

# An analysis of terms “physician” and “medical” in the context of La Tène period and Roman Age

Lucie Burešová

Researchers in archaeology have used various terms of the similar instruments from different geographical areas in their catalogues. The opinions of current medical professionals also cause an issue. There is no consensus on the fundamental question, namely the correct use of the term “medical” for the tools used for the diagnosis and treatment of diseases in periods that do not fulfil the image of modern medicine in terms of information or practices. This paper presents the results of the analysis of the terms “physician” and “medical”, their origin and legitimacy of use for artefacts from the La Tène period and Roman Age, for which the original purpose for diagnosis and treatment is assumed. Special attention is paid to the use of these terms for artefacts originating in the areas of Europe.

**Keywords:** medicine; medical; surgical; archaeology of medicine; history of medicine

## Introduction

Medical terms reflect the degree of development in the field at the time of their creation. Therefore, the etymology, analysis, or synthesis of these terms should not be performed without incorporating the historical perspective (Kábrt – Kábrt 2004, 7). Traditionally, communities use conventional features to assign specific terms to various concepts. In this context, a concept is represented by natural symbolism and enables the communities to recognise the true form of the matter (Spitzer 1975; Stodola 2010). The multidisciplinary nature of the history of medicine requires a consideration of the arguments of archaeologists, but also of the medical historians and physicians. Knowledge of all these fields is applied in this research. For the purposes of this article, the main area of interest is specified as Central Europe (the La Tène period can be dated from 480 to 40 BC and the Roman era can be dated from 40/45 BC to 400 AD).

## Investigated problem and methods

There is no agreement amongst researchers in the fields of archaeology and the history of medicine and the contemporary medical specialists. Philosophy (namely the philosophy of medicine, the philosophy of science and the history of philosophy) also brings fundamental insight into this problem. The main research questions

are: Using the philosophical, historical and modern medicine angles, is it appropriate to call the organised therapeutic practices, observed since the development of the first paradigms in Europe, “medicine” (in this context, medicine is understood as the science and art)? Is it appropriate to call the instruments found in Central Europe, originating from the era since the development of the first paradigms in Europe, medical instruments?

To answer these questions, a literary research is being undertaken. The aim of this research is to determine from which historical period it is appropriate to use the term medical science. The data have been extracted from the original and transcribed written sources, together with contemporary resources, dealing with the history of medicine and the archaeology of medicine. The conceptual framework is based on philosophical resources.

## Concept analysis

Isidor of Seville states that “*medicine is what protects or restores physical health; its purpose is to deal with illnesses and injuries*”, while definition of the purpose of medicine by Soranus of Ephesus is “*to provide, to indulge the health*” (Isidor of Seville 1998, 49). Researchers find three important milestones of development in the history of medicine. Various researchers started to use the term “*medicine*”, to describe the field, from the moment that they consider to be the true beginning of medicine as a field of science. According to Jiří Stodola (2015, 22), science can be defined, using the philosophy of information, as “*an area of human knowledge that is unified by the object of research, the perspective of the object of research, and the methodology*”. Based on the archaeological findings and the Hippocratic works (referring to texts inspired or written by Hippocrates of Kos<sup>1</sup> living around 460–370 BC and by his followers in the broad sense), researchers consider the era from the 5<sup>th</sup> to the 4<sup>th</sup> century BC as a fundamental moment from which medicine could be treated and referred to as a science. It is a moment (the first milestone) in which it is possible to notice the unification of the subject of research and the beginnings of a methodological approach. The beginnings of the early science in the 17<sup>th</sup> century can be described as the second

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<sup>1</sup> The second Hippocrates (he is primarily mentioned in the following text, only in the case of ambiguity is added the number II) is known as the “*founder of Western medicine*”. He was believed to be the grandson of the first known Hippocrates. The collection of works known as Corpus Hippocraticum likely originated from various authors. The possibility that none of the texts came from Hippocrates of Kos himself cannot be ruled out completely. This assumption contrasts with the original approach of attributing some of the texts directly to Hippocrates (e.g. Jouanna 1999).

milestone. Both milestones are characterized by critical re-evaluation of previous practices and by efforts for unification of the current approaches (Sakai 2007).

Sakai (2007) assumes that the fundamental transformation of Western medicine, into the form that continues to today (the third milestone), took place in the 19<sup>th</sup> century. The Hippocratic school stood at the beginning of the development of European (Western) medicine, but the words “*medicine*” or “*medical instruments*” can be tracked back to scholarly texts researching even the previous periods and other territories around the world. Emily K. Teall, in her research of resources of the situation in Mesopotamia since 3000 BC, even uses the word “*doctoring*” (Teall 2014), in addition to the term “*medicine*”. Diagnostic and treatment tools, such as gold, silver or bronze chisels, knives, and obsidian lancets (for example from Peru – Inca Empire; Rifkinson–Mann 1988), have been found and described as “*medical*” by modern researchers. However, other artefacts, with similarities to the current concept of medical devices, were also described by scholars. Examples of these include splints (Egypt ca 2100 BC; Smith – Dawson 1924), dental prostheses (Etruria, Badisches Landesmuseum Karlsruhe 2017, 311; Phénicia and Egypt, Johnson 1959), lower limb prosthesis (China, 3rd–2nd century BC; Li et al. 2013), and lower limb finger prosthesis (Egypt 1550–700 BC, Nerlich et al. 2000). However, the sole finding of individual artefacts, without further evidence of their use by a specialist in an organised scientific practice, does not provide sufficient basis for determining these as activities of medical science. Science arises from the gradual discovery of causal connections, from experience and through systematisation. Abstract concepts are then defined on this basis (Stodola 2019). Epistemology is applied and specialised sciences are formed (Boon – van Baalen 2019). The requirement of measurability, or verifiability of the results of medical science, its repeatability and reproducibility, seems to be problematic to achieve due to the nature of medicine itself. It is necessary to accept the fact that medicine itself does not fulfil the image of exact science, even in its present form. To assess a human in the contemporary medicine, we must follow certain standards, established by analysing statistical data obtained from a large population sample. However, the significant individuality of each subject makes it often impossible to find the same solution, for seemingly the same problem, affecting all patients.

### *Recognition by comparison*

The recognition of medicine, and its contrast to alternative healing practices, is one of the approaches used by researchers to identify medical science in history. For example, the authors of the exhibition “The History of Medicine and Healing in the Czech Lands from the Middle Ages to the Beginning of the 20th Century”, which was held in Prague in 2010 (Kašpar 2010), and presented a large number of artefacts stored in the *Medical Museum of the National Medical Library in Prague*, compared medicine and alternative healing practices.

They used artefacts dating back to the 17<sup>th</sup> century, when the practices of in field were already defined by teachings at University, but there was still no uniformed international terminology. For the purposes of the exhibition, the question of defining medicine was bypassed by presenting a fairly organised field and comparing it with folk practices. The authors focused on the contrast of the two approaches, rather than their separation by precise definition. A similar contrast can be found in Greece in the 5<sup>th</sup> century BC. The existence of alternative practices was described by Hippocratic authors, who condemned enchanting and quackery, but who were generally accepting of the so-called “temple medicine” (Hippocrates 1923a; Bartoš – Fischerová 2012, 22). A number of written sources, from the period before the 5<sup>th</sup> century BC, makes a link between the solution of health problems and deity (Alušík 2018, 53). The question of contrast also arose between Roman surgical practices, probably performed by Roman army surgeons, and the unknown practices of the barbarian population, which can be evidenced only by discoveries of tools, for which there have been no exact analogies (but which show some basic similarities) within the Greek and Roman instrumentarium.

### *Material culture*

Archaeology of medicine in Central Europe (mainly due to the natural conditions and the preservation of artefacts in them) relies primarily on the discoveries of metal artefacts. Also due to the unavailability of written sources from the territory of, what is known today as, the Czech Republic from the Iron Age and the Roman Age, artefacts are limited only to metal tools often used for invasive procedures, which can be described as surgical. Surgery (along with obstetrics) is considered to be the oldest branch of medicine, i.e. medicine as we understand it today (Duda – Niederle 2000, 21). It is not possible to claim that surgery works solely with invasive procedures and medicine deals only with non-invasive practices (moreover, we cannot make this claim even when referring to the current practices). It is important to understand the connection between surgery and the provision of care to the wounded on the battlefield. Although the provision of care on the battlefield was only a part of the surgical field, it is an important reminder of the essence of surgery which is the treatment of health issues, that are often clearly visible to the surgeon, in not necessarily an invasive way. This helps researchers to distinguish surgery from medicine in the broader context. This is in a stark contrast to the idea of medicine.

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<sup>2</sup> There is not enough information about the so-called “*temple medicine*” to assess its relation to medicine. Its representatives are thought to be the priests of Asclepius. The temples provided, among other things, long stay facilities for patients, therefore the temples can be also considered important for their role of removing patients from the places where they might have contracted the disease (Isidor of Seville 1998, 32).

Hippocratic medicine treated conditions and illnesses which were often hidden, and their causes were unclear (according to *On Ancient Medicine*, Hippocrates 1923b; Bartoš – Fischerová 2012, 366). The principle of “not using a knife” has been enshrined in the Hippocratic oath for physicians (Hippocrates 1923b; Bartoš – Fischerová 2012, 152). The ban on physicians practicing surgery was a complicated issue. It is highly likely that the ban was often violated as the surgical texts have been part of the *Corpus Hippocraticum* (e.g. *On fractures*, *On Wounds in the Head* etc.). This was confirmed by Plato, who wrote that drugs and incisions were part of Asclepius medicine (Plato, *Resp.* 407d; Bartoš – Fischerová 2012, 172).

Surgery is characterised by open procedures (disrupting the skin cover of the body or mucous membranes), or so-called bloody procedures (Duda – Niederle 2000, 21). Inseparable part of the surgical field is also formed by bloodless procedures and processes, which often cannot be archaeologically proven. The necessary instruments for these procedures are usually made of non-metallic materials and have been preserved only in rare situations. Examples of preservation of non-metallic equipment can be found in the form of drug box of Pompeii (Bliquez 2014, 432) or leather bags and wooden boxes from the Acropolis of Athens (Bliquez 2014, 17). However, there are also written sources referring to bandage material or wooden urological catheters and probes (Bliquez 2014, 35).

Due to the separate development and different practices in *surgery* and *medicine* (in written sources, it is possible to see references to the divided surgical and medical fields; when referring to medicine, we assume that the practices were close to the contemporary internal medicine), the term “*surgical*” seems to be more appropriate for majority of found artefacts. The word χειρουργία (ή χείρ means hand and εργαειν means clutch or separate) existed in the 5<sup>th</sup> century BC’s Greek language (Bliquez 2014, 6) and indicated manual work, dexterity, or workmanship (Prach 1942, 224, 567). Hippocratic authors, Galen and Erotianus described surgical instruments in Greek with the word ἄρμενον (Bliquez 2014, 6), Hippocrates, Plato and Galen with the word ὄργανον (tool, device; Prach 1942, 374; Bliquez 2014, 6) and Aëtius with the word ἐργαλεῖον (tool; Prach 1942, 223; Bliquez 2014, 6), Celsus in Latin with the word *ferramentum* (Celsus 1938, 494; Bliquez 2014, 6). All terms generally refer to “*a tool*”, but without specification of the field. The Scottish physician and author of the first catalogue of antique instruments (including data obtained mainly by researching cities destroyed by the Vesuvius explosion in the year 79) J. S. Milne (1907) also described the artefacts as “*surgical tools*”<sup>3</sup>. Archaeologist Lawrence J. Bliquez followed Milne’s catalogue. In his works, he has also chosen the designation “*surgical tools*” for

<sup>3</sup> Although the terms “*instrument*” and “*nástroj*” are perceived as synonyms in the Czech language, the English-speaking reader understands an instrument as a specialised object, and tool as a more primitive object.

the Greek instrumentation used from the 5<sup>th</sup> to the 4<sup>th</sup> century BC and subsequently (Bliquez 2003). However, his catalogue has been expanded to include finds from the graves of Colophon, Bingen, Asia Minor, Cyprus, Italy, but also artefacts from the House of Surgeon in Rimini and the Alliano complex. Bliquez considers Milne to be highly qualified to define terms in the English language, primarily for his education and long-term medical practice, but also for his excellent knowledge of Latin and Ancient Greek (Bliquez 2014, 2). It confirms the importance of a cooperation between archaeology and contemporary medicine. The divide between medicine and surgery did not conclude in the Classical period. In Europe, since the 12<sup>th</sup> century, this division (especially through organisations and communities) has led to a number of conflicts. The situation during this period was even more complicated because, along with university-educated physicians and surgeons educated at the college for surgeons, the so-called *barbers* performed selected procedures, such as *bloodletting* (Bagwell 2005).

#### *Current perception comes from the current environment*

Regardless of whether or not it is possible to compare medicine and surgery from the 5<sup>th</sup> century BC with today's medical science, we cannot ignore the view of the modern society on the medical instruments when analysing the topic. The contemporary understating of medical science and legal regulations is influencing the thought processes of researchers and their approach to research of the state of medicine in the past. In terms of the current legislation in the Czech Republic (Act No. 268/2014 Coll. on Medical Devices), a medical device (the term used in the Act) is understood to be *an instrument... (designed) by its manufacturer for a specific use in diagnostic or therapeutic purposes* (Act No. 268/2014 Coll., § 2). The definition of a medical device from today's perspective influences the researchers, primarily because artefacts considered by archaeologists as "*medical instruments*" are analysed using the contemporary criteria. For example, contemporary medical devices include replacements of anatomical structures, therefore archaeologists are tempted to call them "*medical tools*" even when they date back to different historical periods.

The legal definition highlights the requirement for the specific use of an instruments. Thus, for example, a knife, which is presumed to have served more than just surgical purposes, would not comply with that wording. In that case, it is hardly possible to talk about a surgical knife, but instead simply a knife or a multipurpose knife. Although it is necessary to take the different understanding of instruments in the past into consideration, a pure existence of a multi-purpose instrument does not prove the performance of a specific activity. Yet the versatility of instruments is being included in some archaeological works, dealing with the identification of instruments.

At the same time, today's approach even allows custom-made tools, that meet the criteria stated above, to be described as a medical device. The evidence of production

of individual and non-series tools can be found in written sources (for example *On fractures*, Hippocrates 1928; or *Avoiding distress* by Galen in 2<sup>nd</sup> century AD, Singer 2014). Most products were not usually associated with specific workshops, but, at the same time, there were also well-known workshops producing a common range of tools, for example in Pompeii (Bliquez 2014, 15). Even today in the Czech Republic, a serial mass-produced instrumentation is not a requirement for the legitimate functioning of the field of medicine. The instrumentation of the Iron Age and Roman Age in the archaeological discoveries, different from the Roman or Greek tools in other parts of Europe (presumably barbarian parts), does not necessarily clarify that the usual procedures of ancient medicine in that period were not followed in that specific area. However, questions about their producers also arise. Galen wrote about his own designing and manufacturing of new prototypes of tools (from wax), which were afterward produced from the required metals by blacksmiths (Bliquez 2014, 16). It can be assumed that it was not possible to produce instruments, that were equal to Greeks, in the areas where the tool manufacturers were not active. Geographical reach of the activities of Greek medicine in the 5<sup>th</sup> century BC can only be estimated, but in a later period, there was a written request<sup>4</sup>, by an Egyptian “physician”, for sending some instruments from Greece, to be used as templates for further production (Singer 2014, 79; Bliquez 2014, 16). Similar communication could exist in other areas. As Jan Bouzek and Iva Ondřejová (1990, 22) point out, the relationship between inhabitants of the barbarian areas and ancient cities had existed since the Hallstatt period. Ancient documents helped to form our understanding of the inhabitants of Central Europe during the La Tène period and Roman Age and about their relations with Rome. Both Caesar and Tacitus distinguished the tribes of Great Germania, but considered them to represent one unit, while describing the land as rough and desolate (Pečírka – Nováková 1961). The perception of Central Europe by ancient authors, as a wooded and mountainous environment, could have had more than just a geographical significance. The idea of living in a place with difficult accessibility, and in a non-cultivated environment, could have given the impression that the inhabitants of the lands are also uncivilised and have difficulties to access news and ancient knowledge. And yet, an important part of the relationship seems to be the access to education and training, by some individuals from the barbarian lands, in Rome<sup>5</sup> (Pečírka – Nováková 1961).

<sup>4</sup> This information originates from an Egyptian “physician” in Oxyrhynchus Papyrus LIX 4001 and was interpreted as his request to send instruments to him.

<sup>5</sup> For example, Maroboduus spent his youth in Rome near Augustus. He knew the environment and was educated locally. At the same time, information about the military leader Arminius, who also acquired his knowledge in Rome, appears for the first time.

### *Healing versus medicine*

Reportedly, there are about one thousand cuneiform tablets and their fragments that have been related to Mesopotamian healing practices since 3000 BC (Majno 1975, 36). The oldest preserved surgical text in the world, the so-called *Papyrus of Edwin Smith* (Breasted 1991), was written at around 1600 BC (the text was likely based on materials thousands of years older) and is seen by some researchers as a predecessor of the textbooks of traumatology (Dobanovački et al. 2012). In the papyrus, complicated surgical procedures were described, but religious practices, exorcism and astronomy were still important elements in the treatment of patients at that time (Edwin Smith Papyrus also recommended religious practices to address certain cases, van Middendorp – Sanchez – BurrIDGE 2010; e.g. XVIII 18, Breasted 1991). Unlike in Egypt, the new concepts of medicine, which separate activities of the clergy from the organised medicine, began to emerge in Greece. The *founders of medicine* were still worshiped at that time, but the field was able to break free from that practice soon after (Kábrt – Kábrt 2004, 12). The Knoss tablets (15th century BC; Bartoněk 1961) and the Pylos tablets (13th century BC; Bartoněk 1964) provide evidence of the existence of a specialised activity known as medicine<sup>6</sup> (Ventris – Chadwick 2015). Tablet *PYEq 146* (Aurora 2015) bears the inscription *i-ja-te* (Arnott 2014, 45), which is remarkably similar to the word “physician” used in Greek to this day, i.e. *ιατήρ* or *ή ιατρός* (Prach 1942, 263). They probably belonged to the craftsmen or the so-called *δημιουργός* (*dēmiurgos*; Kábrt – Kábrt 2004, 11).

<sup>6</sup> Among the others, the words *a-ke-ti-ra* (Pylos tablet Aa 815, Aurora 2015; Arnott 1996, 267) and *a-ke-ti-ri-ja* (Knoss tablets KN Ak 7001, KN Ai 739, Aurora 2015) have also been recorded. The words were associated with a physician’s assistant and interpreted as a nurse by some authors, although the word is more often associated with a completely different meaning – a seamstress (Olsen 2018, 84). According to some authors, the word *a-ze-ti-ri-ja* (KN M 683, Aurora 2015) is also referring to nurses (Ventris – Chadwick 1973, 214), or wool processors (Olsen 2018, 174). Hippocrates used the word *ἀκεστρίς* for a midwife, but the tablets probably refer to textile workers (Arnott 1996, 267). The term *re-wo-to-ro-ko-wo* could refer to women treating and washing the wounded (Tritsch 1958), but it may be a name for the workers of water transport, water heating and washing (Carlier 1983). The existence of assistants in the performance of medical interventions is documented by iconographic sources (for example the relief of the tomb of the 2nd century AD on Isola Sacra, Bliquez 2014, 431). There is not enough evidence in pre-Christian history to call nursing an organised activity. The origin of the organised practice is usually associated with the early Middle Ages, and the beginnings of nursing education in the 19th century (in 1836 a teaching facility for evangelical nurses was established) the first metaparadigms were published in 1859, nursing has been described as a scientific discipline as of the 1950s (Kutnohorská 2010, 13–39).



According to the preserved sources, we can describe the scientific organisation of therapeutic activities in Greece from the 6<sup>th</sup> century BC. The subsequent organisation of the field is related to the creation of Hippocratic texts. However, knowledge about treatment procedures was disseminated without an excessive dependence on mysticism and the supernatural even before Hippocratic text (Kábrt – Kábrt 2004, 12). It should be noted that even the contemporary medicine is not completely free from spirituality. Modern holistic practices focus on the biological, psychological, social and spiritual aspects of the individual (Hawks 2004).

The Hippocratic paradigm<sup>7</sup> included treatment based on observational knowledge and empirical knowledge, but also a causal synthesis that forms the scientific basis (*On Ancient Medicine*; Hippocrates 1923b). Many of the texts by Greek (and later Roman) authors, written primarily in Greek language, provide an insight into the history of the field (Sakai 2007). Hippocratic works summarise many of the principles applied in medicine to the present time (Bartoš – Fischerová 2012). However, it should be noted, that a number of texts have been disputed by some followers of Hippocratic scholars as early as in the 3<sup>rd</sup> and 2<sup>nd</sup> centuries BC. The texts could have been altered by transcripts immediately after the death of its authors (Staden 2006). Later, Galen himself doubted the correctness and authenticity of transcripts of some of the documents (Staden 2006). Despite that, based on these documents, the term “*medical instruments*” has been routinely used by contemporary historians and archaeologists, to describe Greek and Roman artefacts dating back to the 5<sup>th</sup> century BC. The recognition of Hippocrates as a physician and the founder of Western medicine is accepted by the current medical community without any major reservations (e.g. Hanák – Ivanová – Potomková 2015), but the fundamental question is the level of development of science in his time.

### *The beginnings of science*

The text *Περί αρχαίας ιητρικής* (*On Ancient Medicine*; Hippocrates 1923b) is the first known attempt in the history of Greek thought to give a detailed description (in the form of observation and experience) of the evolution of science from the starting point. It discusses medical methods, as well as questions of the history of scientific methodology in general (Schiefsky 2005, 1). Researchers examining Hippocrates’ work deal with three main issues, namely (1) the identification of works from Corpus Hippocraticum, which were written directly by Hippocrates (II) and the identification of Hippocratic works, (2) the primary influence of philosophy on medicine, or medicine on philosophy, and (3) identifying an opposition in

<sup>7</sup> The paradigm is defined by Jiří Stodola (2015, 23) as: “*a framework of thought that forms the boundaries of a certain theory*”.

Hippocratic works<sup>8</sup> (Schiefsky 2005, 2). The different nature of the various writings within Corpus Hippocraticum, and the contradicting information within, raise doubts that there was in fact a unified consensus. The Hippocratic doctrine may have been artificially constructed by modern researchers (Bartoš – Fischerová 2012, 19). However, the heterogeneity of the texts may also be a result of the diverse approaches. Therefore, Corpus Hippocraticum could be a set of unorganised writings of two or more different, and inconsistent, directions of the medicine at the time.

The situation in the 5<sup>th</sup> – 4<sup>th</sup> centuries BC appears to show signs of a scientific revolution and thus the moment of transition to a new paradigm. The paradigm represents a generally accepted research result, that is applied as a template for solving issues of the same matter (Viceník 1997). The text *On Ancient Medicine* (Hippocrates 1923b) points to an increasing number of anomalies, questioning the paradigm and formulating a new one.

According to T. S. Kuhn, if the protoscience (i.e. the science of the pre-paradigmatic period, often characterised by participation of multiple competing schools) develops into normal science, a cycle of science development applies (Kuhn 1982). In this cycle of development, science experiences a crisis, to which it reacts with the scientific revolution and then creates a new science (Viceník 1997). It is the paradigm that establishes science, but even propaganda plays a crucial (if not the only) role in the choice of the winning paradigm, and the number of supporters of the paradigm determines further development of the field (de Paula Assis 1993). In practice, the winning paradigm (the school defining that paradigm) gains widespread acceptance and becomes the foundation for new studies within the field (Kuhn 1982). This will allow a development of a specialisation within the paradigm (the new science), which means that different groups of scientists can devote their research to a certain set of phenomena (de Paula Assis 1993).

In the 5<sup>th</sup> century BC, the concept of τέχνη was applied. We can translate and explain the term as *art*, *science*, or *craft*. It was probably first applied in medicine and was also adopted by Plato and Aristotle. It was a set of procedures organised in a highly systematic way and based on a knowledge of the nature of the subject (Schiefsky 2005, 5). The word ἐπιστήμη (knowledge/science/understanding) takes on the meaning of “*science*”. However, knowledge is a broader term than science. Aristotle laid the foundation of science, in today’s sense of the word, by referring to

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<sup>8</sup> The opposition may be seen in advocates of the hypothesis that medicine should be systematised based on the interaction of one or more contradictions of hot, cold, wet and dry factors. The author of *On Ancient Medicine* (Hippocrates 1923b) explicitly opposes this hypothesis, but his criticism is aimed at defining hypotheses in general. He seeks to emphasise the importance of experience and knowledge (Schiefsky 2005, 2).

the perceivable world (as opposed to Plato, which refers only to eternal and immutable ideas) using the term ἐπιστήμη (Aristotle 1933; Hobza – Zielina 2013, 81–82). According to the author of the text *On Ancient Medicine* (Hippocrates 1923b), medicine was already well established at the time of drafting the work. In Chapter 1, the author even stated that practitioners have the skills to achieve certain results in a reliable way (Hippocrates 1923b; Schiefsky 2005, 5). The field fulfilled the definition of science and, at the same time, demonstrated its history (as an integral part of the scientific field) and development. Philosophy and history of science are interdependent and cannot exist without each other (Smart 1972). However, the development of the instrumentation, which began in the Hellenistic world, does not fully appear until it reaches the Roman world (Bliquez 2014, 6).

To explore the history of treatment practices before the 5<sup>th</sup> century BC, it is necessary to take into account the original meaning of the word myth (μῦθος), where myth means a “word”, and it is generally related to a spoken transmission (compared to the term λόγος, means a “word”, but related to prose and logical reasoning; Hobza – Zielina 2013, 56). It is suggested by the myths that Asclepius, from his position as *the founder of the field*, passed his legacy in the research, theory and experiment to his “sons”, who might have been descendants or followers in a broad sense (Hiliopoulos et al. 2013), in an activity that seems like a protoscience. His followers then established the practice, so it gained fame, not only in ancient countries, but apparently also in the barbarian lands (Künzl 1995). However, the situation in barbarian lands is very difficult to trace.

The designation “*Celtic medicine*” (e.g. Künzl, E. 1987; Künzl, E. 1995; Podborský 1994, 101, 116) appears to be inappropriate for several reasons. There is no evidence that in the barbarian countries during the La Tène period (with which the Celtic ethnic group is associated) the therapeutic and diagnostic practices were conducted in accordance with certain paradigms, with unifying ideas, or that they somehow fulfilled the definition of science. Similarly, the material culture cannot be primarily associated with ethnicity (Hubinger 1988, 47), and it is questionable whether we can designate all La Tène period artefacts, allegedly produced locally, as “Celtic”. Moreover, it is often difficult to establish the place of production of the artefacts found in Central Europe, dated from 500 BC (i.e. the period that is considered to be the beginning of the paradigms application in Greece) to year 0. Furthermore, there is no local written evidence of medical activities in Central Europe, there are also no specific references to these activities in written resources made outside Central Europe.<sup>9</sup> The descriptions made by ancient authors emphasize the magical side of

<sup>9</sup> In the following period (Roman period), the artefacts (in the area under investigation) determined to be “medical instruments”, were often found in rich graves (e.g. Tejral 1970),

the treatment practice in barbarian countries (Plinius, NH, 30, 4; Bostock – Riley 1855) and it is not appropriate to consider these descriptions as objective. This does not mean that therapeutic activities were not carried out, but paradigms of this field of activities cannot be reconstructed based on the artefacts alone. It is possible to deduce the ways in which tools were used and, in combination with anthropological data, it is also possible to estimate the success of certain therapeutic procedures. However, the fundamental thoughts of the field cannot be based on these assumptions. The connection between the local people and their practices in Central Europe and in Greece is not clear, although it is suggested by E. Künzl (1995), based on his research of some artefacts. He assumed that the transfer of information about medicine, between the Greeks and the Celts, took place from the 4th century BC (Künzl 1995, 221). However, contact with the Greek practice could have taken place even earlier, as other elite imported artefacts from the Hallstatt period have been documented (Golec 2015, 125). Combining Central European activities with practices of the ancient world is problematic, as the imported artefacts do not demonstrate the same structure in their approach to solve health issues.

### *Growth and crises*

The field continued to develop in 4<sup>th</sup> century BC and followed Alexander the Great to Asia. Following that, Diocles of Carystus made significant advances in surgery and the design of new instruments (Eijk 2000, vii), Praxagoras focused on the study of anatomy (Tsoucalas et al. 2019), and Herophilus moved the field to Rome (Wiltse – Pait 1998). In the 2<sup>nd</sup> century BC a terminology was developed. Galen's main contribution to the field lies in the creation of an extensive synthesis of ancient medical knowledge and its interpretation into an accessible terminology, thus providing a basic framework for a coherent scientific system (Kábrt – Kábrt 2004, 13).

However, it is very difficult to estimate the level of accuracy with which the original practices have been followed. Cassius Dio wrote in his Roman history that “*he clearly heard that Antoninus (note: means Markus Aurelius) died, not because of illness, but because of the physicians who wanted to please Commodus*”<sup>10</sup> (Dio – Foster 1914, 72.21.1,

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Roman-style villas (e.g. Elschek 2017) and places of Roman permanent, or temporary, military camps (e.g. Fojtík – Jílek – Popelka 2015).

<sup>10</sup> ὅτι καὶ Ναρισταὶ τάλαιπῶρῆσαντες τρισχίλιοι ἄμα ἠὺτομόλησαν καὶ γῆν ἐν τῇ ἡμετέρᾳ ἔλαβον (Dio – Foster 1914, 412, Exc. UG 66, 72.21.1). καὶ εἶγε πλέον ἐβεβιώκει, πάντα τὰ ἐκεῖ ἂν ἐκεχείρωτο: νῦν δὲ τῇ ἑπτακαϊδεκάτῃ τοῦ Μαρτίου μετέλλαξεν, οὐχ ὑπὸ τῆς νόσου ἦν καὶ τότε ἐνόσησεν, ἀλλ’ ὑπὸ τῶν ἰατρῶν, ὡς ἐγὼ σαφῶς ἤκουσα (Dio – Foster 1914, 412, 72.21.2), τῷ Κομμόδῳ χαριζομένων (Dio – Foster 1914, 62, Xiph. 267, 4–14 R. St., 72.34.1).

72.21.2, 72.34.1). This statement may be expressing the author's consternation that physicians have acted against the Hippocratic doctrine (and the oath of a physician, by killing the patient), it may also be addressing a situation in which physicians have been unable to cure the patient's disease. The situation of intentional killing would be contrary to the already determined principle of *nil nocere*, or "at least not to hurt" (Isidor of Seville 1998, 12). It would also contradict the original wording of the so-called Hippocratic Oath (Hippocrates 1923b), which enshrined the practice of eliminating any actions, that could be harmful to the patient.

Another important point in history, in which medicine achieved a high degree of development, is the 7<sup>th</sup> century in Asia. Arab physicians translated Greek classics and also presented their own works. Avicenna's *Canon of Medicine* (Avicenna 1999) codified Arabic-Greek medicine (Kábrt – Kábrt 2004, 13). This was the most important step in the development of the field, until the first universities were established in Europe, however, the university masters drew information mainly from Galen's works. Some literature suggests that the development on the European continent, between the collapse of the Western Roman Empire and the establishment of the Salerno medical school around 1100 AD, represents the decline in the field (for example Porter 2001, 129).

Researchers, who promote the idea that medicine can be identified as a science only in the modern history, support their argument not only by significant advances made in the modern era, but also by the lack of systematic approach and terminology used in previous periods. However, documents already from the 12<sup>th</sup>-century university in Salerno illustrate a well-advanced system of teaching and scientific work (e.g. Ferraris – Ferraris 1997).

Even the term "*modern medicine*" is not accepted unilaterally. Some scholars consider the works of Jacob Berengar (1460–1530; Kachlík et al. 2008) to be an act of modern medicine. Within the territory of today's Czech Republic, the University of Prague was established, together with the works of its masters, for example Master Klaret who contributed fundamentally to the development of the terminology (the term *lékařstvo cirologia* appears in his dictionary; *cirologia* is most likely a word used to denote surgery; at the same time the "Old Czech" language used the term *lékařstvie ranné*; Michálek 1989, 62). Several important milestones in the development of medicine, led by Jan Jessenius' first public autopsy in our country, had been achieved. However, anatomical autopsy was performed even earlier. There are well known cases of the application of the procedure by Herophilus (330–250 BC) and Erasistratus (304–250 BC) dating back to ancient Alexandria. However, most of the ancient anatomical treatises were lost, with the exception of Galen's works, when the medieval medical university education rose to prominence (Sakai 2007). The autopsies in Europe were supervised by university educated physicians but performed by surgeons (this is an example of a separation of labour and authority between the

different fields). Since 1516, the profession of barbers disappeared in many countries (but barber-surgeons still existed in Germany and England), and autopsies were routinely performed by master physicians (Bagwell 2005).

### *Modern medicine*

The end of the 19<sup>th</sup> century is perceived as a period of fundamental changes in Western medicine. This is also reflected by Bliquez (2014). Progress was so rapid (in terms of the formation and standardisation of the field), that previous conditions were being marked as inadequate and the term “medicine” was reserved for the practices of the new period only. The first binding anatomical nomenclature in Latin has been in place since 1895 (Kachlík et al. 2008). The orchestration of the field can be performed using only the uniformed terminology and nomenclature<sup>11</sup>, which is necessary for the flawless communication between experts. The orchestration of the field is a crucial step (and Galen’s writings was also a good example of that; Singer 1956). Anatomical descriptions can exist without specific terminology, but these descriptions may hinder the dissemination of information to recipients. They are comprehensible only to some specialists with the knowledge of anatomy and allow differing interpretations, without the possibility of verifying the accuracy of information (Sakai 2007). Thus, without the generally applicable anatomical nomenclature, it was not possible to continue the development of anatomical science and medicine as such.

The development of the anatomical nomenclature can also be investigated. T. Sakai (2007) has found a total of five stages in the historical development of anatomical terminology since antiquity. The Galen’s oldest anatomical treatises represent the initial phase. However, Sakai points out that they contain only a limited number of anatomical terms, which were essentially colloquial expressions in the Greek language of the period (Sakai 2007). This anatomical nomenclature is based on the Hippocratic works, as well as works of Herophilos and Erasistratus (Kachlík et al. 2008). Sakai puts the second phase of anatomical terminology to the beginning of the 16<sup>th</sup> century (mainly referring to Vesalius’ *Fabrica*<sup>12</sup> from 1543), the third phase stands at the end of the 16<sup>th</sup> century (the main representatives were Sylvius in Paris and Bauhin in Basel), the fourth phase is based on the anatomical textbooks written in Latin in the 17<sup>th</sup> century, and in modern languages in the 18<sup>th</sup> and

<sup>11</sup> Nowadays, the nomenclature plays an important role primarily in anatomy, histology and embryology (Kachlík et al. 2008). Codes and terms from the International Classification of Diseases, the so-called ICD 10 (i.e. the 10<sup>th</sup> revision of this classification), are used for diagnostics in all medical disciplines.

<sup>12</sup> Vesalius’ illustrations circumvent the need for terminology in his work, yet they cannot replace exact concepts in everyday practice.

19<sup>th</sup> centuries, the fifth phase is dated from the late 19<sup>th</sup> century to the current revision of anatomical terminology (Sakai 2007). This division into phases reflects the important milestones in the development of medicine, with the last (fifth) phase encompassing the period from the 19<sup>th</sup> century to the present. However, in addition to the widespread development of recognised methods, the fifth phase is also associated with several theories identified as pseudoscience (e.g. *phrenology*) or with vociferously rejected practices (e.g. *eugenics*). The interest of contemporary medicine in practices known since the 5<sup>th</sup> century BC (Bliquez 2014, 1) and with an older instrumentarium, such as obsidian scalpels, is notable (Disa – Vossoughi – Goldberg 1993). The roots of this enthusiasm can be found in the 18<sup>th</sup> century, when surgical instruments were being discovered in Herculaneum (1738) and subsequently in Pompeii (1748; Bliquez 2014, 2; **Fig. 1**). It should also be noted that the interest in this issue led to counterfeiting of archaeological artefacts (mainly from famous places like Pompeii, but also from areas like Stradonice domestically), which peaked at the turn of the 20<sup>th</sup> century.

## Synthesis and conclusion

Since the 13<sup>th</sup> century BC there has been a provable continuity in the use of the term “physician” in Greek language, but the concept of medicine has changed over time. Evidence of the scientific approach couldn’t be found before the Hippocratic texts. Medicine is now considered an applied science. However, the occurrence of practices that do not correspond with today’s idea of medicine, or the decline of the field at certain times in history, does not disprove the existence or continuity of medical science. Logically and philosophically, the periods of decline can be identified as a crisis preceding the scientific revolution. A research into the historical background of the field, and numerous rewritten sources, suggest that medicine can be viewed as a science and an art (i.e. as specialisation/craft/expertise), since its first scientific revolution (the moments of development of protoscience into science). The deciding argument for identifying concrete terms for description of instruments (typically archaeological artefacts), is the separation in the development of medicine and surgery. If an artefact is indicative of the instruments used in surgery, and it is dated to the period in which the disciplines were separated, it should be referred to as a surgical tool rather than medical tool.

The fundamental argument for answering the question of correct use of terms in the archaeology of medicine must be searched for in history, and in factual content from the individual historical periods within the field. The practice from the Hippocratic period can be compared to medicine from today’s perspective because, it showed elements of science, and the cycle of development of science

was applied. Surgery has experienced a separate development. Its relationship to medicine has changed over time. The description of surgery (separate from medicine) was established by documented discoveries of instruments and also written resources dating from before 5<sup>th</sup> century BC. The field of surgery has continued to develop to the present day. However, it is no longer an independent discipline. It has lost its individuality and has become a part of a new field which, in accordance with a holistic approach, strives to comprehensively solve all problems of an individual as a human being. By reference to the written resource, the metal artefacts found in the area of interest, including scalpels, knives, spatulas, tweezers, needles and saws, can be considered instruments used for surgical procedures.

The designation of instruments in written resources and the organisation of the field in the particular period (mainly because of the division between medicine and surgery, with different forms of acquiring knowledge and experience) must be also taken into consideration. The identification of instruments as surgical should be taken into account when describing them in catalogues of archaeological findings.

The situation in the 16<sup>th</sup> century can be viewed as the first steps in the pursuit to unravel the complexity of medicine, rather than simply as a union of the two disciplines (medicine and surgery). It was another step in the development towards the current state. Pre-16<sup>th</sup> century, medicine was still adopting new practices.

In order to understand the historical developments, it is necessary to break away from the current perception of medicine and accept this seemingly ambiguous picture. The fundamental criteria for recognising the maturity and structure of the field is often not dependent on the level of knowledge or the perceived complexity of the scientific methods, but upon the overall concept and its primary focus.

An understandable argument for using the term “*medical tool/instrument*” (although inaccurately), even when in conjunction with periods that do not meet the criteria for the definition of science and modern form of medicine, is the consistency, ease of access to information and its transfer among researchers. The term is frequently used and directs readers straight to the contemporary concept of medicine and thus the search results may include information covered by the current medical device characterisation. However, as stated, precise terminology is a fundamental requirement for the functioning and development of science and the term *medical* should therefore only be used in conjunction with a discipline that fulfils the definition of science or is part of the history of medical science. Therefore, it should be avoided to associate the term with artefacts for which this connection is demonstrably non-existent, or with *surgical instruments*. It is therefore inappropriate to use the term “*Celtic medicine*”. It is also necessary to exercise caution when describing tools that could serve multiple purposes. Their designation as *surgical* is questionable, as the discovery of an instrument alone does not necessarily prove the concurrent presence of a specialist.



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*Correspondence*

*Ing. Mgr. Bc. Lucie Burešová*

*Institute for History of Medicine and Foreign Languages*

*First Faculty of Medicine, Charles University*

*U Nemocnice 4*

*CZ-12108, Prague 2*

*Czech Republic*

*buresova.lucie@gmail.com*



Fig. 1: Surgical procedure pictured on a mural in Pompeii (Nass 1907, 6) identified as *Iapyx treats Aeneas* (Bliquez 2014, 439). After: Nass, L. (1907) "Blessés et avariés", *Le Correspondant médical* 306, 6–11.