad worms. The very shape of the *lumbrici* is determined by the action of the salty phlegm, we are told, though the explanation is hardly clear. Because salt is hot and dry, it somehow makes the worm longer but restricts its breadth. These refinements are not found in the *Liber regalis* used by Platearius as a source.

For the *practica* tradition, the second important translation into Latin from Arabic was that of the *al-Qanun fi'l tibb* (Canon of Medicine) of Abu 'Ali al-Husayn ibn' Abd Allah ibn Sina, known in the West as Avicenna (d. 1037). Translated in the late 12th century by Gerald of Cremona, it had become by the middle of the century following the most influential text in university teaching of medicine (Chandelier, 2017). In the third book of the *Canon*, fen XVI, tract 5 is devoted to intestinal worms. The second chapter of tract 5 begins (translating from Latin) 'on the kinds of worms which are three: long and broad and round. And the broad are *ascarides* and small'. This is confusing. The most famous commentator on the *Canon* in 14th-century Italy, Gentile da Foligno (d. 1348) says of this opening statement: 'he teaches first that there are four kinds of worms. Long, round and small, and *cucurbitini* (gourd-seed like)'. Immediately in characteristic scholastic fashion, Gentile flags this as a problem (*dubium*): 3 kinds or 4? On the side of 3, he cites Haly Abbas and other Islamicate authors; on the side of 4, he cites Avicenna himself, despite the very first words of the chapter (French, 2001). It boils down to whether *cucurbitini* are to be regarded as 1 kind or 2 (short and long). Avicenna goes on to discuss the role in the generation of worms of different levels of humidity in 3 parts of the intestines: the superior, the straight and the rectum. Avicenna goes into far more detail on the illnesses which can complicate cases of intestinal worms than earlier authors. Young people are more liable to worms, particularly the long and round kind (*lumbrici*). Vigorous exercise can help to expel them. In all, there are 11 chapters in Avicenna's tract on worms. The later chapters set out a detailed regimen and methods of killing worms so that they may be expelled from the body (Avicenna, 1522).

The *Compendium medicine* of Gilbertus Anglicus (Gilbert the Englishman, d. after 1260) was compiled in the late 1250s. It was the first systematic survey of medicine to take on board the new texts available from Greek and Arabic sources. It reflected Gilbertus's own teaching as a master at the University of Montpellier (McVaugh, 2010). Book 5 of the *Compendium* has a chapter on intestinal worms. It begins with a detailed discussion of the role of putrefaction in generating worms, quoting Aristotle and ibn-Rushd (d. 1198), known to the West as Averroes, author of the *Colliget*, translated into Latin in the early 13th century. On the 3 types of worms and their location within the intestines, Gilbertus follows Haly Abbas in Stephan's translation. He follows Platearius on the different kinds of phlegm that generate these 3 types. Although Gilbertus knew and used Avicenna's *Canon,* he seems to have avoided that author's confusing discussion of kinds (and number) of worms. Apart from his analysis of putrefaction, Gilbertus was at his most original in providing recipes for the mortification and expulsion of worms. One such electuary is described as, 'from the moderns', and as elsewhere in the *Compendium* Gilbertus tried

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to project his own familiarity with the latest treatments. This made his chapter on worms a convenient, authoritative source for recipes that were copied into remedy books owned by ecclesiastical institutions and individuals (Anglicus, 1510).

The only rival in popularity to the *Compendium medicine* during the later Middle Ages was the *Practica dicta Lilium medicine* (1303–1305) of Bernard de Gordon. He began to teach at Montpellier in 1283 and was still active in 1308 (Demaitre, 1980). The *Lilium medicine* represents the *practica* in its finished scholastic form, each illness described in terms of its definition, causes, signs, prognosis and cure. *De vermibus* is Chapter 20 of *Particula* 5 of the *Lilium medicine*, on the illnesses of the intestines. The definition is that 'worms, serpents and (dung) beetles are generated from rottenness inside the human body, just as worms, flies and similar creatures are generated outside'. The cause is that intestinal worms are generated from phlegm when it is putrefied within the intestines, and the 3 kinds are differentiated according to where the putrefaction is within the intestines. *Lumbrici* belong to the upper intestines, *ascarides* or *cucurbitini* to the middle intestine and small (like worms in cheese) to the rectum. After Bernard has dealt with signs, prognosis and cure, he proceeds to a section of clarification in which questions can be raised and answered. Here he makes a comparison between worms and stones in the kidney and bladder, arguing that where dangerous phlegmatic material is exposed to heat, it generates stones, and where humidity dominates in the matter, a 'spirit of life' not only generates worms but also lice, serpents, beetles and many other similar creatures (de Gordon, 1542).

Giovanni Michele de Savonarola (1384?–1462?) belonged to a family of medics in Padua and, as a young man, began practice in Bassano (Pesenti Marangon, 1984). His experience there led him to write a treatise *De vermibus*, for a patron, the money-changer Zanardo, whose children suffered from intestinal worms. His description of long and round *lumbrici*, broad *cucurbitini* or *ascarides*, and tiny worms like those in cheese or vinegar follows that of the *practica* tradition. Savonarola then confronts authoritative arguments for and against the possibility of worms being generated in the stomach as well as the intestines. Succeeding chapters deal with the causes of worms, regimen against worms and the signs and cures for worms. Unlike earlier authors, Savonarola includes cures made by charms and amulets along with medicines to kill worms (Savonarola, 1543).

Back in Padua in 1443, he began his career as a medical teacher by lecturing on book III of Avicenna's *Canon of Medicine*. Between 1440 and 1446 Savonarola compiled his *Practica de aegritudinibus a capite usque ad pedes* (*practica* of illnesses from head to foot), known as his *Practica maior*. The chapter on worms demonstrates his allegiance to Avicenna's authority more clearly than his earlier treatise. He points out that Avicenna, against other medical authorities, said there were 4 kinds of worms. Savonarola relates each to the kind of phlegm from which it was generated: long and round worms came from salt phlegm, long and broad worms from sweet phlegm, short and broad worms (*cucurbitini*) from natural phlegm and tiny worms from sour phlegm. In this, he is following Platearius's general approach to the generation of worms, though Savonarola, like Avicenna, has 4 worms rather than 3. Savonarola cites authorities ancient (Aristotle, *Meteorologica*) and modern (Pietro d'Abano, d. 1316, author of *Conciliator differentiarum*). In both Savonarola's earlier treatise and the *Practica maior,* Pietro is mentioned as the source of a report of a pair of 15-foot worms of the long, flat *ascarides* kind emerging from the large intestine through the stomach and the mouth (Savonarola, 1486).

Parasitic worms or tiny creatures which are not intestinal but affect external parts of the body were also described in the *practica* tradition. This essay will not pursue all the descriptions of these other 'worms' in successive works of *practica* but look at 1 representative example, that of the *Lilium medicine* by Bernard de Gordon. Book 2, Chapter 9 is entitled *De pediculis & lendibus* (of lice and maggots might translate these terms) and says that these animals are generated from putrefaction close to the skin. A corruption of the bodily humours is propelled to the skin by a kind of exudation and there gives rise through the heat of putrefaction to animals. They can be found on the head, or on the body as a whole or in the armpits and chest. The level of humidity in the matter from which they are generated determines what sort of animal they are: *pediculi* are from wetter matter, *lendes* from drier matter and *pessolatae* from matter in between. These animals, which might to a modern observer seem very different from intestinal worms, are generated nevertheless from similar matter and by a similar process of putrefaction. Bernard de Gordon recognizes, however, that the antecedent causes involved in the generation of these worms close to the skin are different from those of intestinal worms. Alongside gluttony, and eating figs and chestnuts, bad hair care and failure to change clothes might cause these animals close to the skin to flourish. The poor, or those in a religious life, or those who are almost feral in their lifestyle are particularly susceptible. These external parasites are not just a nuisance to the victim. Bernard argues that they may be signs of more serious illnesses like *morphea* or *lepra* (de Gordon, 1542).

Discussion

Researchers have attempted to provide modern identifications of worms mentioned in ancient medical texts, oriental and western (Jirsa and Winiwarter, 2010; Trompoukis et al. 2007; Yeh et al. 2019). There are difficulties, however, in doing this exercise for the western Middle Ages. Intestinal worms and other human parasites were described by writings in the *practica* tradition between the 11th and 15th centuries in Western Europe. The Latin names these creatures were given in the text are not safe guides to modern identification of the species described (Mitchell, 2011). Although descriptions by the medieval authors do suggest possible correspondences between some kinds of worms and bioarchaeological findings, the descriptions themselves are not wholly consistent. Whether there are 3 or 4 kinds of intestinal worm was open to interpretation when texts were translated into Latin from Arabic. It was consequently a subject of disputation for university scholastics in their commentaries on the texts. There was much more agreement between authors and commentators on the phlegmatic matter from which worms were generated and the process of putrefaction that gave life to the animals through heat. The perspective within which the generation of worms within the human body was understood was entirely consistent with the humoral medicine of Galen. This did not change from the 11th to the 15th century and the translation of new texts from the Arabic and disputes over interpretation of authoritative texts did not allow for significant challenges to Galenic orthodoxy (García-Ballester, 2002).

As with most nosological literature of the Middle Ages, it is hard to tell whether the authors consistently regarded intestinal worms as a disease or as a state of humoral imbalance for which the appearance of worms was symptomatic. Academic orthodoxy and the precedent of ancient texts reinforced the humoral imbalance paradigm and this is most evident in those parts of the *practica* texts on worms which deal with the nature and causes of the worms

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(Horden and Hsu, 2013; Kaye, 2014). In the part of the *practica* that deals with cures, there is a different emphasis. The very wide range of cures on offer addresses the urgency of killing worms and expelling them from the body. Because worms were thought to be generated from phlegm, a wet and cold humour, the medicinal simples found most often as ingredients in recipes for cures were classed as dry and hot in quality. They were understood as working by contraries, that is, they contributed towards restoring the humoral imbalance by their opposite qualities. A favourite ingredient in recipes for worms was *absinthium* or wormwood which was classed as hot and dry. The juice of wormwood was to be used 'against worms in the lower intestines' according to the *Tractatus de herbis*, a general account of medicinal simples based on 13th-century sources (Ventura, 2009, p. 235). But the *practica* of Johannes Platearius claims that bitter things kill worms whether given as a powder or in pills, and *absinthium* is bitter above all (Muñoz, 2016, p. 578). Therapies which aimed to kill and expel worms tended to bypass the subtleties of humoral imbalance in favour of direct action. The same is true of other illnesses discussed in the *practica* texts whose treatment often owed more to remedies tested by experience than to humoral explanations. This experiential perspective is reinforced in collections of remedies put together for individual or household use (often drawing on recipes from *practica* texts). These treat intestinal worms and worms found in the tooth or ear or in festering wounds without much discrimination between kinds of worms or their causes (Ogden, 1938). They are treated with remedies designed to kill or expel those worms.

This emphasis on destroying and expelling intestinal worms fits quite comfortably with modern medical treatments of parasites. The same is not true for the description and explanation of the causation of the kinds of worms characteristic of medieval medical texts. While it may seem plausible that 15-foot worms exiting the body through the mouth, as described in Savonarola's text, were 15th century tapeworms, this is an exceptional case. The descriptions of the 3 or 4 kinds of worms in medieval sources owe more to textual distinctions inherited from ancient authorities than to contemporary observations. Medieval explanations of the causes of worms in terms of humoral imbalances and generation through putrefaction are still further removed from modern scientific models.

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