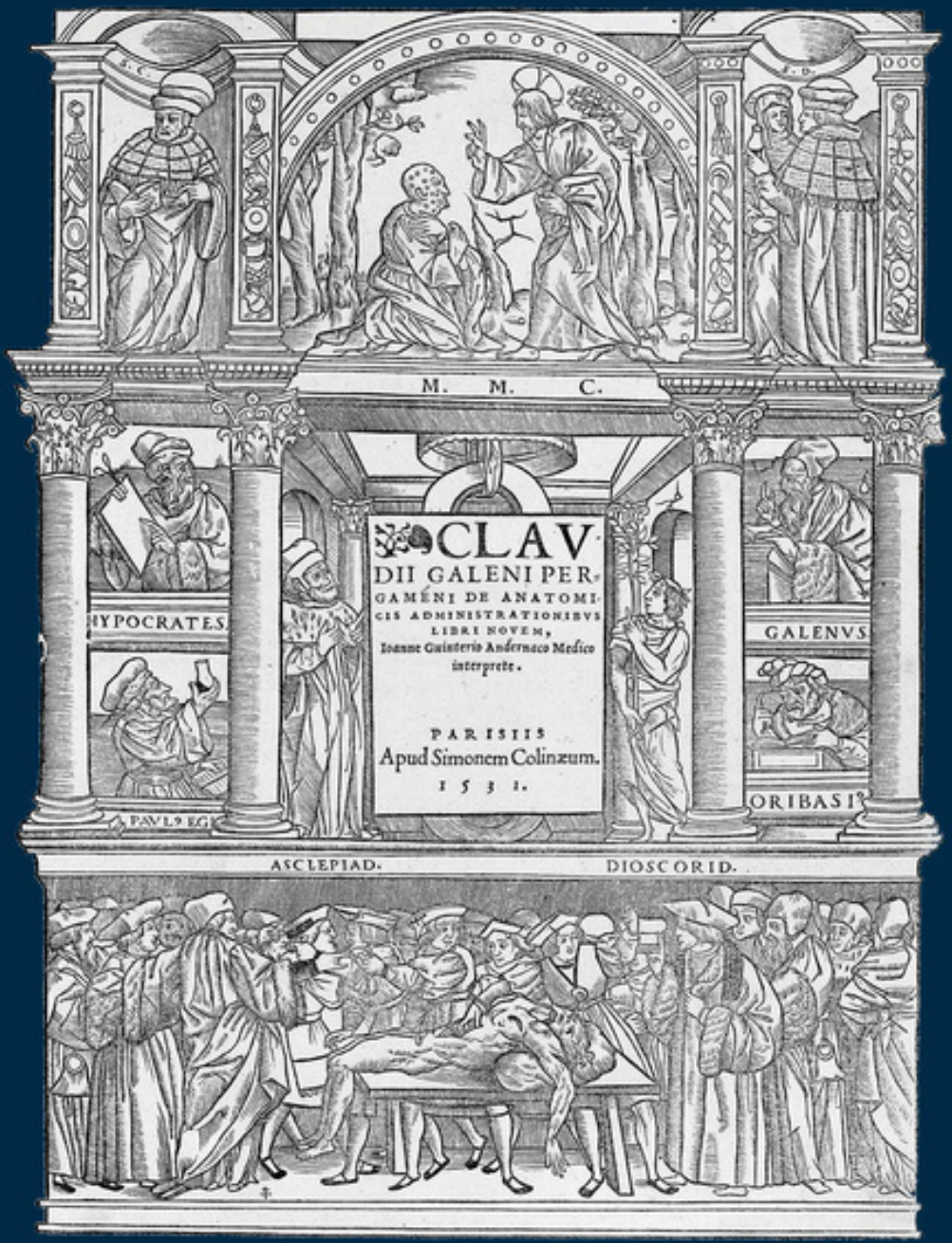
GREEK AND LATIN ROOTS OF MEDICAL AND SCIENTIFIC TERMINOLOGIES

TODD A. CURTIS



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Todd A. Curtis
Department of Classics
The University of Texas at Austin
TX, USA

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Contents

To the Student

Who Is This Textbook Written For?

This textbook is primarily for college students interested in learning the language of medicine. Its approach to medico-scientific terminology is linguistic rather than scientific, making it useful also to students with nonprofessional interests in the language of medicine and science. Although this textbook concerns Greek and Latin words, no background knowledge of these languages is required.

What Will You Learn?

This textbook takes an etymological approach to teaching the language of medicine. Thus, instead of focusing on learning the current definitions of medical and scientific terms found in dictionaries, you will be learning the literal meanings of the Greek and Latin words and word elements that form medical terms. These word elements are the building blocks for over 90% of the terms you will encounter in medicine and science. Learning the original meanings of these word elements will help you memorize the words. More importantly, you will be able to decipher the meanings of medical terms that are unfamiliar to you. By the end of this course, you will have learned most of the words and word elements used in medicine and science, and therefore, you will be able to easily recognize the literal meanings of compound terms, such as **poikiloderma**, by breaking these terms down into their Greek and Latin word elements (e.g. Gr. ***poikilo***, irregular + Gr. ***derma***, skin).

You will also gain a basic understanding of the Latin grammar that is used in anatomical and biological Latin. Thus, you will be able to recognize how the inflectional endings of Latin words reveal their grammatical usage in biological taxonomies (e.g. *nervi* ***digiti*** = nerves **of the finger**; *nervi* ***digitorum*** = nerves **of the fingers**).

Lastly, you will learn the history of the ancient Greek and Roman worlds, with particular attention to ancient Greek medicine. This kind of information is not only interesting in respect to the origins of western medicine, but it is also quite useful in recognizing why the literal meanings of certain loan words in modern medicine are somewhat misleading because they are ensconced in the ancient Greek medical concepts of disease (e.g. **cholera**, **gonorrhea**, and **melancholia**). It also will help you to make sense of the eponyms commonly used in medicine and science, such as **Hippocratic facies**, **Galenicals**, and **Promethium**.

What Information Is in the Vocabulary Tables?

The following is the tabular format for the majority of the vocabulary in this textbook:

Greek or Latin word element	Current usage	Etymology	Examples
DERM/O (**dĕr-mō**) **DERMAT/O** (**dĕr-mă-tō**) **-DERM** (**dĕrm**)	Skin	L. *dermis*, *-is*, f. dermis fr. Gr. *derma*, *dermatos*, skin	Ecto**derm**, **dermat**ocele Loan word: **Dermis** (dĕr′mĭs) pl. **Dermes** (dĕr′mēz″)

Greek or Latin word element	Current usage	Etymology	Examples
CUT/O (kū-tō)	Skin	L. *cutis*, *-is,* f. skin, hide	**Cut**icle, trans**cutane**ous Loan word: **Cutis** (kūt′ĭs) pl. **Cutes** (kūt′ēz″)
CUTANE/O (kū-tā-nē-ō)			

The first column (**Greek or Latin Word Element**) provides you with the combining form, prefix, or suffix that are commonly used in medical terminology. The phonetic spelling of each word element is provided to help with the pronunciation of medical terms.

The second column (**Current Usage**) provides you with the current medical and scientific usages of the word elements in the first column. Learning the information in these first two columns is fundamental to your success.

The third column (**Etymology**) reveals the original form of the Greek or Latin words used to form the corresponding word elements. The abbreviation **Gr.** stands for 'Greek'. The **L.** stands for Latin. The first word represents the nominative singular form (e.g. Gr. *derma*; L. *cutis*) of the Greek or Latin word, and the second word is the genitive singular form (e.g. Gr. *dermatos*; L. *-is*). Most of the roots are derived from the genitive form of the word so that is why it is included. This information is followed by the original meaning of the word. The anatomical Latin term is often derived from a Greek word. In these cases, the anatomical Latin term is presented first, followed by the Greek word that it is derived from (e.g. L. *dermis*, *-is*, f. dermis fr. Gr. *derma*, *dermatos*, skin, hide). The **fr**. stands for "from." In general, it is not necessary to memorize whether the term is Greek or Latin, and the original meaning of the term may differ from its current usage. This column, therefore, is included primarily for your information.

The fourth column (**Examples**) reveals how the word element appears in compound terms (e.g. ectoderm, dermatocele). The word element will appear in bold font in the term. The loan words (i.e. words that are spelled, more or less, the same as in the parent language) are in bold at the bottom of the column. The plural form of the loan word is revealed in the parenthesis (e.g. pl. *dermes*; pl. *cutes*). The plural form of the loan word is not included if medical English does not use this form.

What Is the Best Way to Learn the Word Elements in This Textbook?

It is important to bear in mind that this is a language course. Primary focus should be placed on learning the meanings of word elements to help one recognize the literal meanings of compound medico-scientific terminology. Like other language courses, memorization is key to this process. Here are some recommendations to help you study effectively:

1) It is best to consider this a language course. As with learning modern languages, your goal is to create a working vocabulary. Like modern languages, learning medical and scientific terminology requires continued and frequent practice. Learning a language is also a cumulative process. Therefore, the combining forms, roots, prefixes, and suffixes that you have already learned from previous chapters will show up again in subsequent chapters.
2) It is advisable to create your own flashcards. Write the Latin or Greek word on one side and the literal meaning of this word on the other side. Unlike scientific facts, learning a language requires repetition and time for it to properly percolate in your mind. It is better to see a word multiple times each day for multiple days rather than to look at it just once the night before the test. When learning lists of vocabulary, always focus on what you do not know. There are numerous websites and apps that will help you create electronic notecards and memorize these terms.
3) You should begin the study of your notecards by trying to give the meaning of the Greek or Latin word element/loan word on the card (e.g. DERM/O = ?). Once you have a good understanding of the vocabulary using this method, the best way to know if you have a word element memorized is if you can give the Greek and/or Latin word element in response to the English definition/meaning (e.g. Skin = ?). This also will allow you to recognize that multiple word elements can mean the same thing (e.g. Skin = DERM/O, DERMAT/O, CUTANE/O, CORI/O). As stated earlier, while of interest to classicists, it is not necessary to distinguish whether a word element comes from Greek or Latin because it is of little use to developing a working vocabulary, which is the primary goal of this textbook.
4) Repeatedly saying the Greek and Latin word elements aloud to yourself will help you to memorize and confidently pronounce medical terms, which is why this textbook includes the phonetic spelling of each word element: DERM/O (dĕr-mō).

5) Lastly, repeated practical application of the vocabulary will help you memorize the terms more effectively. For example, you can try to figure out the literal meanings of compound terms (word analysis) that you encounter in your medical dictionary. You can also try to create technical words (word synthesis) for things you encounter in everyday life. Your textbook and the companion website provide you with practice via the word analysis and synthesis questions. They also provide questions in which the word elements and loan words are presented in medical and scientific contexts. **It is strongly recommended that you make use of the companion website because all of the review questions that test your knowledge of word analysis and synthesis, anatomical Latin and loan words, as well as word elements in context for Chapters 2–15 are found on the website.** When you attempt to answer these questions, do not look in the textbook or online for help. If you don't know the answer, you should write down your best guess. After doing this, check your answer. This uncomfortable yet necessary process will reveal what you actually know and what you need to work on. It will also help you commit the vocabulary to long term memory.

To the Instructor

This is a college-level textbook for medical terminology courses taught by classicists. Most medical terminology textbooks on the market today are designed to be taught by healthcare professionals. Because this textbook's approach is linguistic rather than scientific, it better utilizes a classicist's knowledge of Greek and Latin. Furthermore, this textbook allows classicists to teach medical terminology as a true classical civilizations course by presenting medico-scientific terms in their historical context, namely ancient Greek medicine. Having taught this course for over a decade, it has been my experience that pre-medical and pre-allied healthcare students' retention and interest in medical terminology are greatly enhanced by this approach. Although emphasis is placed on ancient medical theories and practices, an instructor need not be a specialist in ancient medicine to use this textbook. Because ancient physicians developed much of their technical vocabulary from everyday Greek and Latin words, there are ample opportunities for the instructor to link medical terms to the history, literature, and mythology of the Greco-Roman world.

I have avoided the typical format used by medical and scientific terminology textbooks written by classicists. These textbooks tend to focus on making a distinction between Latin-based vocabulary and Greek-based vocabulary. The problem with the Latin/Greek arrangement is that it places unnecessary emphasis on whether a root is Greek or Latin, which has little practical value to non-classical students. Instead, I have chosen to use the human anatomical system arrangement because it dovetails with the orientation commonly used in medical and biological courses. This approach fosters the development of a working vocabulary through the recognition and implementation of these word elements in the students' studies. Unlike most medical terminology books, this textbook also provides a basic understanding of Latin grammar to help students make sense of the Latin phrases used in scientific nomenclatures. For the most part, I have kept this to binomial Latin phrases and loan words because the grammar for these types of terms are easier to master.

This textbook is designed so that it can be used as a short course or long course. Unit I contains five chapters, which can be taught in a self-standing short course format (e.g. a five-week summer school format), or it can be combined with Unit II, which allows the textbook to be used in the typical 15-week semester long course format. Unit I provides the basics of Latin and Greek word elements and grammar in respect to diagnostic, therapeutic, chemical, pharmaceutical, and biological terms. Unit II covers the terminology associated with the systems of the body. Each chapter is broken up into manageable sections with accompanying exercises, which provide students with immediate feedback. The explanations of ancient medico-scientific theories/practices, etymological notes, images, tables of vocabulary, and review exercises place emphasis on students recognizing the multivalent nature of Greek and Latin word elements. The historical readings allow students to recognize how the history of Greek medicine is relevant both to the practice and language of modern medicine. **It is strongly recommended that you make use of the companion website because all of the review questions that test the student's knowledge of word analysis and synthesis, anatomical Latin and loan words, as well as word elements in context for Chapters 2–15 are found on the website.**

The pedagogical approach that I have used to teach medical terminology is derived from Lesley Dean-Jones' "Teaching Medical Terminology as a Classics Course." *The Classical Journal* 93, no. 3 (February-March 1998): 290–296. I also have deeply benefited from Oscar Nybakken's *Greek and Latin in Scientific Terminology*. Ames: Iowa State University Press, 1962. Although written in 1960, Nybakkens' text continues to be an indispensable tool for any instructor intending to teach a classical approach to medical and scientific terminology. John Scarborough's *Medical and Biological Terminologies Classical Origins*. Norman: University of Oklahoma Press has provided me with a wealth of historical and etymological information that I have used in teaching medical terminology and in writing this textbook. Similar to Barbara A. Gylys' *Medical Terminology Simplified: A Programmed Learning Approach to Body Systems*

(1993) and Marjorie Canfield Willis' *Medical Terminology: A Programmed Learning Approach to the Language of Health Care* (2008), I have used programmed approach to make the etymological and medical information in each chapter more engaging and memorable. In respect to medical dictionaries, I have found *Taber's Cyclopedic Medical Dictionary* to be one of the best medical sources for reliable etymologies, pronunciations, and clear-cut medical definitions. The phonetic spellings in this book are derived from Donald Venes, ed., *Taber's Medical Dictionary*, *24th edition*. Philadelphia: F.A. Davis Company, 2021. Lastly, the cursory treatment of the grammar of anatomical and scientific Latin taught in this textbook can be supplemented by an introductory Latin course or the textbook that I have written specifically for this subject, *Anatomical Latin: A Programmed Approach to Learning the Grammar and Vocabulary of Anatomical Latin*.

Acknowledgments

The inspiration for this textbook came from Lesley Dean-Jones, who has been my mentor and colleague at the University of Texas at Austin for the past decade. Thanks to the medical terminology students whom I have taught at UT, particularly Bridget Coonrod, Sarah Doski, and Austin Ivery, whose feedback was instrumental to the creation of this textbook. Special thanks to Ellyn Hillberry and Joonmo Chun for their help formatting and proofreading earlier versions of the chapters and appendix. With deep gratitude, I would like to thank my mother, Dixie Curtis, and my wonderful wife, Emerald Curtis, for their patience, encouragement, help, and feedback on this textbook. I love you. Lastly, I would be remiss not to thank my Lord and Savior, Jesus Christ, for making all of this possible.

About the Companion Website

This book is accompanied by a companion website.

www.wiley.com/go/Curtis

The website includes:

Student website: Final Review for chapters 2–15
Instructor website: Answers for chapters 2–15

Unit I

Basics of Medical and Scientific Terminology

1

The Historical Origins of Greek and Latin in Medical Terminology

CHAPTER LEARNING OBJECTIVES

1) Why are most medical and scientific terms derived from Greek? When did Greek begin to be used in medicine? How is it related to modern medical terminology?
2) What are the historical origins of the use of Latin in medical terminology? What is Medieval Latin? What is New Latin? How is Latin used in modern medical and scientific terminology?
3) Who is Asclepius? What is Asclepius' relationship to ancient Greek medicine? What is the Rod of Asclepius? What is the Caduceus of Hermes?
4) Why were ancient Greek physicians important to European medical schools of the medieval and Renaissance periods? Who is Hippocrates? What is the Hippocratic Corpus? Who is Galen? How are Hippocrates and Galen relevant to modern medicine and medical terminology?

The vast majority of technical and scientific terms used in medical terminology are derived from ancient Greek and Latin. It has been estimated that over 90% of our medical terms come from these two classical languages. Far from becoming obsolete due to the advances in modern medicine, these two so-called dead languages continue to function as the primary word-stock for creating new terms for the ever-changing vocabulary of medicine. This raises the question as to how Greek and Latin became the dominant languages of medicine.

Historical Origins of Greek in Medical Terminology

Unlike everyday English, which draws more heavily upon Latin, over two-thirds of our modern medical and scientific terms are derived from ancient Greek words, making Greek the language of medicine. The predominance of Greek in medical terminology is a result of ancient Greek medicine's longstanding influence on Western medicine and civilization. The origins of this influence can be traced back to the 5th and 4th century BC, a period of time in which the Greek-speaking world saw radical developments in government, architecture, theater, art, philosophy, and science. During this time, a large number of medical texts were written by various Greek authors. These ancient medical texts addressed a wide array of subjects, ranging from broad theories on the nature of the human body and disease to technical works dedicated to explaining the treatment of specific kinds of maladies, such as hemorrhoids and bone fractures. Over time, a collection of these texts came to be known as the Hippocratic Corpus because many of them, at one time or another, were perceived as representing the teachings of Hippocrates (c. 460–c. 375 BC), the famous physician from the Greek island of Cos. That said, of the 60 or so texts making up the Hippocratic Corpus, it is unclear which, if any, of these texts were written by Hippocrates. Nevertheless, the belief that these works were "Hippocratic" led to them being studied, expounded upon, and spread throughout the ancient world, and thereby, becoming a fundamental source of terminologies for the practice and study of medicine.

Greek and Latin Roots of Medical and Scientific Terminologies, First Edition. Todd A. Curtis.

Companion website: www.wiley.com/go/Curtis

Greek continued to be the language of medicine even after the Latin-speaking Romans conquered Greece. This is because most of the doctors practicing in the Roman Empire were Greek, and therefore, they wrote in Greek. Some of these physicians' writings, particularly the works of Galen of Pergamum (129-c. 216 AD), became an integral part of medical education in medieval and Renaissance universities. The study of such ancient Greek medical texts via Latin translations in early European medical schools ultimately led to our continued usage of ancient Greek terms for disease in modern medicine. While we continue to use Greek disease terms, such as "cholera," "eczema," and "gonorrhea," it is important to bear in mind that their original meanings do not correspond to their current clinical usage because the origins of such terms are ensconced within ancient medical concepts of disease.

Because ancient physicians developed much of their technical vocabulary from everyday Greek words, most Greek speakers had a basic understanding of what these medical terms meant. For example, when the Alexandrian anatomist Herophilus (335–280 BC) chose the Greek word ἀμνειός (*amneios,* which appears as "amnion" in modern anatomical terminology) for the membrane surrounding the fetus in the womb, his audience would have recognized it as a word for "lambskin," thus giving them a basic understanding of the appearance and protective function of the membrane. Or when Galen used the anatomical term σταφυλή (*staphyle*) for what we call the uvula, his audience would have understood the word picture of a "cluster of grapes," which is what the Greek word originally meant. Today, medical terms such as amnion and staphylectomy appear completely foreign and technical to most English speakers; their potential meanings have been obscured by the boundaries of language and culture. However, when you learn the original meanings of these Greek words, the multivalent nature of word elements in medical terminology becomes far less baffling and technical. For example, if one recognized that the word element STAPHYL- is derived from the Greek word for "a cluster of grapes," *staphyle*, it becomes apparent why STAPHYL- is used today for both the "uvula" and a "type of bacteria" (the uvula looks like a hanging cluster of grapes, and staphylococci bacteria form grapelike clusters, see Figs. 1.1 and 1.2).

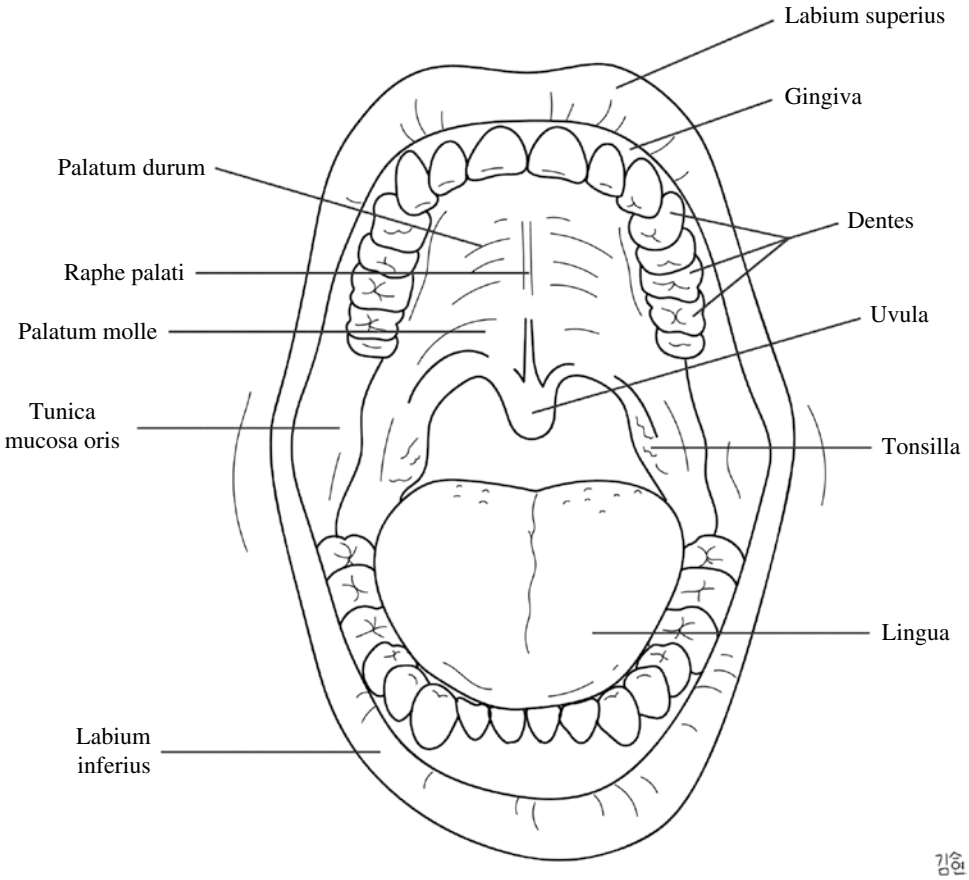

Fig. 1.1 The uvula hanging like a cluster of grapes in the oral cavity. *Source:* Line drawing by Chloe Kim.

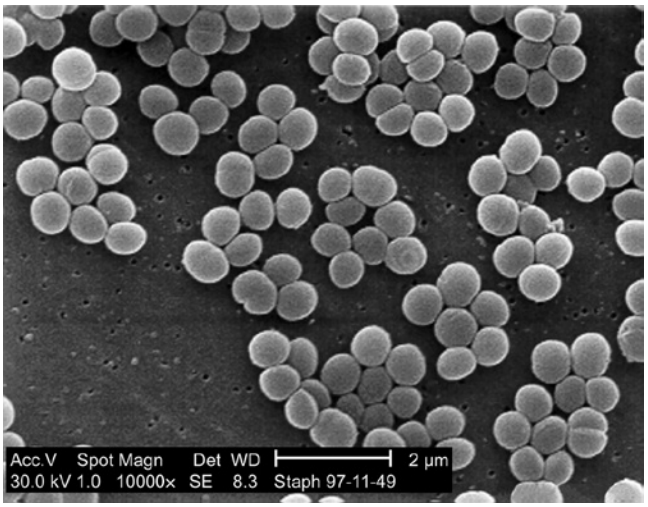

Fig. 1.2 Clustering of *Staphylococcus aureus* under a scanning electron microscope (SEM). *Source:* Janice Haney Carr/ U.S. Department of Health & Human Services/Wikimedia Commons/Public domain.

Historical Origins of Latin in Medical Terminology

Rome's conquest of Greek lands in the 2nd century BC and the subsequent opportunity for employment led to a large influx of Greek physicians into the Roman world. Over time, the traditional medicine of the Romans was supplanted by Greek medical theories and practices. Greek medical terms began to be translated into Latin, the language of ancient Rome. The translation of Greek medical thought into Latin was pivotal to ancient Greek medicine's longstanding influence because Latin would later become the universal language of scholarly exchange in government, religion, science, literature, law, and medicine for much of Europe well into the 17th century.

One of the ways Latin-speaking medical authors conveyed Greek medical terms into Latin was by transliterating them. Transliteration is the movement of a word from one language into another. For example, when faced with the Greek term for "arm," βραχίων, they first changed the Greek letters into their Latin equivalents, *brachion*, and then they removed the Greek ending "*on*" replacing it with the Latin ending "*um*," *brachium*, in order to fit Latin grammar. Many of the Greek terms found in modern medical terminology have been Latinized in this way, and therefore, they adhere to the laws of Latin grammar.

Another way in which Latin medical authors dealt with Greek medical terms was to replace the Greek medical term with a Latin word having an equivalent meaning. For example, the Latin word for "brain," *cerebrum*, was often used instead of the transliterated Greek term for the "brain" *enkephalos* (ἐγκέφαλος). Because many of these Latin terms did not supplant their Greek equivalents, there are a large number of Greek and Latin synonyms used in modern medical terminology. For instance, a reconstructive surgery of the lip can be termed either a labioplasty or a cheiloplasty because the word elements from the Latin *labium* and the Greek word *cheilos* are both used in medicine for the English equivalent of "lip."

Much like their Greek counterparts, Latin medical terms are quite descriptive, having a tendency to be derived from words for everyday objects such as musical instruments (*tibia* = flute), sounds (*murmur* = humming), tools (*fibula* = brooch), plants (*glans* = acorn), and animals (*cancer* = crab). Consequently, the Latin equivalents also often retain the ancient medical concepts of disease associated with the Greek term. Aulus Cornelius Celsus (1st century AD), the author of a Latin encyclopedia of Greek medicine, used the Latin term for a "crab," *cancer*, in place of the Greek term for "crab," *karkinos*, to maintain the metaphor of a burrowing, gnawing, and grasping crab, which was used in antiquity to describe a variety of diseases causing pernicious ulcers. Today, both of these Latin and Greek words are associated with very specific cellular pathologies that metastasize (e.g. cancer and carcinogen). In medical dictionaries, words that are derived from **classical Greek** have the abbreviation **Gr.** before the word, and words that have a **classical Latin** origin have **L.** before the word.

The Middle Ages or the medieval period (c. 5th–14th century AD) saw a sharp decline in the knowledge of the Greek language in the West, and therefore, ancient Greek medical texts were far less accessible to Europeans. Although ancient Greek medical theories continued to be used in Christian monasteries and among learned physicians, their knowledge of Greek medical texts was limited to a small number of Greek texts and parts of more complete works that had been translated into Latin. Conversely, in the Greek-speaking East, also known as the Byzantine Empire, access to ancient Greek medical texts continued, and these texts were later translated into Syriac and Arabic, forming the foundation for the learned approach to medicine found in the medieval Islamic period (900–1300 AD). European understanding of ancient Greek

medicine was transformed by gaining access to these Arabic sources. This started around the 11th century, when learned figures such as Constantinus Africanus began to translate scripts of Greco-Arabic medicine into Latin. By the 12th century, much of the writings of Aristotle, Hippocrates, Galen, and the Arabic medical authors known in Europe as Avicenna (Ibn Sina, 980–1037 AD), Rhazes (Al-Razi 865–925 AD), Isaac Judaeus (Israeli ben Solomon, c. 832–932 AD), and Algizar (Al Jazzar, 895–979 AD) were available in Latin. These Greco-Arabic texts, particularly the writings of Galen, became the curricula for the 13th century medical schools in Italy, and these Italian medical schools served as the blueprint for later medical schools throughout Europe. The new Latin that was formed to translate these Arabic sources is referred to as "**Medieval Latin**," and it is abbreviated **ML**. in the etymologies of medical dictionaries.

With the Renaissance (c. 15th–17th century AD) came a renewed interest in recovering classical Latin and Greek culture. Renaissance Humanists' desire to rediscover and assimilate the language and ideas found in ancient Greek and Roman texts bolstered Latin as the universal language of scholarly exchange and opened the door for knowledge of ancient Greek to be valued as a sign of a strong education. Thus, medico-scientific authors continued to write in Latin up to the 19th century, many revealing at least a rudimentary knowledge of Greek words. The Latin and Latinized Greek terms that medico-scientific authors such as Andreas Vesalius, William Harvey, Giovanni Morgagni, and Aloysius Galvani used for the purpose of expressing their discoveries are the source of much of our modern anatomical terminology. Terms that were coined during this period are termed "**New Latin**" and abbreviated **NL.** in most dictionaries. The Latin used for the familiar binomial of "genus" and "species" devised by Carolus Linnaeus (1707–1778 AD) used today in the classification of living organisms also falls under the category of New Latin.

Renaissance Humanist reforms in education of the 16th century resulted in a preference for Latin and Greek words when forming new English words. The effect of this movement is evident in early English medical books, such as Andrew Boorde's *The Breviarie of Health* (1547 AD), which contains anglicized forms of Latin and Latinized Greek terms (e.g. "vein" from the Latin *vena*, "artery" from the Latinized Greek word *arteria*). Despite the radical changes in our understanding of disease and the body, scientists and physicians continue to pull from the same word-stock that ancient physicians used in the Greco-Roman world. For this reason, modern medical English contains numerous Greek and Latin words whose modern usages have no classical equivalents, such as the Latin word for "poison," *virus*, being used today for "a small infectious agent that replicates inside living cells." The preference for using Greek and Latin words also has led to medical terminology making extensive use of Greek and Latin word elements to form compound terms such as periodontosis (Greek *peri-*, around; Greek *odous*, tooth; *-osis*, condition) and microdentism (Greek *micros*, small; Latin *dens*, tooth; *-ism*, condition).

By the 18th century, the growing movement for the use of national languages in science greatly reduced the amount of medical material written in Latin. As medico-scientific authors increasingly turned to their respective vernacular to express their ideas, Latin began to function less as language and more as a code for technical phrases in medicine, such as *nihil per os* (NPO = nothing by mouth) and *bis in die* (BID = twice a day). The rise of the vernacular and the demise of classical language as a subject in academia ultimately led to a gulf between the technical language of medicine and everyday English.

That said, the rise of the vernacular did not lead to the complete death of Latin. International codes of scientific nomenclatures prescribe that all anatomical and biological terms must be written in grammatically correct Latin (e.g. *flexor pollicis longus* [the long flexor muscle of the thumb], *Toxicodendron radicans* [poison ivy], and *Rana macrocnemis* [a long-legged wood frog]). Up until very recently, the International Botanical Congress demanded that not only the names but even the descriptions of newly discovered plants had to be written in Latin. For this reason, Latin continues to function as *lingua franca* (universal language) of biological and anatomical classification systems. Thus, every newly discovered organism and anatomical structure is given a Latin name. This includes organisms and structures whose vernacular names are derived from an individual or place not found in Latin. In these cases, the vernacular name is Latinized. For instance, the Latin used for the genus and species of a type of cockroach in the United States, *periplaneta americana*, is derived from terms not found in the Latin of the ancient Romans. The term *periplaneta* is a Latinization of two Greek words (*peri*, around + *planan*, to wander) and the modern Latin adjective *americana*, which is derived from the Latin name of the famous explorer of the New World, Amerigo Vespucci (1454–1512 AD). Because Latin is the language of anatomical and biological classification systems, a basic understanding of Latin grammar is still quite useful when one is faced with such terms.

Asclepius and the Symbols of Medicine

In addition to medical terms, the influence of ancient Greek culture is also evident in our medical symbols. The image of a single snake entwined around a knotty staff has been used as a symbol of medicine for well over 2000 years. Owing to its association with the Greek god of medicine, it is called the **Rod of Asclepius**. According to Greek mythology,

Asclepius (also spelled Aesculapius) was the child of the god Apollo and a human princess named Coronis (or in some myths Arsinoë). Having become enraged over Coronis' love for a mortal named Ischys, Apollo killed Coronis before she could give birth to Asclepius. After her body was laid on a funeral pyre to be burned, Apollo came to his senses and rescued his son from the flames by cutting Asclepius out of Coronis' womb. Apollo then gave Asclepius to the centaur Chiron, the friend and patron of heroes. Chiron educated Asclepius in the art of medicine teaching him the uses of herbs and how to perform surgery. In some myths, Asclepius became so skilled in medicine that he was not only able to prevent death, but he could also bring the dead back to life. Because of the audacity of Asclepius allowing mortals to cheat death, or in some accounts, because he was stirred by Hades' fear that Asclepius' healing powers would lead to a lack of souls in the underworld, Zeus killed Asclepius with a thunderbolt. At the request of Apollo and in reward for Asclepius' benefactions to mankind, Asclepius was later elevated to the pantheon of gods through apotheosis (deification).

To ancient Greek doctors, Asclepius was more than merely the patron deity of medicine; he was also the progenitor of a line of physicians. According to legend, Asclepius fathered two sons, Machaon and Podalirius, whom he taught his art of medicine. Their descendants were considered to be the ancestors of a family of Greek physicians called the Asclepiades, from whom Hippocrates was reputed to have descended. In the *Iliad*, Machaon and Podalirius served in Agamemnon's army during the Trojan War. Machaon is said to have healed Menelaus with remedies his father received from Chiron. Later commentators on Homer suggested that each brother had his own expertise, Machaon specializing in surgery on wounds and Podalirius in diet and healing herbs. This distinction can be seen on the arms of the Royal College of Surgeons of England, where Machaon is observed holding a broken arrow assumedly removed from his patient's body and Podalirius appears with the healing staff of Asclepius (Fig. 1.3).

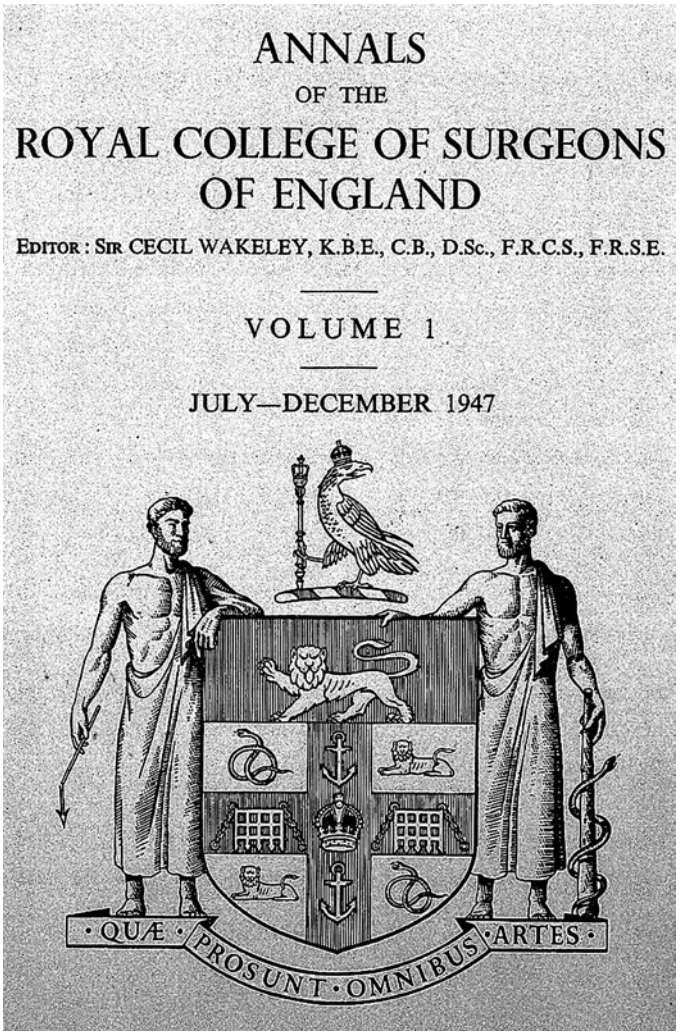

Fig. 1.3 Machaon (left) and Podalirius (right) on the title page for the *Annals of the Royale College of Surgeons of England*, Volume 1, July to December 1947. According to the Royale College of Surgeon's website (https://www.rcseng.ac.uk/about-the-rcs/history-of-the-rcs/coat-of-arms/ accessed6/17/19): "The original coat of arms featured the sons of Aesculapius (Greek god of healing); two brothers who were surgeons at the siege of Troy. On the left side is Machaon who is depicted holding the broken dart reportedly extracted from the side of King Menelaus and which symbolises the healing of wounds. On the right side is Podalirus, a physician, who was originally featured holding a surgeon's knife …. The motto – QUAE PROSUNT OMNIBUS ARTES – means: "the arts which are of service to all." *Source:* Wellcome Collection/CC BY 4.0.

The healing cult of Asclepius was a common feature in the Greco-Roman world. Sanctuaries to Asclepius, known as **Asclepeia** (singular **Asclepeion**), appeared throughout the Mediterranean world, flourishing well into the Christian era. Those suffering with illnesses would either simply pray to Asclepius, or if able, go to Asclepius' sanctuary to be healed. In order to receive healing dreams, the suppliants would go through a process of purifications culminating in the act of "incubation," which involved lying down in a sacred building in the sanctuary known as the *abaton* ("the untrodden place"). According to the ancient testimonies, Asclepius would appear in their dreams, healing them, or he would advise them what to do if they wanted to be cured. These ancient testimonies reveal that Asclepius' cures were, albeit miraculous in nature, often through medical means. For instance, in one account, a man lacking one of his eyes had a dream in which Asclepius poured a salve in his eye socket and when day came, he departed with sight in both his eyes. Some of the ancient accounts of healing attributed to Asclepius describe how a snake cured the suppliant by licking the injured part, which partially explains why the snake is associated with Asclepius' staff and medicine.

The **Caduceus of Hermes** is often confused with the Rod of Asclepius (Fig. 1.4). The caduceus is a herald's wand used by messenger gods such as Hermes, who in the Roman world was known as Mercury. When used as a symbol of medicine, the Caduceus of Hermes is depicted as a winged staff with two snakes entwined around it. Its use as a medical emblem came much later. One of the first instances of the Caduceus of Hermes' association with medicine came in the 16th century AD. Johann Froben (1460–1527 AD), whose printed editions included medical texts, used a caduceus with entwined snakes surmounted by a dove as a printer's device (Fig. 1.5). William Butts (1506–1583 AD), the physician to Henry VIII, and John Caius (1510–1573 AD), the physician to Edward I, were the first doctors to use this symbol. That said, it was rarely used as a symbol of medicine until the 19th century, when the publisher of medical texts, John Churchill (1810–1875 AD), made use of this image. Thanks in part to its adoption in 1902 as a symbol of the U.S. Army Corps, the Caduceus of Hermes is widely used in the United States, albeit less frequently than the Rod of Asclepius. Some have objected to the Caduceus of Hermes being used as a symbol of medicine. They maintain that the Rod of Asclepius is the appropriate symbol because of its longstanding association with medicine. Their criticisms are also based on an awareness of Hermes' role in Greek mythology as the god of merchants, as well as the conductor of the souls of the dead to the realm of Hades. Thus, using the Caduceus of Hermes could be seen as an advertisement that one's approach to medicine is mercantile in nature, or even worse, that it will lead to a patients' soul being conducted to the underworld.

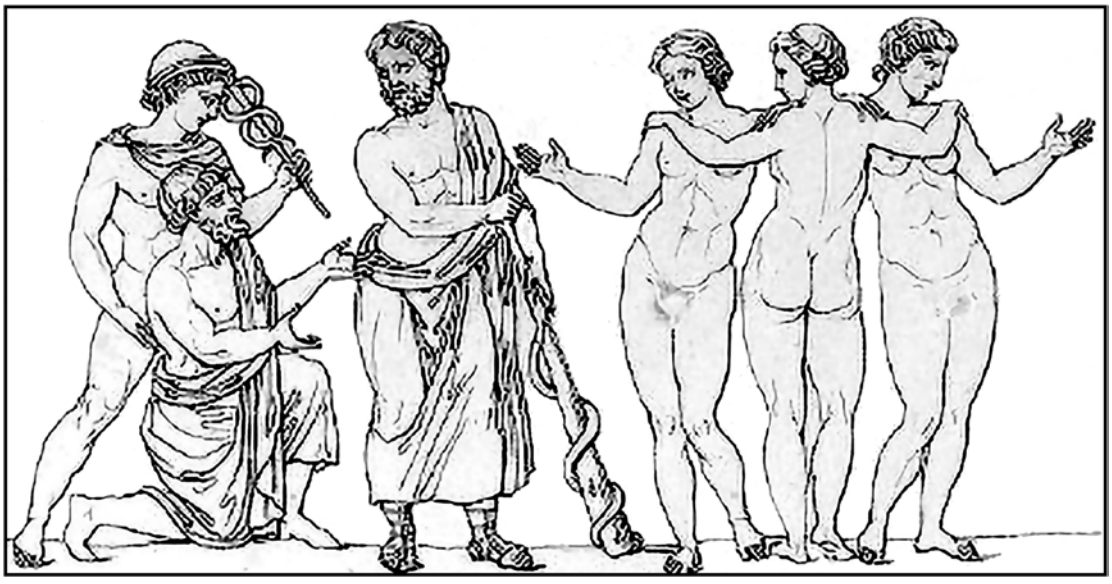

Fig. 1.4 Hermes (Mercury) and a merchant approach a disapproving Asclepius. Hermes (left) is holding his caduceus and Asclepius (right) is holding his iconic snake-entwined staff. The naked Graces to the right of Asclepius are sometimes interpreted as representing Asclepius' retinue of healing goddesses, Hygeia (Health), Panacea (Cure-all), and Iaso (Curing). *Source:* Millin, 1811/Soyer/Public domain.

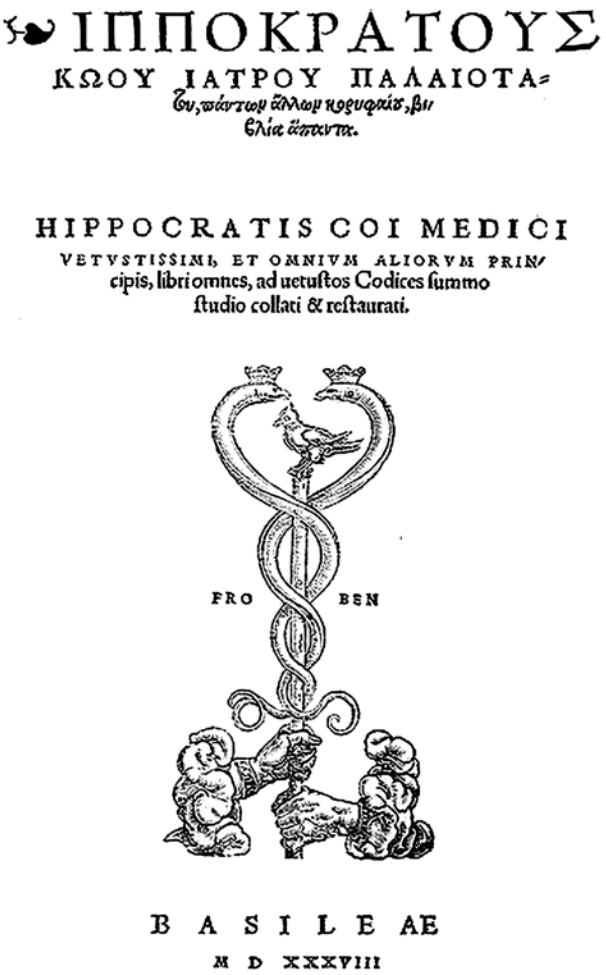

Fig. 1.5 The printer's symbol for Johann Froben's 1538 edition of the Hippocratic Corpus. *Source:* Hieronymus Froben and Nicolaus Episcopius/Wikimedia Commons/Public domain.

Famous Ancient Greek Physicians

A large collection of physicians gained prominence in the Greek and Roman world. Although there was a general lack of consensus among these ancient Greek physicians with respect to their pathophysiological theories and corresponding treatments, their writings were considered to be essential to the practice of medicine for centuries. And despite many of these physicians being pagan with respect to their religious beliefs, medieval Islamic medicine and physicians in the Christian world embraced Greek medicine because they considered ancient Greek medicine's teleological understanding of nature as being consistent with the religious teachings of these monotheistic faiths.

The above frontispiece (Fig. 1.6) is from Thomas Linacre's Latin translation (Paris, S. de Colines, 1530 AD) of Galen's medical treatise *De methodo medendi*. This frontispiece reveals a Renaissance perception of ancient Greek medicine representing the pillars of medicine. Dressed somewhat as contemporaries and standing among the pillars of medicine are some of the great medical authorities from Greek and Roman antiquity: Hippocrates of Cos (c. 460–c. 375 BC), Galen of Pergamum (129-c. 216 AD), Paul of Aegina (death c. 642 AD), Oribasius of Pergamum (c. 320–400 AD), Asclepiades of Bithynia (c. 1st century BC), and Dioscorides of Anazarbus (c. 1st century AD). The base portrays the dissection of a human body, which reflects Galen's conception that the study of human anatomy was fundamental to medicine. At the top, there is an image of Jesus Christ healing a leper, which is described in the Bible, Matthew 8 : 1–3. The collective symbolism is that Jesus is the great physician and Greek medicine should be considered consistent with Christian conceptions of *servus dei* (servant of god) and the *sacra congregatio* (sacred congregation). As to the Galenic text to which this frontispiece is attached, *De method medendi* (*Therapeutic Method*) was one of the most highly read medical texts in the Middle Ages and Renaissance, and it was an integral part of the medical curriculum up to the 17th century.

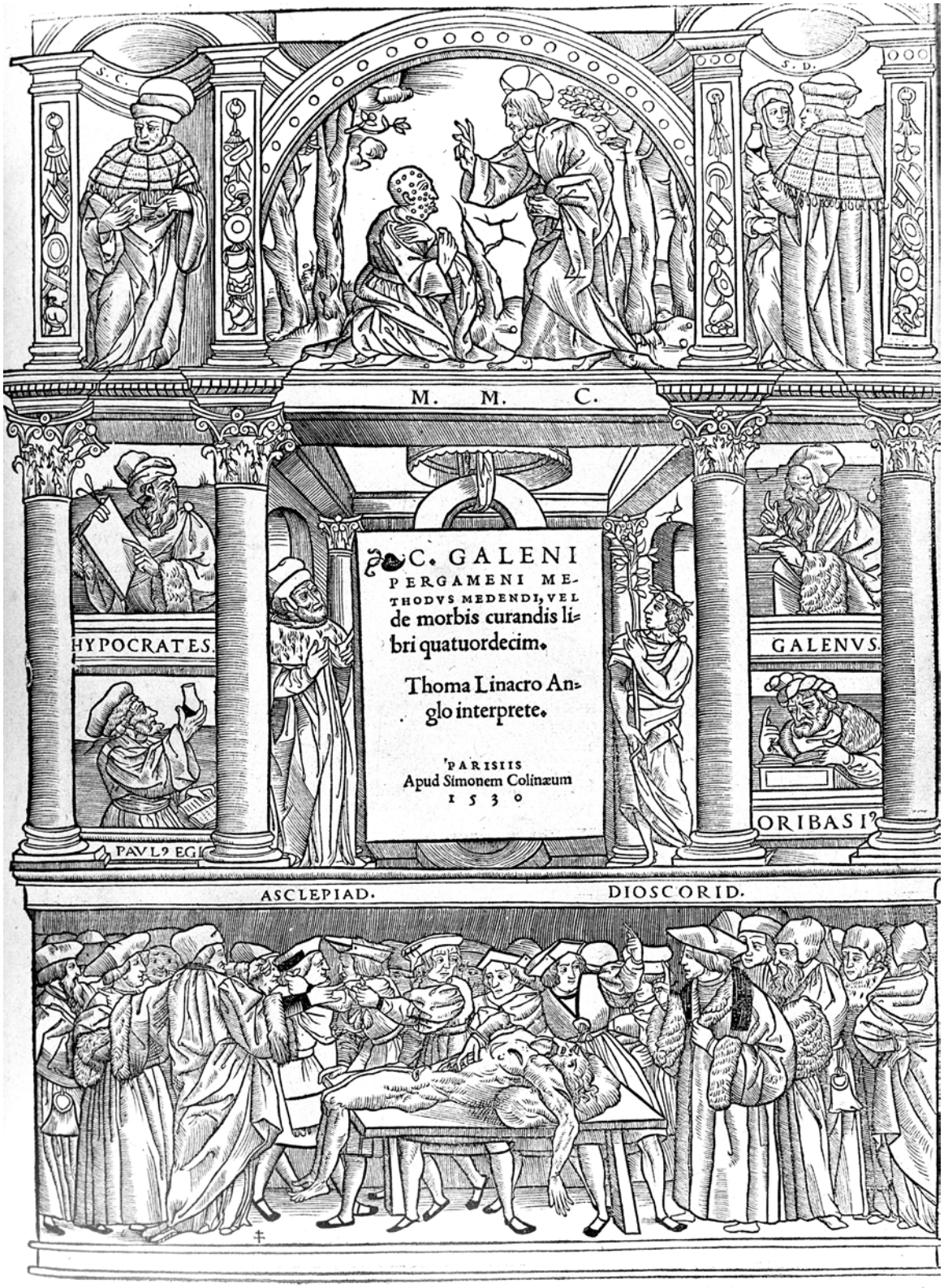

Fig. 1.6 Frontispiece is from Thomas Linacre's Latin translation (Paris, S. de Colines, 1530) of Galen's medical treatise *De methodo medendi*. *Source:* Wellcome Collection/CC BY 4.0.