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Parallels between Greco-Roman veterinary and human medicine: a comparison of the procedures of bloodletting and bone setting

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Abstract

Although much attention has been paid to Greco-Roman medicine, significantly less attention has been paid to veterinary medicine, despite the current degree of academic interest and scholarship on ancient animals. Modern studies on ancient veterinary medicine have either focused on the procedures performed on animals without any comparison to the same procedures in human medicine or briefly mentioned the similarities between procedures in animal and human medicine in the Greco-Roman world. They have also focused on similarities in theoretical frameworks of veterinary and human medicine or similarities in surgical procedures but neglected other types of procedures like bloodletting. Previous studies have also not addressed the differences in procedures when performed on humans in comparison to animals. To what extent were human and animal health and disease understood to be similar, or divergent? Did the same factors cause illness in both humans and animals? Did animals and humans suffer the same ailments and injuries and were they treated in similar ways? The aim of this paper is to answer these questions by comparing bloodletting and bone setting in human and veterinary medicine. This paper builds on previous scholarship discussing the similarities between the procedures of human and veterinary medicine including Sephocle, Gitton-Ripoll and Vallat's 'Extension et insufflation: les soins de l'épaule du cheval chez les hippiatres antiques' and Ortoleva's 'I termini *rota*, *strophus mac(h)ina* e la riduzione della lussazione della spalla del cavallo.' It will examine both medical and veterinary texts including the Hippocratic texts *On Joints* and *On Fractures*, Celsus' *De Medicina*, Galen's texts on bloodletting, Apsyrtus' letters in the Hippiatrica, the *Mulomedicina Chironis* and Vegetius' *Mulomedicina.*

Introduction

At the beginning of his treatise on veterinary medicine, Publius Vegetius Renatus laments the lack of attention given to veterinary medicine by Greco-Roman authors (particularly the lack of eloquently written veterinary texts) and veterinary medicine's secondary position to human medicine.[1] However, he also comments that he consulted both horse doctors and human ones to compile his treatise, stating that many matters in horse medicine did not differ much from matters in human medicine.[2] Later in the treatise, Vegetius discusses treatment methods such as bloodletting or cauterization, treatments also found in human medicine.[3] Vegetius is not alone in his observation that animal medicine was closely connected to human medicine. Like Vegetius, the *Mulomedicina Chironis* also makes mention of bloodletting and cauterization.[4] Apsyrtos mentions parallels to human medicine most often when discussing surgical procedures such as a method for suturing the peritoneum.[5]

Parallels between animal and human medicine invite questions about the relationships between the two. For example: to what extent were human and animal health and disease understood to be similar, or divergent? Did the same factors cause illness in both humans and animals? Did animals and humans suffer the same ailments and injuries and were they treated in similar ways? As the general topic is beyond the scope of this paper, this paper will investigate the similarities and differences for the techniques of bloodletting and bone-setting in both ancient veterinary medicine and human medicine as a more focused way to investigate these questions. It will examine whether these procedures were used to treat equivalent conditions and if they were employed in roughly the same way, or if the differences were more marked.

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[1] Vegetius *Mulomedicina* prologus.2-4.
[2] Vegetius *Mulomedicina* prologus.6.
[3] Vegetius *Mulomedicina* 1.21-26,1.28.
[4] Claudius Hermeros *Mulomedicina Chironis* 1.3-15.
[5] Fischer 1988: 196.

Texts and Historical Context

Veterinary Medical Texts

The analysis for this paper draws upon eleven textual sources (three veterinary texts and eight medical texts) dating from the fifth century BCE to the fifth century CE. Vegetius' *Mulomedicina* can be roughly dated from between 383-450.[6] He draws from the agricultural text of Columella and the veterinary texts of Apsyrtus, Chiron and Pelagonius.[7] Although never cited directly by Vegetius in book 4 of his treatise, Columella's writings on veterinary medicine (which can be found in book 6 of his *De Re Rustica*),[8] provide the basis for Vegetius's book.[9] Apsyrtus' veterinary texts take the form of letters and can be found in the Greek *Hippiatrica*. These texts have been dated anywhere from the end of the first century CE to the early fourth century CE.[10] Oder asserts that the publication date of Apsyrtus' texts is after 334 CE.[11] No text written by Apsyrtus is extant independently. The Greek *Hippiatrica* itself dates to the Byzantine period and is a collection of various texts on horse medicine authored by Eumelos, Anatoilos, Pelagonius, Theomnestos, Hierocles, Tiberios and Hippocrates. It is not preserved in original form and survives in various versions. This paper will examine the extracts of Apsyrtus found in the first volume of Oder and Hoppes' 1924 edition of the *Hippiatrica.* This edition draws from the Berlin manuscript collection of the *Hippiatrica* (particularly the Berlin manuscripts 1538 and 1539), the Paris manuscript 2245 and Grynaeus' 1537 edition of the *Hippiatricorum*.[12] This study will also examine the veterinary text known as the *Mulomedicina Chironis*. The *Mulomedicina Chironis* serves as a Latin compilation of various authors (both Greek and Latin) including Chiron, Apsyrtus and Claudius Hermerus.[13] Oder postulates that Claudius Hermerus may have been the compiler of the text. The text dates roughly to 400 CE and Vegetius draws on it

[6] Oder 1901: 13.
[7] Vegetius *Mulomedicina* prologus.2-4.
[8] Columella *De Re Rustica* 6.1.1-38.4
[9] Lommatzsch 1903: 29.
[10] Fischer 1988: 196-197.
[11] Oder 1901: 13.
[12] Hoppe and Oder 1924: 5-6.
[13] Oder 1901: 5-18.

significantly for his own text. An investigation into Pelagonius' *Ars Veterinaria* is outside of this study's scope.

The Hippocratic Texts: *On Joints* and *On Fractures*

The medical texts to which these veterinary texts will be compared to include the Hippocratic texts *On Fractures* and *On Joints*, Celsus' *De Medicina*, texts from the Galenic Corpus, and Oribasius' *Collectiones Medicae.* Although the Hippocratic texts *On Fractures* and *On Joints* date to the latter half of fifth century BCE (450-400 BCE),[14] they had a long literary afterlife and were influential texts for later medical authors. Around 100 BCE, Apollonius of Citium wrote a commentary on the Hippocratic text *On Joints*, which famously included diagrams of the various procedures.[15] Erotian's *Collection of Hippocratic works* begins with *On Fractures* which is then followed by *On Joints.*[16] Galen wrote his first Hippocratic commentary on *On Fractures*, whereas his commentary on *On Joints* was his longest and fullest.[17] *On Fractures* was one of the many Hippocratic texts which Galen used to support his theory that Hippocrates was a believer in 'incipient teleology' like Plato.[18] *On Joints* continued to be cited into late antiquity by authors such as Aretaeus, Oribasius and Paul of Aegina. The long-lasting literary influence of this text and the mention of the shoulder dislocations cattle suffer from in *On Joints* 8, make these texts appropriate points of contact for a comparison between bone-setting procedures in human medical texts and their veterinary counterparts.[19]

[14] Craik 2015: 194.
[15] Craik 2015: 191-192.
[16] Craik 2015: 188.
[17] Craik 2015: 191-192.
[18] Nutton 2020: 80-82.
[19] Hippocrates *On Joints* Littrè 4.94.15-98.8, Loeb 8.19-53.

Celsus' *De Medicina*

Celsus' text *De Medicina* (which Granados dates to 50 AD)[20] helps medical historians to fill the void that exists in the corpus of surviving ancient surgical texts between those of the Hippocratic Corpus and Galen's surgical works.[21] It was a section of a larger encyclopedia which also addressed the topics of agriculture, rhetoric, philosophy and military science.[22] It is the only fully extant part of this encyclopedia, with the other sections of the encyclopedia being fragmentary. Celsus' descriptions of surgeries show advances which were the outcome of research conducted on human anatomy and physiology in the third century BCE at Alexandria.[23] These advances include the use of ligatures to control hemorrhage, the use of new surgical equipment and advances in wound healing. Vegetius' text interacts with Celsus' text both directly and indirectly. In book 4 of his text, Vegetius cites Celsus directly when mentioning cures for a drooping neck in oxen.[24] As mentioned previously, an important source for Vegetius' work was Columella's *De Re Rustica*.[25] Celsus was Columella's contemporary and an important source for book 5 of his agricultural text.[26] Thus, the place of Celsus' text within the corpus of surviving surgical texts and Vegetius' direct and indirect interaction with his text (through Columella) make *De Medicina* a significant point of comparison for veterinary medical texts.

The Galenic Bloodletting Texts

Galen's first major text on bloodletting *De Venae Sectione adversus Erasistratum* was written soon after his first arrival in Rome, which dates it to 162 CE.[27] This text was a rebuttal against Erasistratus' beliefs on bloodletting, which was originally an address

[20] Granados 1978: 359.
[21] Blatchford 2024: e482.
[22] Prioreschi 2001:184.
[23] Blatchford 2024: e482.
[24] Vegetius, *Mulomedicina* 4.15.4.
[25] Lommatzsch 1903: 29-31.
[26] Baldwin 1963: 788-789.
[27] Brain 2010:100; Nutton 1973:159.

given by Galen to a group of philosophers at the Temple of Peace.[28] The address was a response to a question posed by a listener who asked if Erasistratus was correct to not practice bloodletting.[29] Galen's friend Teuthras had a slave copy down the address, so that he could bring it back with him to Asia Minor.[30] Erasistratus preferred the starvation of his patients and the applications of tourniquets to prevent blood from flowing into the affected limb rather than blood-letting.[31] Erasistratus' followers employed three-day fasts for their patients when treating plethoric conditions or fevers.[32] Other texts which discuss bloodletting such as *De Venae Sectione adversus Erasistrateos* and *Ad Glauconem De Methodi Medendi* were written during Galen's second stay in Rome (from 168-169 CE) or later in his life (*De Curandi Ratione per Venae Sectionem*).[33] *De Venae Sectione adversus Erasistrateos* was Galen's response to the Erasistrateans' enthusiastic adoption of bloodletting after the publication and success on the topic.[34] Galen's later text on bloodletting (*De Curandi Ratione per Venae Sectionem*) is less combative when compared to the two earlier treatises, but still contains an anecdote which positions Galen in a favourable light when compared to his Erasistratean rivals.[35] Galen cures a young steward suffering from an eye condition successfully through the use of bloodletting, while his Erasistratean counterpart fails to do so because of his hesitancy to resort to this treatment.[36] Galen's texts will be used as a point of comparison for the veterinary medical texts because of their long literary afterlife and influence.

[28] Brain 2010: 15; Nutton 2020: 42; Boudon-Millot 2012: 157.
[29] Galen *De venae sectione adversus erasistrateos Romae degentes* K11.194; Boudon-Millot 2012: 157.
[30]Galen *venae sectione adversus erasistrateos Romae degentes* K11.194; Nutton 2020: 42; Boudon-Millot 2012: 157.
[31] Nutton 2020: 42.
[32] Boudon-Millot 2012: 156-157.
[33] Brain 2010: 102,106; Singer and Rosen 2024:16; Boudon Millot
[34] Nutton 2020: 42.
[35] Nutton 2020: 43.
[36] Galen *De curandi ratione per venae sectionem* Kühn 11.299-302.

Oribasius' *Collectiones Medicae* and Antyllus' *On Methods of Treatment*

Oribasius was one of the first medical compilers of late antiquity,[37] whose work is still extant. Galen was a major source for Oribasius' compilation, particularly the section of Oribasius' text which addresses the procedure of bloodletting.[38] Oribasius' work, the *Collectiones Medicae*, also contains extracts from Hippocrates, Dioscorides, Rufus of Ephesus and others. Oribasius' text provides excerpts from the lost medical works of lesser-known physicians like Antyllus and Herotodus.[39] Oribasius' text dates from between 350-403.[40] In medical compilations of this period, authors often quoted excerpts of collected texts verbatim and rarely expressed their own authorial views.[41] This study compares the methods of bloodletting found in the excerpts of chapter two (titled *On Methods of Depletion*) of Antyllus' work *On the Methods of Treatment* in Oribasius' *Collectiones Medicae* with methods of bloodletting found in the veterinary texts.[42] Since Antyllus' work does not survive independently, this study relies upon the text of his compiler. Although Antyllus' work dates closer to the second century CE, the citation of his text by Oribasius indicates that the text was influential after this period and that it had a literary afterlife. [43]

Similarities in the Practice of Bloodletting

The similarities in the practice of bloodletting in human and veterinary medicine helps support the argument that human and animal health and disease were for the most part understood to be similar in the Greco-Roman world. These similarities include the purpose for the procedure, the conditions the procedure treated, the restrictions for the

[37] Salazar 2024: 482.
[38] Salazar 2024: 482-483; Oribasius *Collectiones Medicae* 7.1-14 (*CMG* 6.1.1,194-214).
[39] Peltier 1999: 24; Grant 1960: 158; Harris 2024:146 (footnote 377).
[40] Salazar 2024: 483.
[41] Nutton 2004: 295.
[42] Grant 1960: 169.
[43] Grant 1960: 157.

patient group it was performed on, recommendations for using it prophylactically, the steps taken to prepare the patient, and the time when the procedure should be stopped.

Shared Rationale

In both human medicine and veterinary medicine, the purpose of bloodletting was to remove built-up or corrupted blood from the body, which could cause inflammation and lead to fever. Celsus mentions that bloodletting is unsuitable for bodies which have a deficiency of material or are healthy but is suitable for bodies which have either too much blood or if the blood has been corrupted.[44] Celsus further states that severe fever is one condition in which there is too much blood, and bloodletting is required. Since Celsus was a source which Vegetius interacts with in his text, it is notable that Vegetius mentions a similar purpose for bloodletting:[45]

> *Cuius rei talis redditur ratio. Sanguis enim ciborum humorumque indigestione corruptus per membra discurrit et languorem doloremque aut universe corpori aut aliquibus partibus consuevit inferre.*
>
> Of which matter the reason is given as such. For blood, corrupted by the indigestion of food and humours, flows through the limbs and it is accustomed to bring in sluggishness and pain either to the whole body or to some parts (of it).

Like Celsus, Vegetius states that corrupted blood is the reason why bloodletting should occur. However, unlike Celsus, Vegetius suggests that the cause of this corrupted blood is the indigestion of food and humours. Overall, this shared rational for bloodletting indicates that the same factors were believed to cause illness in both humans and animals.

[44] Celsus *De Medicina* 2.10 (*CML* 1, 78).
[45] Vegetius *Mulomedicina* 1.21.3.

Therapeutic Applications

Bloodletting was performed on both humans and animals to treat similar conditions. Galen notes that the arteries behind the ears are incised to treat vertigo and chronic headaches in human patients, while the temporal arteries are bled to cure ophthalmic diseases.[46] In a discussion on the benefits of prophylactic bloodletting, Galen suggests that individuals who are predisposed to suffer from apoplexy, pneumonia, angina, pleurisy, retained haemorrhoids, plethoric diseases, those who have weaker eyes, and those who have scotoma connected to vertigo should be bled in the spring.[47] Likewise, in his veterinary text, Vegetius mentions that bloodletting from the ears was used to treat conditions such as headaches, vertigo, insanity, heart diseases, falling diseases, phrenetic diseases, edema, sunstroke and rabies.[48]

Restrictions on Bloodletting

Restrictions about preforming bloodletting on specific types of patients can be found in Celsus' *De Medicina*, Galen's texts on bloodletting and two veterinary works, the *Mulomedicina Chironis* and Vegetius' treatise. Celsus states that previous medical authorities warned against treating children, pregnant women and the elderly with venesection, out of fear that it would weaken these individuals and cause pregnant women to abort.[49] However he asserts that it is the patient's strength besides simply the patient's age that should be considered by the practitioner. When discussing how a physician must consider the strength of the condition as part of the therapeutic process, Galen mentions that if the patient is strong and is fighting a violent disease, no-one would hesitate to perform venesection on the patient. Like Celsus, he further states that the severity of the illness and the strength of the patient (not an excess of blood) should be the determining factors for bloodletting but notes that children are the exception to this

[46] Galen *De curandi ratione per venae sectionem* K11.312-313.
[47] Galen *De curandi ratione per venae sectionem* K11.271-272.
[48] Vegetius *Mulomedicina* 1.25.2.
[49] Celsus *De Medicina* 2.10 (*CML* 1, 77-78)

rule.[50] He says that old patients can tolerate bloodletting well-provided they are still strong (which the physician can observe from feeling their pulse), but warns that not all individuals in this age category have the strength for bloodletting.[51] In general, Galen recommends that this treatment be restricted for use in those who are neither elderly nor children.[52] He does not use venesection in children who are under the age of fourteen.[53] Both Vegetius and Chiron warn about performing venesection on castrated animals and breeding animals, out of fear that bloodletting would further weaken them by depriving them further of their vital life force because blood was needed for reproduction.[54] Drawing on a concept found in Chiron's text, Vegetius states that bloodletting is beneficial when it is done in moderation according to the time of the year, strength of the animal and its age.[55] He recommends that young animals should only be bled from the palate annually and blood should be drawn from no other part of their bodies.[56]

Prophylactic Applications

Galen and veterinary medical authors like Apsyrtus, the author of the *Mulomedicina Chironis* and Vegetius mention that bloodletting was sometimes used prophylactically in the spring for specific groups of patients. As mentioned previously, Galen states that individuals who might benefit from prophylactic venesection in the spring include those who are predisposed to suffer from apoplexy, pneumonia, angina, pleurisy, retained hemorrhoids, plethoric diseases, those who have weaker eyes, and those who have scotoma connected to vertigo.[57] Apsyrtus mentions that venesection from the palate helps keep animals in health, while the *Mulomedicina Chironis* states that blood should be

[50] Galen *Ad Glauconem de methodo medendi* K10.286-287.
[51] Galen *Ad Glauconem de methodo medendi* K11.291; *In Hippocratis de acutorum morborum victu* K15.765 (*CMG* 5.9.1, 287).
[52] Galen *Methodus medendi* K10.565; *In Hippocratis de acutorum morborum victu* K15.763 (*CMG* 5.9.1, 286)
[53] Galen *Ad Glauconem de methodo medendi* K11.290.
[54] Claudius Hermerus *Mulomedicina Chironis* 1.14-15; Vegetius, *Mulomedicina* 1.23.
[55] Claudius Hermerus *Mulomedicina Chironis* 1.3; Vegetius *Mulomedicina* 1.22.1-2.
[56] Vegetius, *Mulomedicina* 1.22.2.
[57] Galen *De curandi ratione per venae sectionem* K11.271-272.

drawn from the neck routinely to maintain health (although it is admitted that previous authors of veterinary medicine texts have advised against this).[58] Building off the recommendations of Apsyrtus and the author of the *Mulomedicina Chronis,* who are the veterinary sources for his own text, Vegetius mentions that timely venesection can be beneficial for the animal.[59] Vegetius also says that many people think it is beneficial to bleed their animals in the spring, but reiterates that previous authors thought this practice to be harmful.[60]

Preparation

Humans and animals undergo the same initial steps in preparation for bloodletting as mentioned by Celsus, Erasistratus, the *Mulomedicina Chironis*, and Vegetius. Fasting was one of the initial steps in the preparation of patients for venesection. This step can be found in Celsus' *De Medicina*, although Celsus acknowledges that emergency situations might not always allow for this step:[61]

> *Cum sit autem minime crudo sanguis mittendus, tamen ne id quidem perpetuum est: neque enim semper concoctionem res expectat.*
>
> But although blood ought to be let least with indigestion, nevertheless it does not even hold consistently: for the matter will not always wait for digestion.
>
> [……]
>
> *At si morbi ratio patietur, tum demum nulla cruditatis suspicione remanente id fiet; ideoque ei rei videtur aptissimus adversae valetudinis dies secundus aut tertius.*
>
> But if the reason for the disease endures, then at last it should be done with no suspicion of indigestion; therefore, the second or third day of adverse health may seem the most suitable for this matter.

Likewise, in preparation for venesection, Chiron and Vegetius recommend that a horse be placed on a reduced diet, a day before the procedure, so that any indigestion is

[58] Apsyrtus *Hippiatrica Berolinensia* 9.1.20; Claudius Hermerus *Mulomedicina Chironis* 1.5-6.
[59] Vegetius *Mulomedicina* 1.21.1.
[60] Vegetius *Mulomedicina* 1.22.1.
[61] Celsus *De Medicina* 2.10 (*CML* 1, 79)

avoided.[62] Another significant step in the preparation of both human and animal patients, was using methods to make veins more visible. In this regard, Oribasius quotes the physician Antyllus (living in the second century CE) who mentions the use of a broad strap in the procedure of venesection. Antyllus breaks down the procedure into steps, unlike other authors like Galen who are more interested in the theoretical aspects of the procedure than its steps. The broad strap should have a width of two or more fingers and should be placed in the area between the arm muscle and the bend in the armpit, although it should be applied lower for patients who have rounded and well-defined arm muscles (particularly if the practitioner wishes to open longer veins).[63] For the purposes of making veins visible, Antyllus notes that placing the band below the elbow fold is incorrect, as the vessels above such a band will not swell.[64] In addition to the use of the band, Antyllus says that the patient should rub their hands together and hold something in them.[65] When discussing the method of venesection for the forehead, corner of the eye, on the tongue or near the ears, he states that the patient should place their left or right hand under the chin, so the band can be wrapped around their neck, without crushing the trachea (the band is wrapped around the fingers instead of being directly applied to the neck.).[66] The practitioner should bathe the area with warm water beforehand both when conducting venesection on the hand and the back of the knee. For phlebotomy on the back of the knee or at the ankles, after the band has been applied, the patient should walk around and should be standing upright when the practitioner makes the incision.[67] Vegetius mentions that the method for venesection on horses (which occurs at the jugular vein) utilizes a ligature tied around the animal's neck (not unlike the human procedure for bloodletting from the neck), the use of a sponge and the pressure of the practitioner's thumb to make the vein more prominent. The procedure should be performed while the

[62] Claudius Hermerus *Mulomedicina Chironis* 1.6; Vegetius *Mulomedicina* 1.22.3.
[63] Oribasius *Collectiones Medicae* 7.9.1-2 (*CMG* 6.1.1, 210).
[64]Oribasius *Collectiones Medicae* 7.9.6 (*CMG* 6.1.1, 211).
[65] Oribasius *Collectiones Medicae* 7.9.6-8 (*CMG* 6.1.1, 211).
[66] Oribasius *Collectiones Medicae* 7.9.8-9 (*CMG* 6.1.1, 211).
[67] Oribasius *Collectiones Medicae* 7.9.10-12 (*CMG* 6.1.1, 211).

animal is standing up, which is similar to the position of the human patient for bloodletting from the back of the knee or the ankles:[68]

> *In solo autem aequali statues iumentum cervicemque illius loro cinges quod strictius super scapulas teneatur ab aliquo, ut vena possit clarius eminere. Tunc spongiola cum aqua venam ipsam saepe deterges, ut altius emineat. Pollicem quoque sinistrae manus interius deprimes, ut non eludat et tumidior atque inflatior vena reddatur.*
>
> However, you will stand the draught animal on flat ground and you will encircle its neck with strap, which is held tightly by another above the shoulders, so that the vein can stand out more clearly. Then you will frequently wipe of the vein with a sponge with water, so that it may project out profoundly. You will also press the thumb of your left hand so that the vein may not delude you and so that it returns more swollen and distended.

Termination of the Procedure

Both human and veterinary medical authors mention that the procedure of bloodletting should be stopped around a similar time. Celsus mentions that bloodletting should be stopped when the patient's blood turns from being thick and black to red and translucent.[69] Celsus says that this change rarely occurs on the first day and recommends that the procedure be extended over two days. Galen also mentions that it is important to consider any change in the blood when preforming bloodletting (particularly a change in flow or a change in the patient's pulse).[70] For patients who have an inflammatory focus near the sight of the vein, he notes that the practitioner should wait for a change in the colour of the blood and its consistency before stopping. He notes the comment in the Hippocratic *On Regimen in Acute Diseases*, which mentions that blood should be let until it turns redder or yellower (or more livid if not clear and red).[71] However, Galen maintains that the practitioner must keep in mind the strength of the patient's faculties and the strength of the disease (and thus may need to stop earlier). He asserts that it is fine to

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[68] Vegetius *Mulomedicina* 1.22.3-4.
[69] Celsus *De Medicina* 2.10 (*CML* 1,80).
[70] Galen *De curandi ratione per venae sectionem* K11.292.
[71] Galen *De curandi ratione per venae sectionem* K11.292-293; Hippocrates *On Regimen for Acute Diseases* Littré 2.272.8-274.1, Loeb 22.

wait for the change in blood if the patient is in the prime of their life and the surrounding air is ambient.[72] Both the author of the *Mulomedicina Chironis* and Vegetius agree with Celsus' and Galen's assertions and state that the procedure of bloodletting should be stopped when the blood begins to be redder or becomes purer.[73]

Differences in the Procedure of Bloodletting

Although human and animal health and diseases were considered for the most part to be similar, there were some aspects of divergence. On a small scale, this divergence can be seen from the differences found in the practice of blood-letting in human and animal medicine. These differences include the duration of the procedure, the practitioner monitoring the human patient's pulse to prevent excessive blood withdrawal, the extent to which blood was taken (to the point of the human patient fainting) and the volume of blood which was taken.

Duration of the Procedure

Celsus states that the procedure of bloodletting should be divided over the course of two days. The first day of bloodletting should have the aim of relieving the patient, while the second day should purge the patient. This method prevents the patient from losing all their strength at once:[74]

> *Fere etiam ista medicina, ubi necessaria est, in biduum dividenda est: satius est enim in primo levare aegrum, deinde perpurgare, quam simul omni vi effusa fortasse praecipitare.*
>
> Even this medicine generally, where it is necessary, ought to be divided into two days: for, it is better to ease the sick person on the first day, then to purge, than to

[72] Galen *De curandi ratione per venae sectionem* K11.293.
[73] Claudius Hermerus *Mulomedicina Chironis* 1.10; Vegetius *Mulomedicina* 1.22.6.
[74] Celsus *De Medicina* 2.10 (*CML* 1,79).

perhaps to precipitate the patient's ruin with all their strength having been poured forth.

After the first day the vein should be bandaged over with a superimposed pad containing cold water and flicked open with the tip of practitioner's middle finger the next day. Neither the author of *Mulomedicina Chironis* nor Vegetius make mention of the veterinary procedure of bloodletting lasting two days. Unlike in Celsus' text, there is no mention of any pad to temporarily close over the wound or any method to reopen the wound on the part of the practitioner. The author of *Mulomedicina Chironis* mentions that blood should be taken from the palate (around the area of the canine teeth), a fixed number of days after the initial blood draw.[75] Vegetius also mentions blood being drawn from the palate as an aspect of post procedural care, but he is not any clearer than the author of the *Mulomedicina Chironis* on the number of days after the phlebotomy procedure this would occur.[76] This aspect is different from the two day procedure described by Celsus in that it occurs in a different location on the patient's body (on the palate) from the initial spot of venesection (on the neck).

Pulse Monitoring

An aspect of bloodletting which occasionally appears in the human procedure but is not a part of the procedure performed on animals is the practitioner monitoring the patient's pulse. Both Celsus and Galen mention that the patient's strength should be checked by monitoring their pulse to initially see if their body can withstand bloodletting and to examine how much blood can be withdrawn during the procedure. Celsus says that that the blood vessels are a better diagnostic aid than the appearance of the patient:[77]

> *Facilius itaque illi detractionem eiusmodi sustinent: celeriusque ea, si nimium est pinguis, aliquis adfligitur; ideoque vis corporis melius ex venis quam ex ipsa specie aestimatur.*

[75] Claudius Hermerus *Mulomedicina Chironis* 1.1.11.
[76] Vegetius *Mulomedicina* 1.22.11.
[77] Celsus *De Medicina* 2.10 (*CML* 1, 78).

> Therefore, more easily, the former sustain a withdrawal of this kind: and more quickly and more quickly someone is weakened by it, if he is too fat; therefore the strength of the body is better estimated from the veins than from the appearance itself.

Galen mentions that some physicians limit the amount of blood withdrawn from the patient based on if there are changes in the pulse such as it diminishing in tone during the procedure. [78] Galen himself also stipulates that an alteration in the pulse marks the point at which the physician should stop the procedure.[79] Monitoring the patient's pulse to estimate their strength both before and during the procedure of venesection is not mentioned by the veterinary authors. Neither the *Mulomedicina Chironis* nor Vegetius mention the practitioner monitoring the animal's pulse at the facial artery (below the eye or the straight section of the lower jaw), maxillary artery (on the other side of the rounded part of the jaw), median artery (on the inside of the forearm), metatarsal artery (outside of the hind cannon bone), coccygeal artery (under tail) or digital arteries (below knee, between tendons and cannon bone). These places are the locations where modern grooms usually examine the pulse in horses.[80] Vegetius mentions that the practitioner should use the thumb of their left hand, pressing inwards, to make the vein more prominent and prevent it from moving. While the practitioner could be feeling the flow of blood through this thumb during the procedure, Vegetius does not explicitly mention the practitioner keeping their thumb on the animal's neck (on the jugular vein) after piercing the vein with an arrow (*sagitta*).[81]

Extent and Amount of Blood Drawn

Differences in the extent to which blood was drawn and the amount of blood drawn can be found in Galen, the *Mulomedicina Chironis* and Vegetius' text. In his text *On Venesection against the Erasistrateans at Rome* (*De venae sectione adversus erasistrateos Romae degentes*), Galen mentions that some doctors say they continue the

[78] Galen *De venae sectione adversus erasistrateos Romae degentes* K11.217.
[79] Galen *De venae sectione adversus Erasistratum* K11.172.
[80] Landers 2006:193-196.
[81] Vegetius *Mulomedicina* 1.22.4, 2.40.2.

procedure of venesection until the patient faints, so long as they are sure that the patient has fainted from the removal of blood and not from a humour (like bile or phlegm) flowing to the cardiac orifice.[82] In his text, *On Treatment by Venesection* (*De curandi ratione per venae sectionem*), he states that the practitioner should withdraw blood from the patient to the point that the patient faints.[83] Galen warns however, that the pulse should be closely monitored when the patient faints to prevent their death. Galen believes that the practitioner should withdraw approximately three cotyles for a moderate evacuation, with four cotyles being too much blood, and two cotyles having some benefit for the patient while doing not a lot of harm.[84] According to Brain, three cotyles works out to be one and a half Imperial pints or 850 ml.[85] Both the author of the *Mulomedicina Chironis* and Vegetius, do not make any mention of bleeding the animal patient to the point of fainting. The author of the *Mulomedicina Chironis* is careful to stipulate that that the animal patient should not be moved for less than two hours after the procedure has occurred, so that the body can compose itself again.[86] Unlike Galen, the author of the *Mulomedicina Chironis* and Vegetius do not give specific measurements for the ideal amount of blood to be drawn from the animal. The author of the *Mulomedicina Chironis* simply state that the practitioner should draw as much blood as they see fit based on the size of the animal's body.[87]

Similarities in the Procedure of Bone-Setting

The procedure of bone-setting for breaks and dislocations in both human and veterinary medicine indicates that humans and animals were believed to suffer similar injuries and were treated in similar ways. Practitioners of both veterinary and human medicine used similar machines, methods and tools to heal the injuries of their patients.

[82] Galen *De venae sectione adversus erasistrateos Romae degentes* K11.217.
[83] Galen *De curandi ratione per venae sectionem* K11.287-289.
[84] Galen *De venae sectione adversus Erasistratum* K174.
[85] Brain 2010: 31.
[86] Claudius Hermerus *Mulomedicina Chironis* 1.10.
[87] Claudius Hermerus *Mulomedicina Chironis* 1.9.

Machines

Similar machines and methods of fixing broken bones and dislocations can be found in the Hippocratic texts *On Fractures*, *On Joints*, the *Mulomedicina Chironis* and Vegetius' *Mulomedicina. On Fractures* 13, describes several variations of a reduction method used to fix dislocated ankles.[88] The initial procedure involves two men, one pulling in one direction and the other providing a counter extension.[89] Three of the variations for this procedure utilize the nave of a wheel, straps, and a piece of wood. For the first variation using these elements, the practitioner should bury the nave of the wheel in the earth and place the end of the piece of wood into the wheel nave (with the straps wrapped around the foot also bound around the piece of wood).[90] The practitioner would pull back on the wooden rod and the wheel nave, while an assistant holds the patient's upper body holding the shoulders and upper knee. The only difference between the second and first variation is a rod fixed near the patient's perineum and pegs fixed under either armpit to prevent the movement of the patient's upper body, removing the need for an assistant.[91] The third variation adds a second wheel nave buried in the ground above the patient's head. A wooden rod is inserted into the second wheel nave like the first. Straps are wrapped around the knee and the thigh and wrapped around the rod. The wheel-nave acts as the fulcrum to the rod and the whole mechanism creates a counter extension to the other wheel nave.[92] Next, the Hippocratic author states that instead of using a wheel nave, the practitioner could use a board with winches at either end.[93] *On Joints* 78, a ladder fastened in the ground is used to reduce an inwards dislocation of the hip.[94] The patient should be seated on the ladder, their healthy leg should be strapped to the ladder, while a basket full of stones or a jar full of water should be hung from the patient's injured leg. The author of the *Mulomedicina Chironis* and Vegetius mention the use of a wheel (*rota*)

[88] Hippocrates *On Fractures* Littré 3.460.8-466.8, Loeb 13.1-58.
[89] Hippocrates *On Fractures* Littré 3.462.1-5, Loeb 13.6-11.
[90] Hippocrates *On Fractures* Littré 3.462.7-12, Loeb 13.13-20.
[91] Hippocrates *On Fractures* Littré 3.462.12-464.6, Loeb 13.19-32.
[92] Hippocrates *On Fractures* Littré 3.464.6-12, Loeb 13.34-39.
[93] Hippocrates *On Fractures* Littré 3.464.12-466.3, Loeb 13.39-45.
[94] Hippocrates *On Joints* Littré 4.314.16-316.8, Loeb 78.42-47.

and machine (*machina*) used to fix dislocated shoulders, knees and feet.[95] The author of the *Mulomedicina Chironis* says the following: [96]

> *Si recens causa fuerit, statim alliges eum et armum ad rotam duces aut ad machinam, si habes. si ad rotam duces, stringes eum medium ad columnam. si in campo, strophum fige aut palum, alliges eum et medium vaste cinges, ne ventum recipiat, nisi armum ducas. armum leviter sic loro alligabis supra genu et iosum et infra articulis aequaliter duces, donec strepitum audias vertibuli. et si hoc continebis, denique virgis teneribus caedes armum.*
>
> If the cause was recent, tie (the animal) up immediately and move the shoulder to the wheel or to the machine, if you have it, if you lead it to the wheel, tie him in the middle to a column. If in a field, fix a picket or stake, tie (the animal) up, you will bind his midsection tightly, lest he take in wind, unless you move the shoulder. You will bind the shoulder thus lightly above the knee and hock with a leather strap and you will evenly draw it out below the joints, until you hear a cracking of the joint and if you continue this, then strike the shoulder with soft cords.

According to Ortoleva, the term *stropheus* could only mean a picket or a small piece of wood, which could be planted in the ground.[97] This would prevent the horse's body from moving when traction was produced by the wheel. Ortoleva also believes that the *machina* mentioned by the author of the *Mulomedicina Chironis* was likely a millstone, which could be substituted for the wheel when a wheel could not be found.[98] Like the mechanism in *On Fractures* 13, the mechanism described by the author of the *Mulomedicina Chironis* to fix a dislocated shoulder involves the use of straps, a wheel and pieces of wood (or the use of a column).[99] Sephocle, Gitton-Ripoll and Vallat believe that this piece of wood/or column would have been located near the horse's sternum which would have been protected by a sheep-skin.[100] It would serve as a counter traction point, which is similar to the function of the wooden rod near the patient's perineum in the second variation of the dislocated ankle reduction in *On Fractures* 13.[101] This rod located in the area of the sternum is also similar to the pegs fixed under the patient's armpits.

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[95] Claudius Hermerus *Mulomedicina Chironis* 7.583; Vegetius *Mulomedicina* 2.46.
[96] Claudius Hermerus *Mulomedicina Chironis* 7.583.
[97] Ortoleva 2016: 26.
[98] Ortoleva 2016: 34.
[99] Claudius Hermerus *Mulomedicina Chironis* 7.583.
[100] Sephocle, Gitton-Ripoll and Vallat 2012:184-185.
[101] Sephocle, Gitton-Ripoll and Vallat 2012:185; Hippocrates *On Fractures* Littré 3.462.12-464.6, Loeb 13.22-29.

Both elements provide a counter extension while keeping the patient's upper body fixed. They suggest that the strap was wound around both the leg of the animal and the axel of the wheel, which is similar to how the strap is bound around the patient's foot and tied to the wooden rod in the first variation in the Hippocratic *On Fractures* 13.[102] Sephocle, Gitton-Ripoll and Vallat suggest that the mechanics of the wheel may have worked like the mechanics of the board and winches mentioned in *On Fractures* 13.[103] Like the winches in the Hippocratic text, traction would be applied to the joint when the wheel was turned. Vegetius mentions a ladder (*scalis*) like the ladder used in *On Joints* 78 when discussing fractures of the leg or hip joint.[104]

Treatment Methods and Tools

Veterinary practitioners and human practitioners employed the same methods to treat dislocated and broken bones. In *On Fractures* 4-7, the Hippocratic author describes the method of treatment for a broken arm, which included setting the arm, bandaging it, the application of compression on the arm and the use of a sling.[105] This section of the text also provides a day-to-day overview of care for patients with broken arms. The practitioner treats the break by extending the limb and pushing broken parts back into position.[106] Then the practitioner anointed the arm, applied two sets of bandages and compresses. After the fracture has been re-adjusted the bandages were removed and reapplied on the third day and the seventh day.[107] On the seventh day, the practitioner added a splint to the bandage.[108] The splint was tightened after the seventh day up to the twentieth.[109] *On Fractures* 16, states that practitioners should place a pillow of linen or

[102] Sephocle, Gitton-Ripoll and Vallat 2012:185; Hippocrates *On Fractures* Littré 3.462.7-12, Loeb 13.13-20.
[103] Sephocle, Gitton-Ripoll and Vallat 2012:184; Hippocrates *On Fractures* Littré 3. 3.464.12-466.3, Loeb 13.39-45.
[104] Vegetius, *Mulomedicina* 2.47.2; Hippocrates *On Joints* Littré 4.314.16-316.8, Loeb 78.42-47.
[105] Hippocrates *On Fractures* Littré 3.430.1-442.17, Loeb 4.15-7.47.
[106] Hippocrates *On Fractures* Littré 3.428.11-432.3, Loeb 4.15-41.
[107] Hippocrates *On Fractures* Littré 3.434.3-436.12, Loeb 5.20-6.2.
[108] Hippocrates *On Fractures* Littré 3.436.16-19, Loeb 6.8-12.
[109] Hippocrates *On Fractures* Littré 3.438.18-440.2, Loeb 7.1-5.

wool under a bandaged leg.[110] The use of cautery to fix shoulders which are routinely dislocated can be found in *On Joints* 11.[111] To fix such types of dislocations, the practitioner should grasp the skin at the armpit and draw it towards the location where the head of the humerus gets dislocated.[112] The practitioner should then pass thin, elongated cautery irons through the skin.

Like the Hippocratic author, Vegetius mentions the use of bandages, a sling and splints when discussing leg and hip fractures.[113] The initial method of treating fractured limbs in Vegetius' text is similar to what is described in *On Fractures* 4-7.[114] Vegetius states that the limb should be repositioned, bound with bandages which had been soaked in wine and oil.[115] Wool padding should be applied on top of the bandages, and the fracture should be wrapped with splints. The animal should be placed on a frame, a ladder or in a sling. Vegetius recommends that dressings should be removed on the third day and reapplied, repeating this on the fifth, seventh and ninth days which is a similar notion to the reapplication of bandages found *On Fractures* 4-7.[116] Vegetius mentions that practitioners can use cautery to treat broken and dislocated bones, but only after the bones have been properly positioned and have somewhat healed.[117] This is comparable to what the Hippocratic author says about the use of cautery for shoulder dislocations in *On Joints* 11.[118]

[110] Hippocrates *On Fractures* Littré 3.474.13-15, Loeb 16.13-16.
[111] Hippocrates *On Joints* Littré 4.104.16-112.16, Loeb 11.10-98.
[112] Hippocrates *On Joints* Littré 4.106.7-14, Loeb 11.21-30.
[113] Vegetius *Mulomedicina* 2.47.2-3; Hippocrates *On Fractures* Littré 3.430.1-442.17, Loeb 4.15-7.47.
[114] Hippocrates *On Fractures* Littré 3.428.11-432.3, Loeb 4.15-41.
[115] Vegetius *Mulomedicina* 2.47.2-3.
[116] Vegetius *Mulomedicina* 2.47.2-3; Hippocrates *On Fractures* Littré 3.434.3-436.12, Loeb 5.20-6.2.
[117] Vegetius *Mulomedicina* 28.5-7.
[118] Hippocrates *On Fractures* Littré 4.104.16-112.16, Loeb 11.1-98.

Differences in the Procedure of Bone-Setting

Although breaks and dislocations in humans and animals were treated with similar machines, methods and tools, there were some noticeable therapeutic differences found in human medical texts when compared to veterinary texts. These differences include the attitudes towards treating open fractures and dislocations and the methods of treatment for dislocated and broken bones.

Attitudes Towards Treatment of Open Dislocations and Fractures

While generally pessimistic about the complete recovery and survival of patients who have suffered open fractures and dislocations, the author of *On Fractures* and *On Joints* nevertheless makes recommendations for the treatment of these types of injuries. Open fractures of the bone of the thigh and of the upper arm are discussed in *On Fractures* 35-36.[119] Despite admitting that patients rarely recover from these types of fractures and that reduction has no effect on patient survival, the author mentions that for some cases leverage combined with extension on the first day of the break might be suitable.[120] The author suggests that the patient should be given hellebore after the procedure and the wound should be treated with the remedies used for fractured skulls.[121] In *On Joints* 63, the author mentions treatments for the wounds caused by dislocated leg bones which protrude, despite stating that the patient will be permanently disabled.[122] For these types of dislocations which have been reduced (which will likely cause the patient's death), the author doubtfully recommends hellebore.[123] Both the author of the *Mulomedicina Chironis* and Vegetius mention fractures and dislocations which are unlikely to heal or have a high mortality rate but unlike the Hippocratic author, they do not suggest treatment. Since bindings cannot be made around the hip socket or the thigh, the author of the

[119] Hippocrates *On Fractures* Littré 3.536.13-540.9, Loeb 35.1-20.
[120] Hippocrates *On Fractures* Littré 3.536.13-15, 3.536.18-20, 3.538.7-10, Loeb 35.1-3, 35.7-12, 35.21-26.
[121] Hippocrates *On Fractures* Littré 3.538.11-14, Loeb 36.1-4.
[122] Hippocrates *On Joints* Littré 4.270.10-274.1, Loeb 63.13-44.
[123] Hippocrates *On Joints* Littré 4.268.12-270.10, Loeb 63.1-44.

Mulomedicina Chironis and Vegetius deem these types of fractures incurable.[124] Vegetius states open fractures are difficult to treat and nearly incurable and does not provide any methods of treatment for this type of break.

Treatment Methods

A difference in the method of treatment for dislocated bones is the use of cautery and bloodletting over manual manipulation in veterinary medical practice. Manual manipulation of the limbs and the use of simple tools are very common methods of reduction in the Hippocratic *On Joints*, especially for dislocated shoulders. For example, in *On Joints* 4, one method involves the practitioner placing the tip of his shoulder in the patient's armpit to reduce a shoulder dislocation.[125] Another method used to treat the same injury in *On Joints* 5, employs a pestle shaped piece of wood placed in the patient's armpit.[126] The practitioner is responsible for pulling the patient's arm down along the pestle shaped piece of wood to help facilitate the reduction. The author of the *Mulomedicina Chironis* mentions a procedure for reducing dislocated shoulders in cattle which uses cautery.[127] If the practitioner finds swelling in the dislocated joints, the practitioner should cut the swellings open, apply a poultice, wound healing ointment and dry linen cloths to the wounds. They would then apply constriction to the limb (through binding and compression) and cauterize the limb to stabilize it. This author also states that blood should be drawn in horses from the area between the joint and the coronet (below the tendon) to treat dislocations in the leg caused by twisting and turning.[128]

[124] Claudius Hermerus *Mulomedicina Chironis* 1.45; Vegetius *Mulomedicina* 2.47.1.
[125] Hippocrates *On Joints* Littré 4.84.19-86.8, Loeb 4.1-14.
[126] Hippocrates *On Joints* Littré 4.86.12-15, 4.88.3-6, Loeb 5.1-6.
[127] Claudius Hermerus *Mulomedicina Chironis* 6.572.
[128] Claudius Hermerus *Mulomedicina Chironis* 7.601.

Limitations

The limitations of this study include the scope of the study, the corrupted nature of some of the primary sources (especially the *Mulomedicina Chironis*), the type of veterinary medicine investigated and the chronology of the texts. The scope of this study mainly focuses on the veterinary texts in the Latin tradition (with Apsyrtus' letters being an exception to this). This study did not investigate any of the other authors in the Greek *Hippiatrica* (such as Eumelos, Anatoilos, Pelagonius, Theomnestos, Hierocles, Tiberios and Hippocrates) as they are not overtly named as sources in Vegetius' text and an investigation into both the Latin and all the authors in Greek *Hippiatrica* would prove too extensive for a single study. The *Mulomedicina Chironis*, a major primary source for this study, contains fairly corrupted Latin, making it difficult to clearly identify specific tools and machines for procedures. The type of veterinary medicine investigated, is also limited to large animal practice as the sources tend to focus on them and other farm animals, neglecting family pets or other small animals. The chronology for the texts used (particularly the *Mulomedicina Chironis* and Apsyrtus' letter) is often difficult to infer. Like the Greek *Hippiatrica*, the *Mulomedicina Chironis* is a compilation of texts dating to different periods, but the texts were brought together at the same time. The chronology of surviving veterinary texts is also quite late compared with some of the medical sources. Future studies could focus on the similarities between the procedures described in the Greek *Hippiatrica* and those described in human medical texts. They could investigate other procedures such as surgery.

Conclusion

Within an analysis of the procedures of bloodletting and bone-setting, human and animal health and disease were largely understood to be similar with a few notable divergences. Bloodletting was performed on both humans and animals for the purpose of removing built-up or corrupted blood from the body, which was believed to lead to illnesses like fevers, showing that the same factors caused illness for both humans and animals according to Greco-Roman veterinary and medical authors. Bloodletting was used to treat

similar ailments in both humans and animals, indicating perhaps that humans and animals could suffer from similar ailments in the minds of Greco-Roman veterinary and medical authors and could be treated using the same methods. The procedure of bone-setting was similarly used to treat dislocated and broken shoulders, legs, hips and arms. The technique of bone-setting in human and veterinary medicine shared similar machines, equipment and day-to day care. Bloodletting was acknowledged to be harmful for certain groups by both veterinary and ancient medical authors and it was occasionally recommended for prophylactic use in both humans and animals. Humans and animals underwent the same initial step in preparation for blood-letting (including fasting) and bloodletting was generally stopped around the same time in humans and animals (when the blood changed colour or consistency). Occasionally points of divergence can be found in the procedures of bloodletting and bone-setting, such as the duration of the procedure (with Celsus suggesting that patients should be bled over the course of two days but with no specification from the veterinary sources about the duration of bloodletting for horses), the monitoring of the patient's pulse (which occurred in human bloodletting procedures only), the extent to which blood was taken (in humans to the point of fainting) and the volume of blood taken. The differences between the technique of bone- setting in human and veterinary medicine included differing attitudes towards treating open fractures and dislocations and different methods of treatment for dislocated and broken bones. Human medicine's close connection with and similarity to veterinary medicine indicates that human medicine in antiquity influenced and was influenced by many other disciplines and did not grow out of isolation. Furthermore, such connections between animal and human medicine helps to prove in some respects that the ancient Greeks and Romans did not believe humans to be all that different from their animal counterparts.

Bibliography

Baldwin, B. (1963) 'Columella's sources and how he used them', *Latomus*, 22 (4), 785-791.

Blatchford, J.W. (2024) 'The Surgery of Celsus' *De Medicina*', *Annals of Surgery Open: Perspectives on Surgical History, Education, and Clinical Approaches*, 5(3), e482.

Brain, P. (1986) *Galen on Bloodletting: A study of the origins, development and validity of his opinions, with a translation of the three works*. Cambridge: Cambridge University Press.

Boudon-Millot, V. (2012) *Galien De Pergame: Un médecin grec à Rome*. Paris: Les Belles Lettres.

Celsus (1915) *De Medicina.* vol.1. Edited by F. Marx. Leipzig: Teubner.

Celsus (1935) *On Medicine*. vol. 1. Translated and edited by W.G. Spencer. London: Harvard University Press.

Columella (1954) *Columella: On Agriculture*. *Books 5-9.* Translated by E.S. Forster and E.H. Heffner. London: Harvard University Press.

Craik, E.M. (2015) *The 'Hippocratic' Corpus: Content and Context*. Oxfordshire: Routledge.

Fischer, K.D. (1988) 'Ancient Veterinary Medicine: A survey of Greek and Latin sources and some recent scholarship', *Medizinhistorisches Journal*, 23 (3/4), 191-209.

Grant, R. L. (1960) 'Antyllus and his Medical Works', *Bulletin of the History of Medicine*, 34 (2): 154-174.

Galen (1914) *In Hippocratis De victu acutorum commentaria VI*. Edited by G. Helmreich. Leipzig:Teubner.

Harris, W. (2024) *Dire Remedies: A Social History of Healthcare in Classical Antiquity.* Berlin: De Gruyter.

Hermerus, C. (1901) *Mulomedicina Chironis*. Introduction and edited by E. Oder. Leipzig:

Teubner.

Hippocrates (1928) *On Wounds in the Head. In the Surgery. On Fractures. On Joints. Mochlichon.* Vol.3. Translated by E.T. Withington. London: Harvard University Press.

Hippocrates (2023) *Prognostic. Regimen in Acute Diseases. The Sacred Disease. The Art. Breaths. Law. Decorum. Dentition.* Vol.2. Edited by P. Potter. London: Harvard University Press.

Kühn, K.G. (eds) (1921-1833) *Claudii Galeni Opera Omnia*. 22 vols. Leipzig: Knobloch.

Landers, T.A. (2006) *Professional Care of the Racehorse: A Guide to Grooming, Feeding and Handling the Equine Athlete.* Lexington: Eclipse Press.

Littrè, E. (eds and trans) (1893-61) *Oeuvres completes d'Hippocrates*. 10 vols. Paris: Bailliere.

Nutton, V. (1973) 'The Chronology of Galen's Early Career', *The Classical Quarterly*, 23 (1), 158-171.

Nutton, V. (2004) *Ancient Medicine.* London: Routledge.

Nutton V. (2020) Galen: *A Thinking Doctor in Imperial Rome*. London: Routledge.

Oder, E. and Hoppe, C. (eds) (1924) *Corpus Hippiatricorum Graecorum: Hippiatrica Berolinensia*. vol 1. Leipzig: Teubner.

Oribasius (1928) *Collectiones Medicae*. Edited by J. Raeder. Leipzig: Teubner.

Ortoleva, V. (2016) 'I termini *rota, strophus, mac(h)ina* e la riduzione della lussazione della spalla del cavallo', *Pallas: Revue D'Études Antiques*, 101, 115-141.

Peltier, L. (1999) *Fractures: A History and Iconography of their Treatment*. San Francisco: Norman Publishing.

Prioreschi, P. (2011) *A History of Roman Medicine: Roman Medicine.* vol 3. Omaha, NE: Horatius Press.

Salazar, C.F. (2024) 'Galen in the Late Imperial and Early Byzantine Periods', in Singer, P.N. and Rosen, R.M. (eds) *The Oxford Handbook of Galen*. Oxford: Oxford University Press.

Singer, P.N. and Rosen, R.M. (eds) (2024) *The Oxford Handbook of Galen*. Oxford: Oxford University Press.

Sophocle, L., Gitton-Ripoll, V. and Vallat, F. (2012) 'Extension et insufflation: les soins de l'épaule du cheval chez les hippiatres antiques', *Bulletin de la Société Français de la Médicine et des Sciences Vétérinaires*,12,177-205.

Vegetius, P. R. (1902) *Digestum Artis Mulomedicinae*. Introduction and edited by E. Lommatzsch. Leipzig: Teubner.