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# Introduction


> *Aristotle was the first to undertake the task of teaching and writing about the external parts and sections of the body and to discuss their names. Doctors in later times also thought that they should concern themselves with such matters; their purpose was to establish a list of names that would be sufficient to denote each part or section so that they would not have to indicate it by placing their hand on it.*[1]
>
> *Johnson is a dermatologist, which is Greek for "fake doctor."*[2]

It goes without saying that the exchange of ideas is made much easier if everyone involved draws on a common vocabulary. A shared linguistic foundation is particularly important in medicine and other sciences, given that research in such fields is so complex and is conducted in an international, indeed global, context. But why is it that this terminology is monopolized, almost to the exclusion of all other languages, by Greek and Latin, a closely related pair of ancient languages that are not natively spoken today?[3] We should begin by considering the impact of the Greeks and Romans on Western civilization throughout the last two and a half millennia.

## Medical Terminology: The Historical Context

The Greeks were considerably influenced by the medical discoveries and practices of the Babylonians and Egyptians, but scientific Greek medicine is traditionally said to date from the 5th century BC. The upsurge in medical inquiry at this time is associated with one man in particular: Hippocrates, from the island of Cos, off the western coast of what is now Turkey. Hippocrates is, however, a shadowy and semi-legendary figure, and none of the dozens of surviving medical tracts linked to his name can be definitively proved to have been written by him.

Greek culture, including medicine, was disseminated widely in the following centuries in the wake of the conquests of Alexander the Great of Macedon (ruled 336–323 BC), who overthrew the Persian Empire and established Greek settlements as far east as the Himalayas. The most significant of the cities he founded was Alexandria in the Nile delta. For nearly a thousand years, Alexandria was famous as the most important center of Greek culture, and the contribution of Alexandrian scholarship to medical research was substantial. As late as the 4th century AD, it was said that "for a doctor to establish his competence, all he need do is claim to have received his training at Alexandria."[4] In one important respect, medicine at Alexandria was unique in the Greek world: although the Greeks generally did not practice dissection of human cadavers (largely for religious reasons), it was permitted for a short period in Alexandria in the 3rd century BC, when Herophilus and Erasistratus advanced knowledge of anatomy in a way that would not be matched for more than 1,500 years.

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1. Pseudo-Galen, *Introduction or The Doctor* 14.699K.
2. As said by Dr. Perry Cox in season 4, episode 16 ("My Quarantine") of *Scrubs* (2005).
3. All references to Greek in this book are to the ancient language, not the modern one.
4. Ammianus Marcellinus, *History* 22.18.

It is said that the first Greek doctor to come to Rome arrived in 219 BC, the year before Hannibal crossed the Alps with his elephants at the start of Rome's titanic struggle with Carthage in the Second Punic War. For hundreds of years thereafter, for as long as the Romans maintained military and political control over much of Europe, western Asia, and North Africa, the medical profession remained largely in the hands of physicians who either were Greek or at least claimed to be Greek. Such doctors could command enormous fees, and many gained great distinction—none more so than Galen of Pergamum (AD 129–c. 216), who started his career patching up arena fighters in his home city in western Turkey but migrated to Rome, where he soon became the personal physician to the emperor Marcus Aurelius. As he himself assures us at every opportunity, Galen is a towering figure in ancient medicine. Many of his works have been lost, but those that have escaped the ravages of fire and flood, mice and mildew, are more voluminous than all the Greek texts that survive from the archaic and classical periods, that is to say from the late 8th until the end of the 5th century BC, the first 300 years after the introduction of literary writing in Greece.

Greek language and culture never established so firm a hold in the western Mediterranean as they always enjoyed in the eastern part of the Roman Empire. Early in the 4th century AD, the division between the two halves of the empire became all the more marked when the emperor Constantine I moved the seat of government from Rome to Constantinople (modern-day Istanbul). The West lost its contact with Greek, and the East lost its contact with Latin. For a thousand years, ancient culture was preserved in the West very tenuously, if at all, by Greekless Christian monks who had little understanding of their heritage from pagans.

At last, however, Greek intellectuals turned westward again to Venice and other European centers under pressure from the Turks, whose incursions into the Byzantine Empire culminated in their capture of Constantinople in 1453. This movement coincided with, and arguably gave vital impetus to, the early years of the Renaissance. It brought a rich cultural harvest to the West, including a revival of knowledge of the Greek language and direct access to Greek medical texts, which had been available for so many centuries only in Latin translations either from Greek or indirectly through other languages, in particular Arabic. Latin remained the language of scholarly discourse throughout Europe, but Western culture was much enriched by the Greek texts that were now accessible once more and that were quickly being disseminated thanks to the newly invented printing press.

Even until the early 20th century, knowledge of Latin was commonplace among those with a high level of education, and Greek was frequently studied as well. Nowadays, however, Latin and Greek are no longer the central pillars of education. Latin has lost its status as the primary language of scholarship, and very few people have had any extensive training in that language, while Greek is even less well known. Nevertheless, for a variety of reasons Latin and Greek have remained the languages of choice when it comes to scientific terminology, including that of medicine. This principle is seen especially in the fact that the modern scientific community has made it a firmly regulated policy that new discoveries should be presented to the world via Latin and Greek nomenclature. For this reason, even if Latin and Greek are not as popular as they once were, they nevertheless remain crucial to the scientific disciplines, and in fact it has been estimated that over 90 percent of biomedical terms in English are derived from Greek, from Latin, or from a combination of the two.

## Medical Terminology for English Speakers

A brief consideration of the origins of the English language might make this proportion seem rather ominous for an English speaker trying to learn scientific terminology. English, like Greek and Latin, belongs to the Indo-European family of languages, the dominant language group throughout Europe and western Asia as far as central India. But, whereas Greek and Latin are closely related, English belongs to a quite different branch of the family, one that lost contact with the precursors of Greek and Latin several millennia ago, during the great migration westward from the Indo-European homeland. It is a Germanic language, and it derives its basic grammatical structure and almost all its most commonly-used words from its Germanic background. The twenty-five commonest English words, which account for about a third of all written English, are all

Germanic. In fact, of the one hundred most frequently used words in English, only four ("just," "number," "people," "very") are derived from Latin, and these are all near the bottom of the list.

This seems to suggest that it would be easier for a native speaker of English to understand a paragraph of German than a paragraph of Latin. Spend a few minutes reading the following passage of German, and then spend the same amount of time reading the Latin version of the same passage. To quote a formula much used in late antiquity at the end of prescriptions for cattle- or horse-medicine: "Try it. You will be amazed." When you have finished, consult the English version on page xviii.

German:

> Es ist nicht schwer, die Teile des menschlichen Körpers zu beschreiben: z. B. im Kopf befindet sich der Schädel, das Gehirn, die beiden Ohren, die beiden Augen, die Zunge, die Zähne; die Nase ist in der Mitte des Gesichtes angeordnet; unterhalb des Kopfes im Rücken ist die Wirbelsäule, d.h. die Wirbel; im Brustbereich sind die Brüste, die Rippen und das Brustbein; unterhalb der Brust sind die Eingeweide, der Unterleib, der Magen, der Blinddarm, das Becken, usw.; unterhalb des Magens sind die Genitalien, d.h. in einem männlichen Körper der Penis und die Hoden, in einem weiblichen Körper die Vagina und die Gebärmutter; oberhalb der Kniescheibe ist der Oberschenkelknochen, ein sehr langer Knochen; unterhalb der Kniescheibe sind zwei Knochen; die Fibula ist kleiner als die Tibia. Eine Hand hat fünf Finger, zwei Füße haben zehn Zehen. Im ganzen Körper gibt es zweihundertsechs Knochen; die Zahl der Nerven und Muskeln ist unzählbar; Blut läuft durch den ganzen Körper in Arterien und Adern.

Latin:

> Difficile non est partes corporis humani describere: exempli gratia, in capite sunt cranium, cerebrum, duo aures, duo oculi, lingua, dentes; nasus in media facie locatus est; sub capite, in regione dorsali, est columna spinalis, id est vertebrae; in regione pectorali, sunt mammae, costae, sternum; sub pectore sunt viscera, abdomen, stomachus, appendix, pelvis, et cetera; sub stomacho sunt genitalia membra, id est in corpore masculino penis et testes, in corpore femineo vagina et uterus; super patellam est femur, os longissimum; sub patella sunt duo ossa: fibula minor est quam tibia. quinque digitos habet manus una, duo pedes digitos decem; in toto corpore sunt ossa ducenta sex; nervorum et musculorum numerus innumerabilis est; per totum corpus currit sanguis in arteriis et venis.

As will be clear from the much greater comprehensibility of the Latin version, English, although a Germanic language, has been thoroughly infused with words derived from Latin. This drastic change in the nature of English arose primarily through the conquest of England in 1066 by the Normans, who spoke a variety of French and used Latin in church and the law courts. By extension, English was now also more closely related to Greek, since Latin and Greek are Indo-European cousins with many similar features. What is more, in ancient times the Romans had already adopted a wide range of Greek words into their own language, especially in the technical vocabulary of the academic disciplines, in which the Greeks were generally regarded as having precedence in both chronology and competence. Thus, Latin itself—and particularly the terminology of medicine and of the other scientific arts—had already been permeated with Greek by the time it invaded the English language in the 11th century.

As a result of these developments, English was heavily influenced by Latin and Greek both in technical and nontechnical vocabulary. Such a high rate of borrowing from another language group is all the more amazing since most languages take a very conservative approach to adopting loanwords (at least until the modern information age, in which contact between languages has increased exponentially). Therefore, although English is not actually descended from either Greek or Latin, the influence of the two ancient languages on English is so strong that a modern English speaker finds it easier to learn scientific terminology based on Greek and Latin than would be the case if it were based on German.

## Constructing Medical Terminology

There are two main ways in which words come to be in the lexicon of modern medical terminology. They are a natural development from the classical tradition, or they are deliberately coined by modern-day researchers. In this course, you will be dealing predominantly with words that fall into the latter category, for they are by far the majority. But those words that have come down to us by the natural development of language will not be neglected, if for no other reason than that so many terms of this type have truly fascinating histories.

### *Tradition*

Many words in modern scientific terminology are an inheritance from the past, and often the rationale behind the selection of a given word strikes us as odd, or the change in its form or use seems quite unpredictable. For example:

- If researchers nowadays were to discover for the first time the existence of bundles, bands, or sheets of contractile tissue which act to produce movement in, or maintain the position of, parts of the human or animal body, it is unlikely that they would call them, or be allowed by the scientific community to call them, "little mice." But that is precisely what the word "muscles" means in its Latin form, *musculi*; someone long ago was fanciful enough to compare flexed muscles to mice scurrying about under the skin.
- Likewise, but for quite different reasons, were doctors to decide to treat injuries, deformities, and other disorders by manual operation, it is unlikely that they would hit upon the term "surgery." That term was coined in Greece at least as early as the 5th century BC in the form *cheirourgia*, literally meaning "the process of working with the hands," or "manual labor." It quickly came to refer specifically to surgery as we know it, but its metamorphosis into its modern spelling was slow, as it made its way from ancient Greek to Latin, French, and then English.
- "Captain," "chapter," "chef," "chief," "decapitate," "recapitulate": what do these words have in common? They are all derived from the Latin word *caput*, meaning "head." *Caput* is the origin of the word for "head" in Spanish, Portuguese, and Romanian: *cabeza*, *cabeça*, and *cap* respectively. But the Italian word for "head," *testa*, and the French, *tête*, are derived, rather comically, from the Latin *testa*, "pot"; similarly, the German word for "head," *Kopf*, preserves the late Latin *cuppa*, "cup." *Haupt*, which *Kopf* supplanted, is derived from the same Indo-European root as "head" and *caput*.

There are many other surprising, amusing, and informative etymologies of this kind that can be understood only through specialized linguistic knowledge, but such developments are exceptional. It is important to appreciate that when English has adopted Latin words, or Greek words via Latin, it has usually done so in a way that is systematic and therefore predictable. The vast majority of our Latin-based words follow a limited number of distinct patterns of Anglicization, exemplified by the following selection of word groups:

*decor*, *error*, *pallor*, *tremor* (no change)

*frigidus*, *horridus*, *tepidus*, *timidus* (remove *-us*)

*mixtura*, *natura*, *pictura*, *structura* (change *-a* to silent *-e*)

*brevitas*, *dignitas*, *gravitas*, *simplicitas* (change *-as* to *-y*)

*atrox, audax*, *ferox*, *vivax* (change *-x* to *-cious*)

## *Invention*

Generally speaking, when modern researchers coin names for new discoveries, they take great care to ensure that the terms they use are logical, clear, descriptive, and systematic. There are few modern designations as whimsical as "muscle." A famous exception is "quark," coined by Murray Gell-Mann, one of the physicists who discovered these elementary particles; the name is apparently an arbitrary reminiscence of "Three quarks for Muster Mark," a shout heard in Humphrey Chimpden Earwicker's pub in James Joyce's *Finnegan's Wake*. It is a rather unhelpful term, not least because it is not entirely clear what Joyce meant by it, but even so it has a sort of impish drollery that should be indulged occasionally.

There are six main combinations in which Greek and Latin are used to make modern technical words:

| | |
|---|---|
| pure Greek | "pandemic" |
| pure Latin | "omnivorous" |
| mixed Greek and Latin | "pancultural," "omnitonic" |
| mixed Greek and another language | "pan-Anglo-Saxon" |
| mixed Latin and another language | "omniloving" |
| mixed Greek, Latin, and other elements | "deoxyribonucleic" (see p. 309) |

Of special note is the third type. Isidore of Seville (the patron saint of the Internet) says of it, "Words that are partly Greek and partly Latin are called 'intermediate.' They are also called 'bastard,' because they corrupt the final syllables; for example, the Greeks say 'Alexandros' and 'Menandros,' but the Romans say 'Alexander' and 'Menander'" (*Etymologies* 1.7.13). The language here is rather judgmental ("bastard," "corrupt"), and to this day words that fall into any of the last four categories may have little aesthetic appeal to linguistic purists. Even so, such mixtures are a regular feature of the terminological landscape of modern medicine (see Chapter XXV), and their hybrid nature does not necessarily make these bilingual Greek and Latin words inferior to "pure" vocabulary in function or aesthetics. Most are sufficiently descriptive for accurate communication, and indeed some seem to have a better phonetic quality than their purebred associates, though this is a matter of individual opinion. On the other hand, some bilingual choices are better than others, and there is something to be said for consistency.[5]

The six categories listed above do not account for every possible type of modern coinage. There are many that are impervious to scrutiny without specialist knowledge that to some extent lies beyond the scope of this course. Such words have to be investigated on an individual basis, as exemplified by the following concoctions (for more on these types of formation, see Chapter XXVI):

- "Warfarin" is structured on an acronym of *Wisconsin Alumni Research Foundation* + *ar* + the chemical suffix *-in*; the *ar* has no real meaning of its own.
- "Aspirin" is a shortened form of its German name, *acetylirte Spirsäure* (i.e., acetylated spiraeic acid) + *-in*, with no predictable pattern in the letters retained in the abbreviation.
- "Amphetamine" retains less than half of its full name, alphamethylphenethylamine.
- "Ibuprofen" is comparable, being an abbreviation of isobutylphenylpropionic acid, but with a presumably euphonic reversal of the syllables *phen* (changed to *fen*) and *pro*.

---

5. Every time classical scholars raise their eyes to the starry firmament, they are struck dumb with wonder at what possessed William Herschel to call the first new planet discovered since antiquity by the Latinized form of the name of the Greek god of the sky, Uranus. All the then-known planets, i.e., all that are visible to the naked eye, are named in honor of Roman deities. Cosmically spectacular as this inconsistency may be, it might have been worse: Herschel had to be persuaded not to call his new planet "George," in honor of George III of England.

## Some Basic Principles

Before you begin to work through this book, you will need to be sure that you understand some general principles of language that will be referred to throughout the course. You may already be familiar with some or all of these concepts, in which case you can use the following discussion as a review exercise.

### *Three Parts of Speech*

Languages are composed of elements called "parts of speech," the number and definition of which vary from one language to another. English, for example, is usually reckoned to have eight parts of speech: verbs, nouns, adjectives, adverbs, pronouns, prepositions, conjunctions, and interjections. In learning a language, we have to learn how to use each of its parts of speech, but to understand medical terminology we will be working with only three: verbs, nouns, and adjectives.

**Verbs** describe actions, states, or occurrences:

Blood *is* red; serious wounds *fester*; skillful doctors *prevent* many diseases.

**Nouns** define people, places, and things:

*Blood* is red; serious *wounds* fester; skillful *doctors* prevent many *diseases*.

**Adjectives** qualify nouns:

Blood is *red*; *serious* wounds fester; *skillful* doctors prevent *many* diseases.

Now test your knowledge of these parts of speech in this famous Hippocratean dictum ( *Aphorisms* 1.1). How many verbs are there? How many nouns? How many adjectives? (You can check your answers on p. xviii.)

*Life is short, art long, opportunity fleeting, experience uncertain, judgment difficult.*

Now count the verbs, nouns, and adjectives in the following passages (Celsus, *On Medicine* 7 Introduction; Galen, *On Antidotes* 14.7). Which one has more verbs? Which has more nouns? Which has more adjectives? Again, you can check your answers on page xviii. Be careful about words like "tampering," which is a gerund, that is, a verbal noun. This word is clearly related to the verb "to tamper," but note that it must function as a noun in this context, a fact that can be seen by substituting other nouns in its place (e.g., "crafty at poker"). Remember in this exercise to count infinitives (e.g., "to cure") as verbs. (NB: Gerunds and infinitives do not feature in medical terminology.)

A. The ideal surgeon is fairly young, with strong and steady hands, ambidextrous, with good eyesight, eager to cure his patient, but detached enough not to want to hurry or to cut less deeply than is necessary. He must perform his task as if the patient's screams had no effect on him.

B. It is important to devote time to personal examination of each medicine, so as to distinguish those that are effective from those that are useless. For drug sellers are so crafty at tampering with medicines that they fool even people with great experience in such matters.

### *Three Parts of Words*

A remarkably large percentage of English words are monosyllabic, and we tend not to construct elaborate compound terms unless they are derived from Greek and Latin, in which languages such forms are normal. For example, "disyllabic" is made up of four distinct Greek elements (*di* + *syl* + *lab* + *ic*), whereas "elaborate" and "compound" are made up of three and two Latin elements respectively (*e* + *labor* + *ate*; *com* + *pound*).

The accurate analysis of the component parts of words is vital to the successful study of medical terminology. Consider the terms "ectopia" and "dislocation." These two words have the same literal meaning, the former being derived from Greek and the latter from Latin. They are typical compounds in that they consist of the three primary elements from which words can be constructed: a **prefix**, a **base**, and a **suffix**.

The core element in a word is, as its name implies, the base. The other elements are defined in relation to this core: a prefix is "fixed before" it, and a suffix is "fixed after" it, and both of these affect the meaning of the word in important ways. In the examples above, the bases *top-* and *loc-* establish that the word will have something to do with "place." The prefixes *ec-* and *dis-* mean "away from," and the suffixes *-ia* and *-ation* mean "a state of," so both words literally mean "a state of being out of place." Changing either the prefix or the suffix will affect the overall meaning. For example, using the prefix *dys-* ("bad") to create "dystopia," we have a word meaning "a state of being in the wrong place." Similarly, different suffixes can alter a word's meaning and, frequently, its part of speech: "location" is a noun, "locate" is a verb, and "local" is an adjective.

Not all compound words are composed in exactly this manner. Sometimes there may be more than one prefix, as in "asymptomatic," "incontinence," and "anti-inflammatory," of which the first has two Greek prefixes (*a-* and *sym-*), the second has two Latin (*in-* and *con-*), the third has one Greek (*anti-*) and one Latin (*in-*). Or there may be no prefix but more than one base, as in "mucopurulent," which means "full of mucus and pus," both *muc-* and *pur-* being Latin bases, followed by the Latin suffix *-lent*, "full of"; or in "neuralgia," which means "a state of pain in the nerves," both *neur-* and *alg-* being Greek bases. Or there may be more than one base with no prefix or suffix, as in "vermicide" and "spermicide," the "killing of worms" and the "killing of sperms."

Just as "anti-inflammatory" uses a Greek prefix as the first element in a word that is otherwise derived entirely from Latin, so "spermicide" also combines Greek (*sperm-*) and Latin (*-cide*). ("Vermicide" is pure Latin.) Scientists are sometimes prone to ignore the distinction between Greek and Latin (as witness Herschel and Uranus). In practice, it often makes little or no difference whether an element in a word is Greek or Latin, and the similarity of the two languages means that some elements are identical in both, but identifying the correct language is not an entirely negligible consideration. The majority of words in the medical lexicon are either pure Greek or pure Latin, and so if you encounter a word element that exists in both Greek and Latin, the probability is that it is from the same language as the other elements in the word. Consider, for example, the word "orthopedic." The base *ped-* means "child" in Greek, whereas it means "foot" in Latin. The adjectival suffix *-ic* gives us no clue, since, as is the case with certain other suffixes, it is found in both Greek and Latin with the same meaning, "having to do with." But *orth-* is Greek for "straight," so we are therefore justified in deducing that "orthopedic" literally means "having to do with straight children," not "having to do with straight feet." (Now used to refer to the correction of deformities in anyone, the term was originally coined in reference to the treatment of children.)

One final point, small but important, needs to be made here about the analysis of words. Look again at "mucopurulent" and "orthopedic": did you notice that no account was taken of the "o" in the middle of these words? And in "spermicide" and "vermicide," did you notice that no account was taken of the first "i"? These vowels have been added to make the words more cohesive and easier to pronounce: "~~mucpurulent~~" and "~~orthpedic~~," for example, are harder to say than "mucopurulent" and "orthopedic." Such "combining vowels," as they are called, play an essential role. Any vowel may be used in this capacity in Latin words, and the choice of combining vowel will often seem arbitrary, but do not worry about this. You only need to be able to recognize combining vowels when they appear, and in any case with experience you will be able to guess more efficiently which vowel would be used in particular contexts. Combining vowels are much easier in Greek, as they are nearly always "o," for example, in "otorhinolaryngology" ("the study of the ear, nose, and throat"), where this vowel is used three times to join together *ot-*, *rhin-*, *laryng-*, and *-logy*.

### *Word Ana + ly + sis Drills*

One of the most satisfying and indeed exciting aspects of your acquisition of medical terminology will be the realization that the more you learn, the easier it will be to learn more. Suppose, for example, that you know that the word "anatomy" can be cut up as follows:

*ana* ("up") + *tom* ("to cut") + *y* ("process or state")
= the process of cutting something up, extended to the science of body systems

This knowledge will help you split "atom":

*a* ("not") + *tom* ("to cut")
= something so tiny that it cannot be cut into smaller pieces (as was originally thought)

Should you care to know, you are now two-thirds of the way to understanding "apathy":

*a* ("not") + *path* ("feeling, suffering") + *y* ("process or state")
= the state of "not feeling," indifference

The chain continues with "psychopath," "psychiatric," "geriatric," "gerontology," and "entomology":

*psych* ("soul, mind") + *o* (combining vowel) + *path* ("feeling, suffering")
= someone with a mental ailment (used specifically to describe an antisocial disorder)

*psych* ("soul, mind") + *iatr* ("doctor") + *ic* ("concerning")
= concerning the treatment of the mind by a doctor

*ger* ("old person") + *iatr* + *ic*
= concerning the treatment of the elderly by a doctor

*geront* ("old person") + *o* + *log* ("study") + *y*
= the process of studying the elderly or the phenomenon of aging[6]

*en* ("in") + *tom* + *o* + *log* + *y*
= the process of studying what can be cut into[7]

The words analyzed above are all Greek, but the same can be done with words of a Latin origin:

*dis* ("apart") + *sect* ("to cut") + *ion* ("process or state")
= the process of cutting apart[8]

---

6. Note that the word for "old person" has more than one form (*ger-*, *geront-*). It is common for nouns and verbs in Greek and Latin to have this kind of variation, and in such cases you will need to learn each form.

7. Note that analysis alone will not give us the exact meaning of "entomology." Aristotle said, "I call *entoma* any creatures that have notches along their body that can be cut into" (*History of Animals* 487*a*). He is referring to insects: the Latin equivalents to *en-* and *tom-* are *in-* and *sect-*.

8. Latin has no simple word meaning "up" that would here match the Greek prefix *ana-* seen in "anatomy."

Using this model, see if you can figure out how to analyze the following Latin words, breaking them down into their component parts and giving a meaning for each (check your answers on p. xviii).

1. disposable _____
2. expose _____
3. export _____
4. portable _____
5. vivisection _____
6. revive _____
7. reflex _____
8. inflexible _____

## *A Note on Vocabulary*

In both Greek and Latin, the number of prefixes and suffixes is quite limited, and you will soon become familiar with almost all of them. Bases are different, for they are as numerous as the objects and concepts that require a name. In this course, you will learn only a fraction of the bases found in medical and scientific terminology, but that fraction has been carefully selected to include the most widely used bases. You will also acquire the tools necessary to handle unfamiliar bases when you encounter them.

This modest aspiration needs to be seen in context. For one thing, most technical terms are extremely restricted in their use and are familiar to only a very limited number of experts. But it will perhaps be more reassuring that there is much the same limitation in normal language use as well; even a reasonably well-informed native speaker of English does not recognize, let alone use, more than a small percentage of the language's vast lexicon, and yet practically none of us feels oppressed or restricted by this limited range of our knowledge. Each of us acquires a functional vocabulary based on our interests and experiences, and no one masters everything.

It would, of course, have been easy to include more bases to learn in each chapter, but that would have been counterproductive, since such additional rote learning would risk distracting you from the primary aim of the course, which is not simply learning facts about words but rather understanding how they come to be formed. As for the omissions of vocabulary in this textbook, there is a certain comfort in knowing that the challenges of compiling a work like this were encountered by the ancients as well. In the 1st century AD, as the concluding words of his *On Naming the Parts of the Human Body*, Rufus of Ephesus wrote:

> *Here then are most of the terms used in naming the parts of the human body. It is quite possible that there are some omissions, but it would not be right to undervalue the great number that are included just because of a few that have been overlooked.*

## Guide to the Exercises

### I. Translation of German/Latin Paragraph

*It is not difficult to describe the parts of the human body: for example, in the head are the skull, the brain, the two ears, the two eyes, the tongue, the teeth; the nose is located in the middle of the face; below the head, in the back region, is the spinal column, that is, the vertebrae; in the chest region are the breasts, the ribs, and the chest bone; below the chest are the intestines, the abdomen, the stomach, the appendix, the pelvis, and so forth; below the stomach are the genital members, that is, in a male body the penis and the testicles, in a female body the vagina and the womb; above the kneecap is the thigh bone, a very long bone; below the kneecap are two bones; the fibula is smaller than the tibia. One hand has five digits, two feet have ten digits. In the whole body there are 206 bones; the number of nerves and muscles is uncountable; blood runs through the whole body in arteries and veins.*

In translating the Latin version of this passage, you will have noticed some major dissimilarities between Latin and English, perhaps above all the very different word order and the absence of both the definite and indefinite article—that is, "a(n)" and "the." (This absence largely accounts for the disparity in the length of the versions: the English and German versions have 172 and 159 words respectively, whereas the Latin has only 120.) Despite these differences (neither of which is at issue in learning scientific terminology), and despite the fact that English is a Germanic and not a Latinate language, you will no doubt have found the Latin version considerably easier to translate than the German. You may therefore face with confidence the task of learning words derived from Latin and then also those derived from its closely related cousin, Greek.

### II. Three Parts of Speech

1. **Verbs**: 1 *Nouns*: 5 Adjectives: 5
   *Life* **is** short, *art* long, *opportunity* fleeting, *experience* uncertain, *judgment* difficult.
2. **Verbs**: 9 *Nouns*: 8 Adjectives: 10
   The ideal *surgeon* **is** fairly young, with strong and steady *hands*, ambidextrous, with good *eyesight*, eager **to cure** his *patient*, but detached enough not **to want to hurry** or **to cut** less deeply than **is** necessary. He **must perform** his *task* as if the *patient's screams* **had** no *effect* on him.
3. **Verbs**: 7 *Nouns*: 10 Adjectives: 8
   It **is** important **to devote** *time* to personal *examination* of each *medicine*, so as **to distinguish** those that **are** effective from those that **are** useless. For *drug sellers* **are** so crafty at *tampering* with *medicines* that they **fool** even *people* with great *experience* in such *matters*.

### III. Three Parts of Words

1. *dis* ("apart") + *pos* ("put, place") + *able* ("able to be") = able to be put/thrown away
2. *ex* ("out") + *pose* ("put, place") = to place out in the open
3. *ex* ("out") + *port* ("carry, bring") = to bring out (e.g., of a country)
4. *port* ("carry, bring") + *able* ("able to be") = able to be carried
5. *viv* ("live") + *i* (combining vowel) + *sect* ("cut") + *ion* ("process or state") = the process of cutting into something while it is still alive
6. *re* ("back, again") + *vive* ("live") = to make alive again
7. *re* ("back, again") + *flex* ("bend") = a bending back
8. *in* ("not") + *flex* ("bend") + *ible* ("able to be") = not able to be bent

2, 6: You may have been uncertain about what to do with the final "e" in "expose" and "revive," since the "e" does not appear as part of that word element in some other words ("disposable," "vivisection"). A silent final "e" is a typical way for English to end a word and in nearly all cases does not represent a separate Latin- or Greek-based element. This phenomenon will be brought to your attention at various points throughout the course.

# How to Use This Book

This book is designed to give you the tools necessary for understanding the ways in which English medical terminology has been derived from Greek and Latin. Although the emphasis is on the language of medicine, the course will also be useful to students of other scientific disciplines, if less specifically so. This is because the principles and vocabulary used in medical terminology are widely employed in fields such as botany, zoology, physics, and astronomy, and from time to time words from such fields will appear in this book.

## Methodology and Organization

A variety of textbooks exists for the purpose of teaching students medical vocabulary, and these fall largely into two groups, each of which appeal to different audiences. The first group includes books designed by medical professionals to teach as much vocabulary as possible in a way that is as practical as possible for medical professionals-in-training. This approach focuses less on the principles of language and more on rote memorization of word elements and their specific uses in medicine. The second group takes a more linguistic approach, focusing more on the workings of language and less on comprehensive coverage of the medical science behind each term. This book belongs to the latter group. (To adapt a quotation from a popular science fiction television series, "We're classicists, not doctors!") As such, its appeal will vary depending on the needs and aims of the individual student, and it will not be the best choice for all medical terminology courses.

The approach taken in this course has some important consequences. First, while the definitions of terms have been selected to be as accurate and up-to-date as possible (derived almost entirely from *Dorland's Illustrated Medical Dictionary*, 32nd edition; see Additional Resources), there is no emphasis on providing encyclopedic knowledge about those terms. For instance, you will learn the Latin formation of the phrase *delirium tremens*, a condition resulting from withdrawal from alcohol, but there is nothing in this book about how it is caused, diagnosed, or treated. Second, the chapters are organized systematically according to linguistic phenomena, not according to categories such as biological systems, medical disciplines, or types of diseases. This means that you will not find an entire chapter devoted to, for example, the circulatory system (although you can read about such systems near the end of each chapter, for which see below). Rather, the chapters are divided into such topics as diminutive word formations, prefixes that undergo assimilation, suffixes that mean "result of," and terms derived from classical mythology. Accordingly, the vocabulary for each chapter has been chosen to suit the linguistic topic in that chapter and has not been organized by meaning. For example, you will learn the base *somn-* ("sleep") in Chapter V because of its applicability to the suffix *-lent* ("somnolent"), whereas *dorm-*, a base closely related in meaning, is taught in Chapter VI because of its use with *-ancy* ("dormancy"). These divisions have been made to give you the best chance of learning the linguistic principles themselves.

There are twenty-eight chapters in all: fourteen for Latin-based terminology, ten for Greek-based, and four for other types of construction. As medical terminology was developed first in Greek, it might be assumed that Greek should be taught first, but in this course you will start with Latin. The reason is a pedagogical one. Generally speaking, terminology derived from Latin is more familiar to students than terminology derived from Greek. Although there will be plenty of Latin vocabulary to learn, the meaning of numerous Latin elements will be quite obvious to English speakers, and so your first efforts in linguistic analysis will be carried out on terminology that is somewhat easier than what you will find in the Greek chapters, especially since

Greek comes with the added challenge of learning a new alphabet from the very beginning. This is not to say that Latin-based terms are universally easy (see Chapter XI for a reality check), or that Greek-based terms are universally difficult, but only that starting with Latin will allow you to begin the task of dissecting medical terminology in a minimally invasive way.

The chapters are subdivided into groups of three or four based on content, and each group is followed by a separate review section that tests this material. The chapters are designed to stand on their own, though they should be covered in the order they appear, as each subsequent chapter will assume knowledge of the material previously covered. In Chapter I it is also assumed that you will have read the Introduction, including the section "Some Basic Principles," which describes the parts of speech and the parts of a word referred to throughout the course. In most cases the chapters are of roughly comparable length, though there are some notable exceptions (esp. Chapter XI), and it is assumed that time spent on a given chapter will vary according to that chapter's contents and the specific needs of the class.

Every chapter begins with a lesson on particular linguistic phenomena, followed by a Vocabulary section and accompanying notes to aid your study of the material. As stated in the Introduction, no textbook could ever hope to offer a complete list of medical vocabulary, and there is no one alive who understands all terms from every branch of medicine, so do not expect that you will have mastered everything by the end of the course. Rather, this book will equip you with the knowledge of the most important word elements as well as the principles by which scientific terminology is formed so that you will have the tools necessary for handling unfamiliar vocabulary when you encounter it in your chosen discipline. Sometimes, especially in the introduction of new material, words that are not specific to medicine appear among the examples or, more rarely, the exercises. Although such words are not the focus of the course, they will give you a chance to examine a given linguistic principle in a familiar context, which will better prepare you to handle more complicated words. Finally, a great number of bases introduced in this book have alternative forms; but, as some alternatives are quite rare, only the most useful ones are presented in the Vocabulary sections.

## Exercises

Most chapters have seven types of exercise to reinforce your knowledge of the vocabulary and principles presented:

- *Identification*. Give a brief definition of a term.
- *Name That Term*. Supply a suitable term to fit a given definition.
- *Everyone Makes Mistakse*. Identify and fix the mistake in a given word.
- *Fill in the* _____. Supply the missing part of a word to match the definition provided.
- *Matching*. Pair each term with the appropriate definition. In this exercise you will sometimes encounter word elements with which you are unfamiliar, but it will always be possible to deduce the correct answer on the basis of what you have learned thus far. This exercise will therefore give you valuable practice in handling words in which you can recognize only one or two elements.
- *Back to the Bases*. You are given two English words that share the same base but have different prefixes and/or suffixes. Use the English words to guess what the base means.
- *The Wordsmith*. In this bonus exercise, coin your own terms using the knowledge that you have gained thus far. In the opening chapters you will receive more guidance for these, and as you proceed they will become more challenging (and more fun). Some of your answers may strike you as strange and even quite humorous; this is as it should be, for the formation of scientific terminology is sometimes an odd process. It might even be said that if you cannot laugh at yourself during this exercise you are doing it wrong. While many of the words you will create are unlikely to appear in a standard medical dictionary, remember that by coining your own terms you will be consolidating important vocabulary.

After each chapter you will find a section entitled "Guide to the Exercises," which provides an answer key and additional commentary. You are strongly advised to consult the guide even when you are confident in your answers, because the commentary will bring up issues you may not have considered and will often give further etymological information. Use the guide only after attempting all exercises in a given chapter on your own.

It must be stressed that the exercises are a crucial part of the learning process, for they serve to *teach* as well as to *test* knowledge of medical terminology. Rather than ask you to regurgitate information memorized by rote, the exercises provide a more interactive setting for the discovery of medical terms, and as such they should be considered an important facet of the course. The variation in the types of exercises will further aid your learning, as they will challenge you to think about vocabulary from a number of different angles. Early on you will encounter a few words that incorporate principles that you have not yet learned; for instance, you will see "construction" in Chapter II when you learn the prefix *con-* and the base *struct-*, but you will not formally learn the suffix *-ion* until Chapter VI. Rest assured that each principle will be taught in its time, and do not feel frustrated: the inductive approach taken in the exercises is important for developing your linguistic intuition.

Some of the exercises are rather more challenging than others, so you should not expect to get every answer fully correct. In many cases the exercises have purposefully been made more difficult than normal to help you achieve the ultimate goal of correctly using and identifying medical terminology "in the wild." In antiquity, gladiators trained with swords that were heavier than normal so that their movements in an actual fight would be faster. For similar reasons, in modern times baseball players swing weighted bats in the on-deck circle before coming up to bat; the human muscular system adjusts itself to meet these heightened demands and therefore performs better under less rigorous circumstances (i.e., with a normal bat) at home plate. In the same way, students who routinely attempt difficult textbook exercises will find their mental muscles better suited to perform well on exams and, beyond that, in the everyday rigors of scientific occupations.

According to Plutarch, "A doctor who distributes exactly the same quantity and weight of a medicine to every patient is utterly ridiculous" (*Table Talk* 643*c*). Similarly, it is not expected that all exercise types will be equally helpful to everyone. Rather, the book presents a variety of exercises that individual instructors may prescribe based on individual aims. Instructors may also expand on these by introducing materials of their own, including "real world" medical documents that make use of the terminology presented in the course (the exercises in Chapters XXVI–XXVIII provide practice of this kind).

## Broad-Spectrum Approach

"Patients do not like to receive the same treatment all the time" (Hippocrates, *Precepts* 7). With this principle in mind, we have added four further sections that will deepen your understanding of the material while providing some variation to the regimen of each chapter. Two are primarily linguistic in nature:

- *Word to the Wise*. These boxes are marked by the snake and rod, the sign of the healer god Asclepius, and contain explanations of medical terms that have especially interesting histories. One particular value of this section is that it gives you a chance to see how words are a product of the culture in which they are found. Some of them will surprise you.
- *Know Yourself*. This section contains a labeled diagram of an anatomical system along with an overview of the terms' etymologies. This information will both reinforce principles you have already learned and give you a glimpse of other linguistic phenomena to be learned later. Although, as stated above, the organization of the course demands that vocabulary words from a given anatomical system be spaced out in various chapters according to the linguistic principles pertaining to each word, the Know Yourself section in each chapter will give you a chance to study the vocabulary of a given system together in one location. This means that many vocabulary items will appear more than once in the book; this is intentional and will help you learn the terminology by encountering it in different contexts.

In addition to teaching the linguistic principles behind the formation of medical vocabulary, this textbook also provides information that will give you a better understanding of the world of ancient medicine and how it has affected modern times. Indeed, learning about Greek and Roman medical culture is an important aspect of learning medical terminology, since language does not operate in a vacuum but rather is an expression of (and an influence on) the culture of which it is a part. While this book does not offer a complete picture of ancient medicine, each chapter has two sections that will give you a window, however small, into the world of doctoring in antiquity:

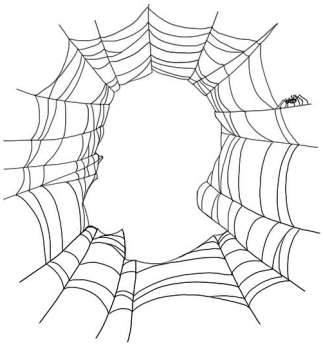
- *Hippocratic Quotations*. These excerpts, attributed to the so-called father of Western medicine, are enclosed in a box marked with a bust of Hippocrates. They provide a glimpse of the medical art from the 5th and 4th centuries BC and cover such topics as patient care, the ethical demands of the profession, and the limits of medicine's practical uses.
- *Medicine in Antiquity*. This section at the end of each chapter gives a snapshot of various features of ancient medicine and challenges you to think critically about how ancient assumptions and practices pertaining to the medical art relate to those of the modern world. Here you will read a range of excerpts from Greek and Latin primary literature on topics such as the role of doctors in society, diseases, conceptions of the human body, and the religious and superstitious aspects of ancient medical practice, along with a commentary on the passages. Each review section has additional discussion questions to encourage you to think through the ramifications of the primary texts you read at the end of each chapter. The passages and commentary have no pretense of comprehensively covering the very substantial topics they address, but they will give a sample of what some important ancient writers had to say.

At the end of the book is an appendix that, in contrast to the vermiform appendix located in the human abdomen, has a clearly recognizable function. Here you will find a variety of resources to help you situate yourself both in the textbook itself and in the context of antiquity. The Chronological Table locates important people and events along a general timeline of ancient history. The Glossary of Proper Names provides a brief summary of the important facts to know about a variety of people, places, and events from Greek and Roman culture. The comprehensive Index of Word Elements gives you the page number of all prefixes, suffixes, and bases taught throughout the course. After this index you will find two lists that give the topics covered in the Know Yourself and Medicine in Antiquity sections in each chapter. A final section provides some information about the numerous images you will encounter throughout the textbook.

## Course Website

While it is hoped that every aspect of this textbook will be beneficial to you, it is also assumed that different readers will have different priorities in taking this course, and not everyone will be equally interested in all parts. One of the advantages of the layout is the ease with which you can choose which portions to emphasize: the lessons on linguistic principles, the cultural background, or simply the vocabulary and exercises. Whatever the case, you are strongly encouraged to explore the course website, *hippocratescode.com*, which will provide more of whatever interests you most. The material found online includes the following:

- Vocabulary practice
- Additional exercises
- Pronunciation help
- Further explanations of linguistic concepts
- More examples of interesting etymologies
- More excerpts from ancient medical writers
- Mini-lectures on topics related to the language and culture of medicine



# Additional Resources

## I. General Sources on Ancient Medicine

Mattern, Susan. *The Prince of Medicine: Galen in the Roman Empire*. Oxford and New York: Oxford University Press, 2013.
Many fascinating insights into the medical world of the early empire are to be found in this thoughtful and informative biography of the great doctor, whose importance is outdone only by his own estimation of it.

Nutton, Vivian. *Ancient Medicine*. London: Routledge, 2nd ed. 2012.
A wide-ranging, detailed, and highly readable account of medicine in Greece and Rome by the foremost living authority in the field.

## II. Translations of Select Primary Literature

Chadwick, John, et al. *Hippocratic Writings*. London: Penguin, 1984.
Translations of several of the treatises in the Hippocratic Corpus.

Singer, Peter. *Galen: Selected Works*. Oxford and New York: Oxford University Press, 2002.
Translations of some of Galen's best known shorter works.

Temkin, Oswei. *Soranus' Gynecology*. Baltimore: Johns Hopkins University Press, 1991.
A translation of the most authoritative work on gynecology to survive from antiquity.

## III. Dictionaries and Other Reference Works

*Dorland's Illustrated Medical Dictionary*. Philadelphia: Saunders/Elsevier, 32nd ed. 2012.
The most authoritative and comprehensive medical dictionary. First published 125 years ago with 770 pages, this indispensable work has more than doubled in size.

*Gray's Anatomy: the Anatomical Basis of Clinical Practice*. Philadelphia: Elsevier, 41st ed. 2015.
A highly influential reference work, first published in 1858, when anesthesia was in its infancy and hygiene was more or less optional in operating theaters.

*Taber's Cyclopedic Medical Dictionary*. Philadelphia: F. A. Davis Co., 22nd ed. 2013.
More pages than *Dorland* but not as bulky. Like *Dorland*, a *sine qua non* in the medical profession.

*The Oxford Classical Dictionary*. Oxford and New York: Oxford University Press, 4th ed. 2012.
An up-to-date and reliable source of information about ancient Greece and Rome.

*The Oxford English Dictionary*. Oxford and New York: Oxford University Press, 2nd ed. 1989.
The definitive record of the English language. The entry for each word begins with information about its origin.

# Chapter I


## Latin Prefixes 1

*In this chapter you will study . . .*

* *Some common Latin prefixes*
* *A series of Latin bases that are used with these prefixes to create medical terms*
* *The skeletal system*
* *Ancient ideas about the origins of the medical art*

The ability to recognize prefixes, suffixes, bases, and combining vowels is essential in determining a word's meaning (for explanations of these elements, see the Introduction). While the number of possible bases is extremely large, prefixes and suffixes are relatively few. Many of the prefixes will already be familiar to you (e.g., you know that "circumnavigate" and "circumference" both have something to do with "around"), so the transference of their basic meanings to medical terminology will usually not require a great deal of effort.

A prefix is a word element that is "fixed before" a base and gives further definition to it. Consider the examples *pre-* and *post-* in the words "prenatal" and "postnatal." When these prefixes are added to "natal," there is a shift in meaning, specifically with reference to a designated time period. Prefixes may also denote spatial relationships, as in "intracellular" and "extracellular," where the change in prefix shifts the meaning from "within the cell" to "outside the cell." In these cases the prefixes have been added to adjectives ("natal," "cellular"), but prefixes may also be added to other parts of speech, including nouns (e.g., "pretrial") and verbs (e.g., "presuppose"). Note that adding a prefix to a base does not change its part of speech; "natal," "prenatal," and "postnatal" are all adjectives.

There are some fifty Latin prefixes to be learned (including numerical prefixes), and these will be spaced out across the first three chapters. To get started, examine the following list of words. Can you determine the meaning of each prefix from these familiar English examples?

antechamber
benefaction
contradiction
dehydrate
deplane
descend
extramarital
infrastructure
international
intervene
intramural
juxtaposition
maleficent
persevere
perspective
perverse
postdoctoral
postscript
premonition
prepare
proceed
produce
progress
retroactive
retrospect
secede
seduce
separate
ultramarathon
ultraviolet

Even without formal instruction in Latin prefixes, you may be able to get a sense of their meaning through familiar English words. For example, "intervene" has to do with getting involved in a situation, and "international" indicates something that is shared by multiple countries, so you can see that *inter-* means "between" or "among." A "premonition" is a warning of something yet to come, and to "prepare" something means to get it ready in advance; therefore, you can see that *pre-* means "before." You might also be able to detect that the prefix *de-* has a sense of "down" ("descend"), though it can also carry a sense of "from" ("depart") or give a word an opposite meaning ("decaffeinated," "dehydrate").

You may have noticed that in many cases a prefix is attached to a word that could otherwise stand alone. For example, "national" can exist on its own apart from the prefix *inter-*, and the same phenomenon can be observed when one removes the *de-* from "dehydrate," the *post-* from "postdoctoral," and the *retro-* from "retroactive." In other cases, however, the base cannot stand on its own and requires a prefix to be added to it in English. Such is the case for "descend," "intervene," and "retrospect." That is, "~~scend~~," "~~vene~~," and "~~spect~~" are not English words. Other examples of this kind include the verbs "rejuvenate" and "interrogate." Can you think of more?

Learn the following prefixes and study the notes that follow. You can find vocabulary drills for these and other word elements online at *hippocratescode.com*.

| Prefix | Meaning | Examples |
|---|---|---|
| **ante-** | *before, in front of* | antecedent, antenatal |
| **ben(e)-** | *well* | benefit, benevolent |
| **contra-** | *opposite, against* | contraception, controversial |
| **de-** | *down, away, off* | decongestant, defecation |
| **extra-** | *outside, beyond* | extraterrestrial, extrovert |
| **infra-** | *below* | infrared, infrasonic |
| **inter-** | *between, among* | intermediate, intermittent |
| **intra-** | *within* | intravenous, introvert |
| **juxta-** | *by the side of, close to* | juxtaposition, juxta-articular |
| **mal(e)-** | *badly, poorly* | malnutrition, malevolent |
| **per-** | *through* | perforation, perspiration |
| **post-** | *after, behind* | postnatal, postoperative |
| **pre-** | *before, in front of* | precancerous, premolar |
| **pro-** | *forward, in front of* | prolapse, protrusion |
| **retro-** | *backward, behind* | retrograde, retrovirus |
| **se-** | *apart, aside, away* | secrete, segregation |
| **super-** | *above* | supersonic, supervise |
| **ultra-** | *beyond* | ultrasound, ultraviolet |

### *Notes*

1. Do not confuse *ante-* ("before") with *anti-* ("against"), a Greek prefix that will be learned later. Notice the difference between "antebellum" ("before the war") and "anti-war" ("against war").
2. It is worth observing that the prefixes *ben-* and *mal-* may have an additional "e" (e.g., "benefaction," "malefi-cent"), but this "e" is not always present (e.g., "malfunction," "malnutrition").
3. In the prefixes *contra-*, *extra-*, and *intra-*, the final "a" is sometimes replaced by an "o," as in "controversy," "extrovert," and "introvert." There is no clearly defined rule for determining when this will happen—why do we say "extravagant" and "extrovert" instead of "~~extrovagant~~" and "~~extravert~~"?
4. The normal way to use the prefix *post-* is to append it directly to the base, as in "postnatal" and "postopera-tive." Note that by convention, however, *post-* may be added to a base with a hyphen, as in "post-anesthesia," "post-concussion," and "post-traumatic." Sometimes the prefix may appear as a separate word altogether ("post anesthesia," "post concussion," "Post Traumatic Stress Disorder"). There is often no logical reason for these variations, nor do they show any kind of consistency. You should simply be aware that they exist and that they may be used interchangeably.
5. In some words, *super-* is written as *supra-* with no change in meaning (e.g., "supramolecular"). In contrast to *super-* and *supra-*, *inter-* and *intra-* have distinct meanings despite being related. The difficulty with these two prefixes is demonstrated by the common misspelling "~~intermural~~" instead of the proper "intramural" when the intended sense is "within the walls" (e.g., of a college campus).

*I shall begin with a definition of what I believe medicine to be: to free the sick of all their suffering, to dull the pains brought on by disease, and, being aware that medicine has no power in such cases, not to treat those who have been overwhelmed by their illness.*

Hippocrates, *The Art* 3

## Vocabulary

In the Vocabulary section of each chapter you will learn a series of bases: Latin for Chapters I–XIV, Greek for Chapters XV–XXV, and a mixture for Chapters XXVI–XXVIII. The entries for each chapter have been chosen to suit the linguistic principle taught in that chapter. While it may be desirable in some cases to group vocabulary items into their more obvious categories (e.g., names of veins, parts of the heart, etc.), this course is designed to emphasize linguistic principles, and the vocabulary has been arranged to suit that emphasis. You will, however, also be able to study terms grouped into anatomical systems in the Know Yourself section.

Each vocabulary box has the base on the left, the definition in the middle, and example terms on the right. No definitions for the example terms are given, because nearly all of them are found in the exercises of this or later chapters, which will allow you to learn the meaning of these terms in an interactive way. For now, see if you can guess the meaning of the examples as you study the bases:

| | | |
|---|---|---|
| **articul-** | *joint* | abarticular, juxta-articular |
| **bucc-** | *cheek, mouth* | buccolingual, suprabuccal |
| **caps-** | *box, container* | capsule, extracapsular |
| **ced-**, **cess-**, **-cede** | *to go, to come* | procession, secede |
| **celer-** | *quick* | accelerator, deceleration |
| **cerebr-** | *brain* | cerebrum, decerebration |
| **cut-**, **cuss-** | *to shake, to strike* | concussion, percussion |
| **ict-** | *stroke, blow* | interictal, preictal |
| **ject-** | *to throw* | interject, retroject |
| **later-** | *side, flank* | contralateral, quadrilateral |
| **matur-** | *ripe, fully grown* | immature, premature |
| **ment-** | *mind* | dementia, mental |
| **mit(t)-**, **mis(s)-** | *to send* | intermission, remit |
| **par-**, **part-** | *to give birth to* | intrapartum, postpartum |
| **pariet-** | *wall* | parietal, transparietal |
| **pon-**, **posit-**, **-pose** | *to put, to place* | depose, juxtaposition |
| **salin-** | *salt* | desalination, saline |
| **uter-** | *womb* | extrauterine, postuterine |
| **vas-** | *vessel* | extravasate, vascular |
| **vert-**, **vers-** | *to turn* | extrovert, retroversion |

### *Notes*

1. The definitions for the Latin bases above are a mixture of nouns, adjectives, and verbs (e.g., "cheek," "quick," "to send"). This distinction exists because the bases come from Latin words that are themselves different parts of speech. This does not mean, however, that any English derivatives from a base have to be the same part of speech as the Latin original. For example, the adjectival base *celer-* ("quick") can be used in English verbs and nouns (e.g., "decelerate," "deceleration"). So while a Latin base's part of speech is not an entirely negligible consideration linguistically speaking, in this course you will not need to commit such information to memory.
2. As you can see, most of the verbal bases have alternative forms (e.g., *ced-* may also appear as *cess-*). It is important to learn the alternatives, since any of them may be used depending on the nature of the English word being formed.
3. The base *caps-* appears in several frequently used words as *capsul-*. This is a diminutive form, meaning that *capsul-* indicates a "little box." The same principle can be seen in the diminutive base *vascul-*, which is derived from *vas-* ("vessel"). You will study diminutives in Chapter IX.
4. Note that the base *pon-* takes the form *-pose* when it is placed at the end of a word, as in "depose," "juxtapose," and "propose." The same is true for *ced-*, which has an alternate form *-cede* (e.g., "recede," "secede"). The final "e" in *-pose* and *-cede* is a standard English suffix found in many words derived from Latin or Greek, but it is not a Latin or Greek suffix and will not be taught as such. This suffix is simply a spelling convention in English (cf. the varied spelling in words such as "proceed" and "exceed").

Words often retain their general meaning while gradually changing their degree of intensity. For example, the English word "plague" is derived from the Latin *plaga*, "stroke, blow." On the contrary, the Latin for "plague" is *pestis*, which has diminished nowadays to the milder "pest," and even the colloquial "pesky." By contrast, the word "disease" began as a gentle term—"lack of ease"—but now has more serious connotations. Note in particular that some experts now talk of "sexually transmitted infections" instead of "sexually transmitted diseases" on account of the latter term being too extreme for some ailments of this kind, which do not always have serious symptoms.

## Exercises

*Complete these exercises. When you are finished, check your answers at the end of the chapter.*

## I. Identification

*Give the meaning of the following words, paying special attention to the prefixes that you have learned in this chapter. All prefixes and most bases can be found in the charts above (bases not covered will already be familiar to you); suffixes will be taught formally in later chapters. Note that you are not expected to arrive at the exact definitions given in the Guide to the Exercises, which often contain very precise technical information; do your best to define the terms and then check the guide to see how close you are.*

*Example: secrete* *to separate or emit*

1. premature _____
2. deceleration _____
3. suprabuccal _____
4. dementia _____
5. ultrasensitive _____
6. juxta-articular _____
7. extrauterine _____
8. capsule _____
9. postoperative _____
10. desalination _____
11. percussion _____
12. malabsorption _____

13. mental _____
14. extravascular _____
15. benefactor _____

## II. Name That Term

*Using your knowledge of the prefixes learned in this chapter, come up with a suitable term for the following definitions. (Hint: you can find a word for each definition in the Identification section above. First, see if you can come up with the term on your own; then use the list above if you need help.)*

*Example: occurring between cells* *intercellular*

1. located or occurring outside a vessel _____
2. decrease in velocity _____
3. the removal of salt from a substance _____
4. occurring before the proper time, not ripe _____
5. located or occurring outside the uterus _____
6. one who confers a gift or benefit _____
7. overly responsive to stimuli _____
8. a striking or drumming _____
9. a progressive debilitation of the cognitive faculties _____
10. occurring after a medical procedure _____

## III. Everyone Makes Mistakse

*The following groups of words contain two properly spelled and one improperly spelled term. Circle the incorrect one.*

*Example: antebellum, (antichamber,) anterior*

1. contravene, controdiction, contrary
2. extrovert, extroordinary, extradition
3. introvenous, introduction, intracranial
4. supraorbital, superfluous, suprasaturated
5. benificent, malevolent, benefactor
6. supersonic, ultrasonic, ultersonic

## IV. Fill in the _____

*For the following words, supply a prefix from this chapter that will complete the meaning provided.*

*Example: __pre__ cancerous: not yet developed into cancer*

1. _____ject: throw between, utter an exclamation
   _____ject: throw backwards, set something in the past

2. _____ ocular: within the eye
   _____ ocular: between the eyes
3. _____ diction: a statement about the future, a prophecy
   _____ diction: a statement against, refuting arguments or evidence
   _____ diction: a speaking well, a blessing
   _____ diction: a speaking badly, a curse
4. _____ duce: lead down, infer from a general principle
   _____ duce: lead away, persuade (usually to do something bad)

## V. Matching

*Definitions for the following terms are included in the right-hand column. Put the letter of the corresponding definition in the blank by the appropriate word. Each term has only one correct answer.*

| | | | |
|---|---|---|---|
| 1. _____ | anteflexion | a. | to withdraw or separate from |
| 2. _____ | postuterine | b. | removal of the brain |
| 3. _____ | contraindication | c. | sunstroke |
| 4. _____ | retroversion | d. | a downward turning (esp. of the eyes) |
| 5. _____ | decerebration | e. | an abnormal forward bending (esp. of the uterus) |
| 6. _____ | intrapartum | f. | placement next to or near to |
| 7. _____ | infraversion | g. | relating to a wall or wall-like structure |
| 8. _____ | extravasate | h. | having to do with the opposite side of the body |
| 9. _____ | preictal | i. | a symptom that argues against a certain type of treatment |
| 10. _____ | contralateral | j. | occurring during ("within") birth |
| 11. _____ | process | k. | referring to the region behind the uterus |
| 12. _____ | parietal | l. | a turning backwards (esp. the tilting of an organ) |
| 13. _____ | ictus solis | m. | prior to a stroke or convulsion |
| 14. _____ | secede | n. | to escape from a vessel into tissue |
| 15. _____ | juxtaposition | o. | a prominence or projection, as of a bone |

## VI. Back to the Bases

*Much of the task of understanding medical terminology comes down to intuition—that is, the ability to determine a word's meaning even when you have not formally studied it before. The following words are grouped into pairs that have the same base. See if you can use each pair of words to work out what each base means.*

| | | | |
|---|---|---|---|
| *Example:* | *inspect, spectacle* | *spect-* | *to look at* |
| 1. | invalid, valiant | *val-* | _____ |
| 2. | binocular, oculist | *ocul-* | _____ |
| 3. | evacuate, vacuum | *vacu-* | _____ |
| 4. | reflex, flexible | *flex-* | _____ |
| 5. | quadruped, pedestrian | *ped-* | _____ |

## VII. The Wordsmith

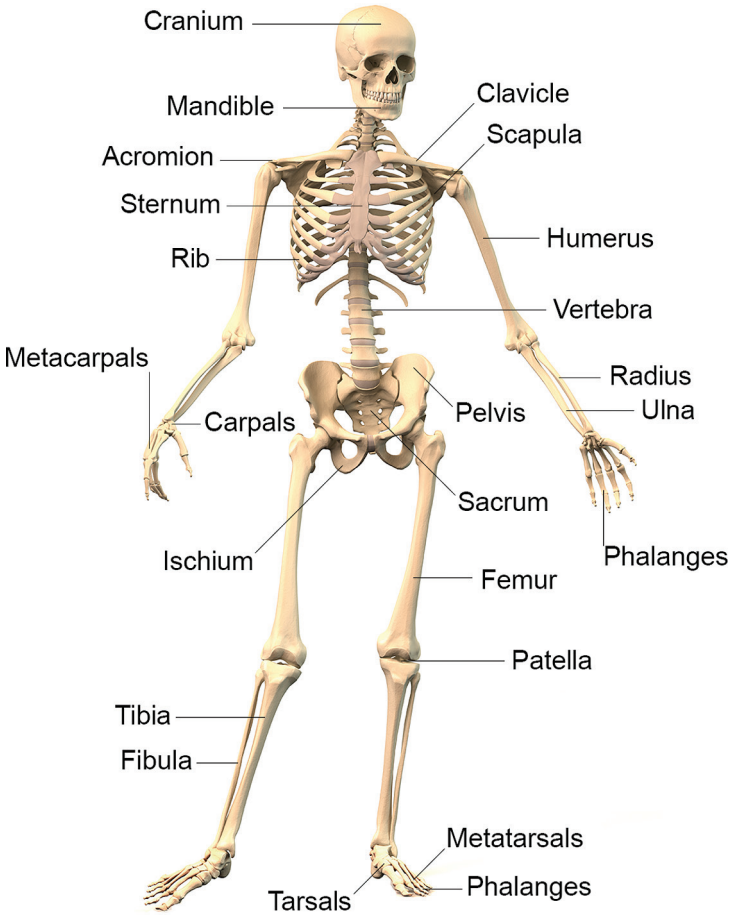
*In the scientific world, researchers often need to create names for newly discovered species of plants and animals, diseases, procedures, elements, and other such things. In this exercise you will come up with your own terminology. The goal here is not to get the "right answer" or even to form a "real word," but to think creatively and to practice using the vocabulary you have learned. (Some of your answers may seem strange to you, but this is par for the course in scientific terminology, which often contains vocabulary that would never be used in everyday speech.) In the early chapters you will receive more guidance, with subsequent chapters offering more of a creative challenge. For this exercise, use the term "**corporeal**" ("of the body") and **a prefix from this chapter** to form an appropriate word.*

*Example: An ailment "within the body" could be called _____intracorporeal_____.*

1. Someone with an "out-of-body" experience undergoes a(n) _____ event.
2. According to some worldviews, the human soul wanders around by itself before being united with a physical body. The time prior to this union could be called _____ or _____.
3. Static electricity that travels between two bodies could be called a(n) _____ discharge.
4. Someone who has delusions about possessing a badly formed body suffers from _____ Psychosis.
5. If there were an unfortunate medical condition in which people had bodies that were oriented in a direction opposite to their faces, it could be called _____ Syndrome.


### Know Yourself

*Each chapter will include a diagram with important vocabulary for various (usually anatomical) structures. This section will serve three chief purposes: 1) to build your vocabulary, 2) to reinforce the linguistic principles you have already learned, and 3) to prepare you for what is to come in later lessons. You will find that many words in these diagrams also appear in other chapters; such repetition in multiple contexts will help to solidify what you have learned. Early on there will be terms that you will not yet be able to analyze in full, but rest assured that in time you will have acquired the tools that you need. Finally, by learning about human anatomical systems, you will be putting into practice in a literal way one of the most popular ancient Greek maxims, one that was associated with the god Apollo, the father of Asclepius: GNOTHI SAUTON ("Know yourself"), seen written in Greek in the mosaic here.*




Although not all names for human body parts are derived from Latin or Greek (e.g., "knee," "knuckle," and "elbow" are Germanic; see p. 114), the names of bones often come directly or indirectly from Latin. "Humerus," "ulna," "pelvis," "patella," "tibia," and "fibula," for instance, are unchanged Latin words. In some cases the name arose from the supposed resemblance between the bone and some object: *tibia* means "flute," whereas *fibula* means "clasp" or "buckle," *patella* means "little dish," and *pelvis* means "washing basin."

Other bones get their names directly from Latin, but for reasons other than some physical resemblance. The sacrum, short for *os sacrum* ("holy bone"), may have been so called in antiquity because it was the part of an animal that was offered as a sacrifice to the gods. (There is a Greek myth explaining how Prometheus managed to trick the gods into accepting the less desirable parts of a sacrificial victim while they retained the meat for themselves.) *Vertebra* is a pure Latin word derived from the verb *vertere*, "to turn," and refers to the mobility of the spinal column. In an interesting anticipation of Darwin, it was suggested in antiquity that animals originally had a rigid spinal column and that it evolved its present flexibility from their turning around to see if predators were pursuing them. In other cases, such as *femur*, it is unclear why the name was chosen—some Romans speculated, with no great logic, that it was so called because it is located in the region of the body in which a man differs from a woman (*femina*).

Other bone names are derived from Latin but have undergone some sort of change. The diminutive "clavicle," from the Latin *clavicula* ("little key"), has kept the Latin base but received an anglicized suffix. (For more on Latin diminutive suffixes, see Chapter IX.) The same is true for "mandible," which comes from the Latin base meaning "to chew" and the suffix *-ble*, which indicates a means of doing something; that is, the mandible is a "means of chewing." Of course, some bone names undergo changes that are technically speaking not correct. "Humerus" involves a slight error in spelling and would be more correct as *umerus*, the original Latin word for "shoulder." (Interestingly, the term "funny bone" may have arisen as a pun, playing on "humerus" and "humorous.")

# Medicine in Antiquity

*As described in How to Use This Book, this section will provide excerpts from primary documents that shed light on some aspect of ancient medicine. Passages from Greek and Roman sources will be used throughout the book, often side by side so that you will get a broader view of a particular issue. There follows a short commentary on the passages to help you think critically about what you have read. For details about the authors, see the Glossary and Chronological Table.*

## Origins of Medicine I: Asclepius

1. Diodorus Siculus, *The Library* 4.71

*According to mythology, Asclepius was the son of the god Apollo and the nymph Coronis. He had outstanding natural abilities and devoted himself to the science of medicine. Many of the discoveries that contribute to human health were made by him. He gained a great reputation and was even able to cure many people whose lives had been despaired of. The unexpected success of his cures was the reason why he was thought to have brought numerous dead people back to life. Mythology states that Hades, god of the underworld, accused him of diminishing the importance of his kingdom; he claimed that, because of Asclepius' cures, the number of dead people was steadily decreasing. Stirred to anger, Zeus destroyed Asclepius with a thunderbolt.*

2. Celsus, *On Medicine* Proem 2

*The Greeks have made rather greater medical advances than have other peoples. Even among the Greeks, however, medicine is just a few generations old and does not go back to the origins of the race. Asclepius is famous as the earliest exponent of the art. Medicine was still rudimentary and crude in his time, and he came to be reckoned as one of the gods simply because he developed it in a more sophisticated way.*

3. Celsus, *On Medicine* Proem 3

*Asclepius had two sons, Podalirius and Machaon, who went with Agamemnon to the Trojan War and rendered very considerable assistance to their fellow-soldiers. Even so, Homer makes no mention of them providing relief from the plague* [in *Iliad* 1] *or any of the other diseases that afflicted the Greeks. He says that they used to treat patients with either surgery or drugs. Hence it is clear that these were the only branches of medicine that they attempted and that they must be the longest established practices. We can also learn from Homer that diseases were thought to be caused by the anger of the immortal gods and that it was to the gods that humans looked to obtain relief from diseases.*

In the developed world today, the medical art is advanced in the laboratory through scientific experimentation and discovery. New devices, chemicals, and procedures are carefully tested and retested to improve the efficacy and convenience of various medical treatments, and human ingenuity plays a major part in the development of these treatments. But how did the art of medicine get its start? To answer this question, a historian of science could produce a long list of people and events that have helped to shape the progression of medicine throughout history, and even if there is likely to be some disagreement about when medicine as we understand it actually began, there would probably be a general consensus about the processes by which medical knowledge has been obtained, at least as far as our historical records allow.

The passages above, however, show a tension in identifying the source of that knowledge. On the one hand, note that some ancient people evidently regarded medicine as an inheritance from the divine. According to both Diodorus and Celsus, some of the most important early medical advances came at the hands of Asclepius, who was later counted among the gods. (You will read about the mysterious happenings in his temple sanctuary in Chapter III.) Celsus also says that, according to Homer, it was a common belief that the gods were responsible for diseases and cures in general. On the other hand, as Diodorus and Celsus themselves show, not everyone was so quick to credit such things to the gods. Celsus is doubtful that Asclepius was actually a god, and Diodorus also seems skeptical about claims that he raised people from the dead. To these men, the birth of medicine was the result of human factors, and rumors of divine intervention arose only because new types of medicine produced such wondrous results.

Nevertheless, observe how both authors regard these mythical accounts as an indication of an important historical reality concerning the birth of medicine. For both of them, the idea that Asclepius was divine may have been a fabrication, but it was a telling one, for it revealed something about the social impact medicine had in its early stages—and about people's tendency to seek explanations for the unexplained. Modern readers may be predisposed to see a sharp line between "history" and "myth," where one is true and one is fabricated, but we should be careful not to assume that this same dichotomy was made in other times by other cultures. For people of Greco-Roman antiquity, at least, the origins of medicine might not have been so much shrouded in myth as illuminated by it.

## Guide to the Exercises

### I. Identification

1. occurring before the proper time, not ripe
2. decrease in velocity
3. located or occurring above the cheek
4. a progressive debilitation of the cognitive faculties
5. overly responsive to stimuli
6. located or occurring next to a joint
7. located or occurring outside the uterus/womb
8. a structure in which something is enclosed (e.g., a soluble container of a dose of medicine)
9. occurring after a medical procedure
10. the removal of salt from a substance
11. a striking or drumming
12. impaired absorption (e.g., of nutrients)
13. related to the mind
14. located or occurring outside the vessels
15. one who confers a gift or benefit

### II. Name That Term

1. extravascular
2. deceleration
3. desalination
4. premature
5. extrauterine
6. benefactor
7. ultrasensitive
8. percussion
9. dementia
10. postoperative

### III. Everyone Makes Mistakse (correct form provided in parentheses)

1. controdiction (contradiction)
2. extroordinary (extraordinary)
3. introvenous (intravenous)
4. suprasaturated (supersaturated)
5. benificent (beneficent)
6. ultersonic (ultrasonic)

### IV. Fill in the _____

1. interject, retroject
2. intraocular, interocular
3. prediction, contradiction, benediction, malediction
4. deduce, seduce

## V. Matching

| | | | | |
|---|---|---|---|---|
| 1. e | 4. l | 7. d | 10. h | 13. c |
| 2. k | 5. b | 8. n | 11. o | 14. a |
| 3. i | 6. j | 9. m | 12. g | 15. f |

13: *Ictus solis* is a Latin phrase literally meaning "stroke of the sun"; you will learn about such phrases in Chapters XI–XII.

## VI. Back to the Bases

1. to be strong or well
2. eye
3. empty
4. to bend
5. foot

4: Notice that *flect-* (like *spect-* in the example) is given in a verbal form. This is because the Latin word from which it comes is a verb. By contrast, *lumin-* and *ocul-* come from Latin nouns, and so their definition is given as a noun. Do not worry if you choose a different part of speech so long as you get the general meaning (e.g., for #3 it is also fine to say that *vacu-* means "to be empty," even though the base is actually an adjective in Latin).

## VII. The Wordsmith

1. extracorporeal
2. antecorporeal, precorporeal
3. intercorporeal
4. Malcorporeal
5. Retrocorporeal

1: Did you happen to spell this word "extrocorporeal"? Which sounds better?

2: Which term did you think of first? These prefixes are often used interchangeably ("antenatal," "prenatal"), but not always ("premonition," but not "~~antemonition~~").

# Chapter II


## Latin Prefixes 2

*In this chapter you will study . . .*

** Assimilation in Latin prefixes*
** More common Latin prefixes*
** A series of Latin bases that are used with these prefixes to create medical terms*
** More on the skeletal system*
** Ancient ideas about how writing shaped the art of medicine*

As with the prefixes in Chapter I, the prefixes that you will learn in this chapter are to some extent already familiar to you through regular English usage. What can you deduce about the meaning of the prefixes in the following words?

| | | |
|---|---|---|
| abduction | dismember | obstruct |
| abort | dissipate | replay |
| addition | exhume | return |
| ambidextrous | expel | reverse |
| ambivalent | extend | submarine |
| circumnavigate | inconceivable | subpar |
| circumvent | intolerable | subterranean |
| conduct | intuitive | transcontinental |
| contraction | invasion | transition |
| discontinue | obliterate | transplant |

You might have guessed that, since "ambidextrous" means "able to use both hands with equal proficiency" and "ambivalent" describes someone who has mixed feelings about something, *ambi-* means "both." You also know that to "expel" something is to eject it or push it out and that "extend" means to "stretch out," so you might have guessed that *ex-* means "out." Similarly, *re-* means "back" or "again," as is evident in "return" and "reverse," and "transcontinental" can help you guess that *trans-* means "across."

All these examples show the prefixes in their standard form (e.g., *ab-, circum-, re-*), but you read in Chapter I that some prefixes have alternative forms that must be learned as well. Such is the case for *contra-*, which appears in its standard form in "contraception" but with an altered spelling in "controversy." In this chapter you will learn some more ways in which the spelling of prefixes can vary.

One of the primary ways in which the appearance of prefixes changes is through a process known as assimilation (Lat. *ad* + *simil* + *atio*, "a making similar to"), where a part of the prefix is altered to fit more neatly with the base. Assimilation occurs for phonetic reasons: some consonant clusters are hard to pronounce or, when pronounced quickly, tend to change in sound, so when a prefix and a base combine to create such a

cluster, part of the prefix is modified to ease the transition. Interestingly, the word "assimilation" itself undergoes the process of assimilation at the union of *ad-* and *simil-*. The combination "ds" makes "adsimilation" slightly difficult to pronounce, and it is more naturally rendered as "assimilation." The following list of words will demonstrate this feature further, with the unmodified version given in parentheses to allow you to see the transformation that has taken place. Pronounce each pair of words aloud and observe which form has the easier or more natural pronunciation:

| ***ad-*** | ***con-*** | ***sub-*** |
|---|---|---|
| accentuate (adcentuate) | collate (conlate) | succumb (subcumb) |
| affect (adfect) | compact (conpact) | sufficient (subficient) |
| aggregate (adgregate) | coordinate (conordinate) | suppress (subpress) |
| alleviate (adleviate) | corrode (conrode) | suspend (subpend) |

These examples show that in some cases the final consonant of the prefix is changed to match the initial consonant of the base ("collate," "succumb"), but in other cases the final consonant of the prefix becomes a different letter altogether ("compact," "suspend"). Note that you cannot always tell from the first letter of the base which of these two types of change will occur: *sub-* becomes *sus-* when joined to the base *-pend*, but it becomes *sup-* when joined to the base *-press*.

In still other cases the consonant disappears completely, as in "coordinate" and "eject." In the first of these examples, the "n" has been removed from the prefix *con-*, and in the second the prefix *ex-* has become simply *e-*. Again, these changes are made for ease of pronunciation: "coordinate" sounds better than "conordinate," and "eject" sounds better than "exject." (It is also telling that the modern English pronunciation of the Latin-based word *subpoena* assimilates the "b" sound to a "p.")

In a couple of cases the prefix may also gain a letter that was not there previously. Such is the case in "abstraction," where the prefix *ab-* is now written as *abs-*. The same is true for *re-*, which becomes *red-* in "redemption" (*empt-*, "to buy") and "redundant" (*und-*, "wave").

It should be noted that assimilation does not change the *meaning* of the prefix but only its *form*. When *ex-* appears as *e-*, for example, the prefix still means "out of." Therefore, you only need to be able to recognize a prefix when it is found in one of its alternative forms. Some of these changes will be immediately obvious, while experience will make others much easier to identify.

Learn the following prefixes, paying special attention to the variety of alternative forms:

| Prefix | Alternative Forms | Meaning | Examples |
|---|---|---|---|
| **ab-** | **a-**, **abs-** | *away from, from* | absorption, aversion |
| **ad-** | **ac-**, **af-**, **ag-**, etc. | *to, toward, near* | adhesive, affect |
| **ambi-** | **ambo-** | *both, around* | ambidextrous, ambiguous |
| **circum-** | **circu-** | *around* | circuit, circumcision |
| **con-** | **co-**, **com-**, etc. | *with, together, very* | congenital, correct |
| **dis-** | **di-**, **dif-** | *apart* | dislocation, disseminate |
| **ex-** | **e-**, **ec-**, **ef-** | *out, from* | effusion, extension |

| Prefix | Alternative Forms | Meaning | Examples |
|---|---|---|---|
| **in-** | **il-**, **im-**, **ir-**, etc. | *into, on* | implant, injection |
| **in-** | **il-**, **im-**, **ir-**, etc. | *not* | impotent, indigestion |
| **ob-** | **oc-**, **of-**, etc. | *against, toward* | occlude, occult |
| **re-** | **red-** | *back, again, against* | recuperate, redundant |
| **sub-** | **suc-**, **sus-**, etc. | *under, up from under* | subconscious, suffused |
| **trans-** | **tra-**, **tran-** | *across, through* | tradition, transplant |

### *Notes*

1. The prefix *ab-* may lose its consonant, becoming *a-*, but the "b" never changes to a different consonant. Therefore, do not assume that *ab-* is the prefix in such words as "arrive," "alleviate," or "affect." In words of this type the prefix will always be *ad-* and never *ab-*. Conversely, the alternative form *a-* comes from *ab-*, not *ad-*. (There are just a few exceptions to this rule, including "astringent" and "aspire.")
2. The prefix *con-* comes from the Latin preposition *cum*, meaning "with." (You are probably most familiar with this word from the phrase *summa cum laude*, "with highest praise.") However, when used as a prefix the preposition *cum* never keeps its original spelling, so it is conventional to speak of *con-* as its regular form.
3. Be careful with words like "contraction." At first glance you might be tempted to say that the prefix is *contra-* ("against"), but in fact the "tra" is part of the base. It may help to note that, if the prefix is assumed to be *contra-*, the resulting word ("~~ction~~") would be nonsensical.
4. Be careful to distinguish between the two prefixes that are spelled *in-*. The word "intense" has the prefix *in-* that means "into," whereas the word "impenetrable" has the prefix *in-* that means "not." Consider also the examples "illuminate" ("to shine light on") and "illicit" ("not permissible"). When encountering an unfamiliar word beginning with *in-*, you will have to decide which prefix is being used, since there is nothing in the form of the elements to differentiate between them (you will notice that the alternative forms of *in-* are the same as well). This is an *im*portant but not *im*possible task.
5. English uses a wide range of negative prefixes: coffee may be *dis*gusting, *in*sipid, *non*-fattening, or *un*sweetened (to say nothing of the splendid "*unde*caffeinated"), but is drinking it *im*moral, *a*moral, or *non*-moral? Of these prefixes, four are Latinate (*de-*, *dis-*, *in-*, *non-*), whereas one is Greek (*a-*) and one is Germanic (*un-*). *Non* is the standard Latin adverb meaning "not," but curiously its frequent use as a negative prefix is not matched in Latin itself.
6. The prefix *sub-* may also mean "slightly" or "not fully," as in "subacute," "subastringent," and "subgranular" (e.g., subacute afflictions are less intense than acute ones).
7. In some cases a prefix does not greatly change the meaning of the stem but rather *intensifies* it, in which case the prefix is translated as "completely," "very," or "thoroughly." Such is the case with the prefix *con-* in examples such as "corrode," where the base (*rod-*) means "gnaw" (as in "rodent," a creature that gnaws), with the full form meaning "to eat up (completely)."
8. In certain situations you may encounter the Latin prefix *cis-* ("on this side, on the nearer side"), which together with *trans-* forms an antonymic pair. The Romans used this distinction most famously in designating their Gallic provinces as "Transalpine" and "Cisalpine": Gaul across the Alps and Gaul on this side of the Alps (i.e., from the perspective of Rome). In modern terminology, *cis-* can be used in chemistry and in genetics to describe structures that have certain elements "on the same side" of a midline division, but perhaps the most common use nowadays is in discussions of gender, where "cisgender" and "cissexual" are used to denote someone whose psychological gender and physical gender align, as opposed to "transgender" and "transsexual."

*Medicine has been well organized now for a long time and has evolved both a set of principles and a method on the basis of which many fine discoveries have been made over a period of many years. What remains to be discovered will be discovered, if the researcher has the requisite ability and a sound knowledge of what has already been discovered and uses this knowledge as the starting point for his research. Anyone who undervalues and rejects all this knowledge and tries to pursue research along some other path, following some other theory, has been, and still is, delusional.*

Hippocrates, *Ancient Medicine* 2

## Vocabulary

Learn the following Latin bases, including any alternative forms:

| | | |
|---|---|---|
| **ax-** | *axis* | abaxial, adaxial |
| **cori-** | *skin* | corium, excoriation |
| **corn(u)-** | *horn* | circumcorneal, unicornous |
| **cub-**, **cumb-**, **cubit-** | *to lie down, to recline* | incubation, recumbent |
| **fund-**, **fus-** | *to pour, to melt* | effusion, transfusion |
| **glutin-** | *to glue* | agglutinant, conglutinant |
| **greg-** | *flock, herd* | aggregate, segregation |
| **ili-** | *flank, hip* | ilium, transiliac |
| **lab-**, **laps-** | *to slip, to fall* | prolapse, relapse |
| **ocul-** | *eye* | circumocular, interocular |
| **rad-**, **ras-** | *to scrape* | abrasion, erase |
| **sangui(n)-** | *blood* | exsanguination, sanguinous |
| **stru-**, **struct-** | *to build* | construction, obstruction |
| **sud-** | *to sweat* | sudomotor, transudation |
| **tund-**, **tus-** | *to beat, to strike* | contusion, obtundent |
| **vesic-** | *bladder* | transvesical, vesicle |

As stated in Know Yourself in Chapter I, many Latin words undergo some kind of transformation in the process of becoming an English word (e.g., *clavicula* to "clavicle"), but others are adopted directly into English without any changes (e.g., "abdomen"). The latter require no specialized knowledge of Latin to identify, since they are the same in both languages. As you will learn in Chapter XI, however, Latin nouns change their form depending on how they are used in a sentence, and sometimes this change involves an alteration of the base itself (albeit normally a minor one), so with some Latin words it is necessary to learn both a standard form and an alternative. For example, "abdomen" is a regular English word, but there is a slight change made in its adjectival form, "abdominal." So too the noun "cervix" undergoes a slight change in its adjectival form, "cervical." The following Latin nouns are related in that all of them may be used as English words in their standard form but undergo changes in other situations. Learn both forms along with the definition:

| | | |
|---|---|---|
| **abdomen**, **abdomin-** | *abdomen* | abdominal, abdominoplasty |
| **cervix**, **cervic-** | *neck* | cervical, costocervical |
| **corpus**, **corpor-** | *body* | corporeal, corporectomy |
| **cortex**, **cortic-** | *bark, outer layer* | cortical, juxtacortical |
| **femur**, **femor-** | *femur, thigh* | femoral, femoroiliac |
| **semen**, **semin-** | *seed* | insemination, seminal |

### *Notes*

1. The term "cervix" often indicates the part of the body connecting the head to the trunk, but it can also refer to any constricted, neck-like portion of a body part or organ. In cases of ambiguity, the full Latin name may be used to specify which cervix is meant. For example, the *cervix uteri* is the lower, narrow end of the uterus. The *cervix vesicae urinariae* is the constricted portion of the urinary bladder near its union with the urethra. The *cervix dentis* is the slightly constricted region of a tooth where the crown and root meet. You will learn about such Latin phrases beginning in Chapter XI.
2. The cornea of the eye is a transparent structure forming the anterior part of the sclera, the tough, white outer coating of the eyeball. It was so called because of its "horn-like" consistency. *Cornea* is actually a Latin adjective and is the source of the English adjective "corneous." The full name for this structure of the eye is *cornea tunica*, or "horn-like coating." (The omission of the noun in such phrases is not uncommon in scientific vocabulary; later you will learn about *biceps* and *trachea*, two other examples of this phenomenon.)

The term "ambulance" is derived from the French *hôpital ambulant*, literally "walking hospital" (from Lat. *ambul-*, "to walk"), which arose in the early 19th century, when medical personnel walked over battlefields to treat wounded soldiers where they lay or to transport them in carts to safety. In antiquity it was thought by some that the Greek word for "doctor" (*iatros*) was also derived from a military context, since in the olden days doctors had earned their name from extracting arrows (Gk. *ios*). The Latin word for "doctor" (*medicus*) was thought to be related to *medius*, "in the middle," since medicine ensured good health by striking a balance between extremes. The Latin word *doctor* meant "teacher" and was not originally specific to medicine (cf. the modern use of "Doctor of Philosophy," that is, a Ph.D).

## Exercises

*Complete these exercises, and then compare your answers with those at the end of the chapter.*

## I. Identification

*Give the meaning of the following words, paying special attention to the prefixes that you have learned in this chapter. Again, suffixes will be learned later, so give the best answer you can from your knowledge of the prefixes and bases.*

1. recumbent _____
2. accelerator _____
3. juxtacortical _____
4. abrasion _____
5. excoriation _____
6. adaxial _____
7. circumocular _____
8. conglutinant _____
9. exsanguination _____
10. invertebrate _____
11. transiliac _____
12. collateral _____
13. transfusion _____
14. inject _____
15. circumvascular _____

## II. Name That Term

*Give a suitable term for the following definitions. (Hint: you can find a word for each definition in the previous exercise. First, see if you can come up with the term on your own; then use the list above if you need help.)*

1. extensive loss or draining of blood _____
2. a scraping away of some surface _____
3. promoting adhesion or gluing _____
4. at or toward the axis _____
5. located or occurring near the outer surface _____
6. located or occurring around the vessels _____
7. an agent that speeds up an action or function _____

8. lying down, in a reclined state _____
9. the removal of the skin through scratching, burning, etc. _____
10. across or extending between the hips _____

## III. Everyone Makse Mistakes

*The following words have spelling errors in their prefixes. Provide the correct form.*

*Example: inrigate* ____*irrigate*____

1. subceptibility _____
2. obposition _____
3. disferential _____
4. exlimination _____
5. circumitous _____
6. inreparable _____
7. conefficient _____
8. adpetite _____
9. inliterate _____
10. osstruction _____

## IV. Fill in the _____

*For the following words, supply a prefix (or prefixes) from this chapter that will complete the meaning provided. Be sure to use assimilation where necessary.*

1. _____clude: "to close out," to place outside a group
   _____clude: "to close in," to assign to a group
2. _____version: "a turning inside out," a change in order
   _____version: "a turning aside," an amusement or lure
3. _____ject: "to throw forward," to set in the future
   _____ject: "to throw against," to protest or complain
   _____ject: "to throw in," to put something (e.g., a fluid) inside
4. _____articular: near a joint
   _____articular: around a joint
   _____articular: distant from a joint
5. _____lapse: a slipping back into something
   _____lapse: the falling forward or slipping of a body part from its normal location
   _____lapse: a falling down (lit. "together")
6. _____cussion: "a striking together," a head injury
   _____cussion: "a shaking under," a technique used in detecting water in a body cavity
   _____cussion: "a shaking through again," a consequence
7. _____pose: "to place near," to locate besides
   _____pose: "to set forward," to put forth
   _____pose: "to set against," to compete against
   _____pose: "to place upon," to force something on someone

## V. Matching

*Definitions for the following terms are included in the right-hand column. Put the letter of the corresponding definition in the blank by the appropriate word. Each term has only one correct answer.*

| | | | |
|---|---|---|---|
| 1. | _____ | contusion | a. restoration of blood flow to the vessels |
| 2. | _____ | obtundent | b. the escape or pouring of fluid into another area |
| 3. | _____ | aggregate | c. someone showing both introversion and extroversion |
| 4. | _____ | ambivert | d. across or through the bladder |
| 5. | _____ | revascularization | e. a medicinal substance "placed up under" an orifice |
| 6. | _____ | suppository | f. a soothing agent that deadens the senses |
| 7. | _____ | transudation | g. a substance that causes adhesion or gluing |
| 8. | _____ | effusion | h. a bruise, the result of a blunt-force strike |
| 9. | _____ | agglutinant | i. a sum total of substances coming together in a mass |
| 10. | _____ | transvesical | j. the oozing or sweating of a fluid through pores |

## VI. Back to the Bases

*Use the following pairs of words to guess the meaning of each base.*

| | | | |
|---|---|---|---|
| 1. | centigrade, gradual | *grad-* | _____ |
| 2. | intermediate, medium | *medi-* | _____ |
| 3. | tripartite, particle | *part-* | _____ |
| 4. | incandescent, candid | *cand-* | _____ |
| 5. | concord, cordial | *cord-* | _____ |

## VII. The Wordsmith

*The English language lays claim to countless fascinating words. Among these is "defenestration," the act of throwing something or someone out a window (*fenestra *is Latin for "window"; recall that the prefix* de- *means "down from"). Perhaps not surprisingly, there are few other words that use the root word "fenestrate" and a prefix to indicate the movement of something in relation to a window—until now. For the following situations, provide a term of your own creation that is comprised of the base "**fenestration**" and **a prefix from this chapter**. Remember that there is no single correct answer. And if you are troubled by the oddity of the words you come up with, they will be no more ridiculous than "defenestration" itself.*

*Example: The bedroom window had been the entry point for burglars in the past, but Todd's _____profenestration_____ of a menacing thorn bush in front of the sill put a stop to this.*

1. _____ of certain types of plant near a window may not be a good idea, since too much sunlight can be detrimental to their growth.
2. The broken glass resulting from the _____ of the baseball all but sealed the boys' fate: they were to be grounded indefinitely.
3. The janitorial staff at the aquarium do their best to keep the glass clean from the constant nasal _____ of children who press their noses against the transparent surface to see the creatures up close.

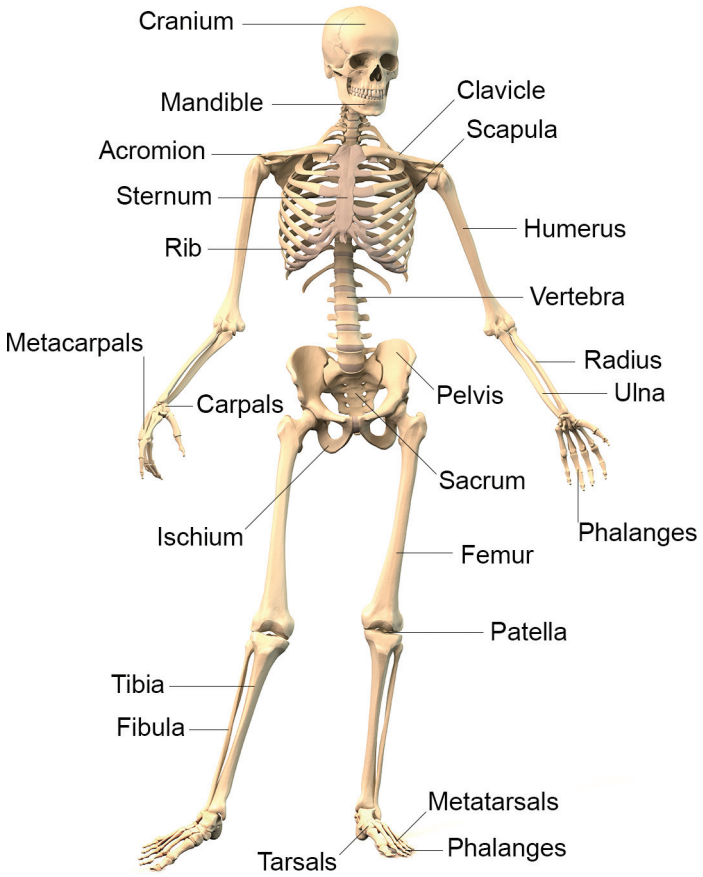
4. The couple reveled in the delights of the evening: the chirping of crickets, the aroma of wine, and a delicate _____ of moonlight that gave the room a soft glow.

5. _____ is a common problem in school on a sunny day, as students often look past the classroom window into some idyllic setting in the distance.


## Know Yourself

In the previous chapter, it was emphasized that many bone names are derived from Latin: some are taken directly from that language without any alteration (e.g., "tibia"), while others undergo spelling changes in the process of their adoption as English words (e.g., "clavicle"). Bones could be named for a variety of reasons, including their resemblance to some object (e.g., *patella*, "little dish") or function (e.g., *vertebra*, from the Latin verb meaning "to turn"). Since the history of anatomy is so complex, it should come as no surprise that there is such variation in the ways bones get their names.

Not all bone names come from Latin, though, and it is worth observing a few instances in which other languages have had some input in anatomical nomenclature. Although it will be some time before you begin studying Greek terms formally, note that several bone names come directly or indirectly from this language. *Acromion* (lit. "point of the shoulder"), the name for the bony process of the scapula at its juncture with the clavicle, is adopted from Greek without any change. So too is *phalanges*, which literally means "phalanxes," that is, lines of troops. *Cranium*, *ischium*, and *sternum* are all Latin words, but they have been adopted from Greek with a small phonetic change (*cranion*, *ischion*, *sternon*). Other names, such as "tarsals" and "metacarpals," are derived from Greek but have been adapted slightly to an English spelling system.




In anatomical systems, Latin and Greek names predominate, but it is not uncommon to find words of a different origin. For example, many familiar names for body parts are Germanic: "finger," "hand," "arm," "shoulder," "toe," "foot," and so forth. When it comes to bones, however, nearly all examples are Latin and Greek. While "skull," "kneecap," "shin," and other such Germanic words are often used as informal designations, the official names for bones (e.g., "cranium," "patella," "tibia") are all derived directly or indirectly from Latin or Greek, with the exception of the Germanic "rib" (though note the adjectival form "costal," from Lat. *costa*).

# Medicine in Antiquity

## Origins of Medicine II: The Written Word

1. Galen, *On Anatomical Procedures* 2.280K

   *In the earliest times, there was no need for manuals on anatomy, since sons practiced dissection under their fathers' supervision, just like reading and writing . . . and there was no fear that anyone who learned that way would forget what he practiced, any more than those who have practiced the letters of the alphabet are likely to forget how to write. But as time went on, it seemed good to share the skill with people outside the family and not just with their own children. Once they began to share their art with adults whom they respected as good people, this brought an immediate end to instruction in anatomy from an early age, and that inevitably meant an immediate decline in standards of instruction. . . . When medicine was no longer confined to the clan of the Asclepiads, it deteriorated more and more with each passing generation, and hence the need arose for manuals to preserve knowledge of it.*

2. Celsus, *On Medicine* Proem 5

   *After Asclepius and his sons, no one of any distinction practiced medicine until literary studies became more widespread.*

3. Pliny the Elder, *Natural History* 29.4

   *Amazing as it may be, medicine lay in darkest obscurity throughout the time from the Trojan War until the Peloponnesian War* [end of the 5th century BC]. *Then it was called back into the light by Hippocrates, who was born on the famous and powerful island of Cos, which was dedicated to Asclepius. It was customary for those who had been freed from a disease to record in Asclepius' temple the remedies that would be helpful, so that people who suffered the same illness at a later time might be helped. Hippocrates is said to have copied these cures down and used them as the foundation for clinical medicine after the temple burned down.*

Educated people in developed countries will likely find it difficult to imagine a world without writing. From books to blogs to billboards, writing is encountered and absorbed constantly, usually without any special consideration of the fact that one is performing the action of reading, so natural has it become for so many. Indeed, in many developed countries the literacy rate among adults is near 100 percent. But for ancient Greeks and Romans, writing was hardly so common, and literacy came at a much higher premium.

The earliest form of written Greek that has been identified comes from about 1400 BC. This script, known as Linear B, was used primarily for record keeping, and it is probable that only a very select group of scribes possessed the ability to work with these symbols. Records of this writing die out at around 1200 BC, and it is not until the 8th century BC that written Greek again appears in inscriptions on cups and other artifacts, this time with the alphabet that is still in use today. This is the time period in which the Greek poets Homer and Hesiod lived, and it is thought by many that the new alphabet was used to record their poems (others believe that it took generations of oral recitation before this literature was set down in writing). However that may be, the rediscovery of writing did not suddenly cause a huge spike in the literacy rate of the Greek mainland. As before, it was probably only a small percentage of individuals who could operate in this medium, and oral recitation remained the most important mode of literary performance. In fact, it was not until the period after Alexander the Great (died 323 BC), the era in which our modern notion of a library was birthed, that writing truly seemed to take hold as a primary method for the transmission of Greek literature. We might therefore estimate that it took about half a millennium for writing to become widespread in Greek society—a fact that is quite difficult for us to appreciate.

Although the technology of writing had been available for some time, even in the 5th and 4th centuries BC writing was sometimes viewed with suspicion. Most famously, the character of Socrates in Plato's dialogue *Phaedrus* criticized writing as an inferior mode of communication, at least as far as philosophical knowledge is concerned: you could ask a person questions to probe for further information or to expose inconsistencies, but you could not do anything with a written document except read it. Furthermore, writing could only *remind* a person of what had already been learned; it could not *teach* any truth on its own. For Plato, interactive conversation was the only way to ensure a proper philosophical education.

The passage by Galen above suggests that the medical art was similarly slow to adopt writing as the primary means of transmitting its specialized knowledge, with all medical education being achieved through one-on-one apprenticeship. Whatever the cause of this exclusive reliance on individual interaction—whether a distrust of writing as an educational medium or simply the weight of tradition—all three passages above refer to a general decline in the art of medicine under this model until the adoption of writing led to a sort of medical resuscitation that kept the art of doctoring alive. It is unlikely that any ancient doctor would have regarded the written word as sufficient in and of itself for a medical education, but after Asclepius it was at least clear that writing provided an absolutely essential element in the spread of medical knowledge.

At first glance it might seem that these passages describe a shift from a world of "divine" medicine to "human" medicine. After all, it was the divine system under the guidance of Asclepius that eventually failed to perpetuate itself, necessitating the use of writing by human scholars taking a "scientific" approach. Look again, however, at the passage of Pliny. It was in the temple of Asclepius, a religious sanctuary for miraculous healing, that Hippocrates discovered the cures that would form the basis for his own practice—cures which, importantly, he wrote down. Even long after the tradition of medicine begun by Asclepius died out (according to the consensus tradition presented by the texts above), one of the foremost thinkers in ancient medical science was still indebted to the divine for his success. It is no surprise, then, that well over a thousand years later a Byzantine encyclopedia records that "everyone who consults the books written by Hippocrates regards them as preeminent in their understanding of medicine and welcomes them as the utterances of a god, rather than as words coming from the mouth of a mere mortal" (Suda, *Lexicon* s.v. *Hippocrates* 24). In the next chapter you will learn more about the sorts of things Hippocrates might have learned from perusing the lists of cures found in the healing sanctuary of Asclepius.

## Guide to the Exercises

### I. Identification

1. lying down, in a reclined state
2. an agent or apparatus that is used to increase the rate at which an object proceeds or a substance acts or at which some reaction occurs
3. located or occurring near the surface/skin of an organ or tissue
4. the wearing or scraping away of a substance, or an area of the body surface stripped of skin or membrane by such a process
5. a wearing off or abrading of the skin, or an area so affected
6. located alongside or directed toward the axis
7. surrounding or occurring around the eye
8. promoting union or adhesion (e.g., of the edges of a wound); lit. "gluing together"
9. extensive loss or draining of blood through hemorrhage
10. any animal that has no vertebral column
11. across or between the two ilia, the superior portions of the hip bone
12. secondary or accessory; located on the side or flank; a side branch (e.g., of a blood vessel or nerve)
13. the introduction of blood or blood components into the bloodstream; lit. a "pouring across"
14. to force (lit. "throw") a substance (esp. a drug or vaccine) into the body
15. around or encircling a vessel

## II. Name That Term

1. exsanguination
2. abrasion
3. conglutinant
4. adaxial
5. juxtacortical
6. circumvascular
7. accelerator
8. recumbent
9. excoriation
10. transiliac

## III. Everyone Makse Mistakes

1. susceptibility
2. opposition
3. differential
4. elimination
5. circuitous
6. irreparable
7. coefficient
8. appetite
9. illiterate
10. obstruction

## IV. Fill in the _____

1. exclude, include
2. inversion, diversion
3. project, object, inject
4. juxta-articular, circumarticular, abarticular
5. relapse, prolapse, collapse
6. concussion, succussion, repercussion
7. juxtapose, propose, oppose, impose

## V. Matching

1. h
2. f
3. i
4. c
5. a
6. e
7. j
8. b
9. g
10. d

## VI. Back to the Bases

1. step, degree
2. middle
3. part, portion
4. to glow white
5. heart

## VII. The Wordsmith

1. juxtafenestration
2. perfenestration, infenestration
3. obfenestration
4. infenestration, perfenestration
5. ultrafenestration, perfenestration

3: You may also have written “offenestration” by analogy with words such as “offer,” where there is assimilation of the “b,” though there is also the example of “obfuscate,” where there is no assimilation.

4, 5: It is noteworthy that some variations of the word “defenestration” are almost by definition interchangeable. In order for something to go “into” or “beyond” a window, it must also go “through” it. Even so, you might feel a slight difference in tone between these options: “perfenestration,” for example, would seem more likely to include broken glass than “infenestration.”

# Chapter XIX

## Greek Suffixes 1

*In this chapter you will study . . .*

** Greek adjectival suffixes meaning "related to" or "similar to"*
** Two verbal suffixes commonly added to Greek bases*
** A series of Greek bases that are used with these suffixes to create medical terms*
** The cerebral system*
** Ancient surgical procedures*

Greek suffixes function in the same way as their Latin counterparts. That is, Greek suffixes are added to the end of a base and affect the meaning of the word as well as its part of speech (i.e., adjective, noun, verb). As with Latin suffixes, Greek suffixes may have alternative forms that need to be learned alongside the regular form, and multiple suffixes may appear in a single word. In fact, some Greek suffixes are identical with Latin suffixes you have already learned, often with a very similar (or even identical) meaning.

The following Greek suffixes are **adjectival**, meaning that they combine with bases to form adjectives. At some level all these suffixes mean "related to" or "similar to," though as the chart shows some of them have their own particular nuances:

| Suffix | Alt. Forms | Meaning | Examples |
|---|---|---|---|
| **-al** | **-ial** | related to, belonging to | aerial, carpal |
| **-an** | **-ian** | related to, similar to | protozoan, salpingian |
| **-ic** | **-tic**, **-ac** | related to, similar to | allergic, cardiac |
| **-istic** | | related to, related to the process of | ballistic, characteristic |
| **-ite** | | belonging to, similar to, derived from | dendrite, somite |
| **-oid** | **-ode** | similar to, having the shape of | adenoid, geode |
| **-ous** | | full of, related to, similar to | amorphous, anhydrous |
| **-tic** | **-etic**, **-stic** | related to the act or process of | diagnostic, epileptic, pathetic |

### *Notes*

1. The suffixes *-ic* and *-tic* are very close in form, and in fact *-ic* has an alternative form that is also spelled *-tic*. You may therefore wonder why these forms are listed as separate suffixes and not as alternative forms for the same suffix, especially since their meanings are so closely related. The answer is that the suffix *-tic* and its variants are added to verbal bases (e.g., *lep-*, "to seize"), whereas the suffix *-ic* and its alternative *-tic* are added to nominal bases (e.g., *erg-*, "work"). In theory this distinction can be a difficult one to remember, but in practice the similarity of meaning between the two suffixes means that there is not often much at stake in deciding which is which.
2. Greek adjectival suffixes may create substantives, as do their Latin counterparts (see, e.g., "characteristic" and "geode"). This is especially true in the case of *-ite*, which comes ultimately from the Greek suffix *-ites*. The Greek adjective *dendrites*, for example, originally meant "related to a tree" or "tree-like," but in modern anatomical terminology "dendrite" is a noun indicating the thread-like cytoplasmic extensions of a neuron, so called because they resemble the branches of a tree. The *-ite* suffix is also frequently used to name minerals, where the adjectival form in *-ite* was paired with the Greek word *lithos* ("stone"), which eventually fell out (cf. the substantive use of adjectives with the understood *musculus*). "Bauxite," for example, means "[stone] belonging to Les Baux," the location in France where this aluminum ore was first discovered. The adjectival suffix *-ite* may also be used to denote groups of people: for example, "Hittite," "Israelite," "Wisconsinite."

The following suffixes are **verbal**, meaning that they combine with bases to form verbs. As with some of the adjectival suffixes above, these will be recognizable to you, since you learned them as Latin verbal suffixes in Chapter IX. In the original languages, *-ize* is Greek and *-ate* is Latin, but they are both used so frequently with word elements from each language that they deserve to be considered twice. As their meanings are unchanged regardless of the language of the word elements to which they are attached, you will simply need to have your memory refreshed as to their definitions and to grow accustomed to seeing them added to Greek bases. (Recall that there is also an adjectival Latin suffix *-ate* meaning "shaped like.")

| Suffix | Meaning | Examples |
|---|---|---|
| **-ate** | to make, to do something with | carbonate, gyrate |
| **-ize** | to make, to do something with | oxidize, sympathize |

Knowing these suffixes, you will now be able to analyze fully many Greek adjectives and verbs. Study these examples, which incorporate word elements that you have already learned:

| | | | |
|---|---|---|---|
| acephalous | *a + cephal + ous* | amphibian | *amphi + bi + an* |
| euthanize | *eu + than + ize* | hypodermic | *hypo + derm + ic* |
| paralytic | *para + ly + tic* | pentacyclic | *pent + a + cycl + ic* |

NB: A number of words used in the Greek chapters so far end in the suffix *-e*, such as "microscope," "endocrine," and "eclipse." In such words the "e" is not a Greek suffix but rather an English one, just as you saw in many Latin words in the first half of the course (e.g., "prolapse," "occlude"). This suffix does not have any special meaning of its own but is simply a way to end a word in English.

*Whatever drugs do not cure, surgery cures; whatever surgery does not cure, cautery cures; whatever cautery does not cure must be reckoned to be incurable.*

Hippocrates, *Aphorisms* 7.87

## Vocabulary

Learn the following Greek bases, including any alternative forms:

| | | |
|---|---|---|
| **aden-** | *gland* | adenalgia, adenoid |
| **aer-** | *air, gas* | aerate, aeronomic |
| **agon-** | *to compete, to strive* | agonist, antagonize |
| **andr-** | *man, male* | androgynous, android |
| **anthrop-** | *human being* | anthropoid, anthropomorphic |
| **asthm-**, **asthmat-** | *short breath, panting* | asthmatic, asthmogenic |
| **aster-**, **astr-** | *star* | asteroid, astronomy |
| **botan-** | *herb, plant* | botanical, botany |
| **carp-** | *wrist* | carpal, carpopedal |
| **cau-**, **caus-**, **cauter-** | *to burn* | caustic, cauterize |
| **cleid-** | *clavicle* | cleidocranial, cleidomastoid |
| **cyst-** | *bladder, sac* | cystic, megacystis |
| **ge-** | *earth* | geode, geography |
| **ger-**, **geront-** | *old person, old age* | geriatric, gerontology |
| **gyn-**, **gyne-**, **gynec-** | *woman, female* | androgynous, gynecology |
| **kine-** | *to move* | kinetic, photokinesis |
| **lep-** | *to seize* | epileptic, narcolepsy |
| **mast-** | *breast* | mastectomy, mastoid |
| **nause-** | *(sea) sickness* | nausea, nauseate |
| **ped-** | *child, instruction* | orthopedic, pediatrician |
| **rhe-**, **-rrhea**<br>**rheum-**, **rheumat-** | *to flow*<br>*flowing, discharge* | leukorrhea, rheography<br>rheumatic, rheumatoid |
| **som-**, **somat-** | *body* | lysosome, somatic |
| **spir-** | *coil* | spiral, spirochete |
| **sthen-** | *strength* | asthenic, calisthenics |
| **thorac-** | *chest* | thoracic, thoracostenosis |
| **typh-** | *stupor* | typhoid, typhus |
| **zo-** | *animal* | entozoal, protozoan |

### *Notes*

1. Be careful to distinguish between the bases *agon-* ("to compete"), *gon-/goni-* ("angle"), and *gon-* ("to be produced").
2. The Greek base *ped-* ("child, instruction") is not the same as the Latin base *ped-* ("foot"). A pediatrician is not a foot doctor, nor is a "bipedal" creature defined as having two children.
3. Note that there is no difference in spelling between the Greek *spir-* ("coil") and the Latin *spir-* ("to breathe"). As in other potentially ambiguous cases, let context be your guide.
4. There is another Greek base *carp-* meaning "fruit" (e.g., "carpogonium," "gymnocarpous"), though this is less common than the *carp-* that means "wrist."
5. The Greek word *thorax* originally indicated a protective covering for the chest, such as a breastplate, but it was also extended in antiquity to mean the part covered by such equipment.

Tendons are the transition point between muscles and bone. In linguistic terms, the word "tendon" itself is an apt example of a transition from Greek to Latin in medical vocabulary and shows how foreign words can slowly creep into a language until they are fully assimilated as native words. For Celsus, writing around AD 50, the word *tenon* ("sinew") was Greek, but a few hundred years later there is evidence of Latin endings being attached to the base *ten-*. In medieval Latin the word became *tendon* or *tendo*, perhaps influenced by a perceived association with the Latin verb *tendere*, "to stretch." The Latinized *tendon* also has descendants in the Romance languages.

## Exercises

## I. Word Analysis and Identification

*Divide each word into its component parts, and then provide its meaning.*

1. asthenic _____
2. androgynous _____
3. somatic _____
4. anthropoid _____
5. spiral _____
6. aerate _____
7. cystic _____
8. asthmatic _____
9. adenoid _____
10. acoustic _____

## II. Name That Term

*Give a suitable term for the following definitions.*

1. related to the wrist _____
2. to put together, to create an integrated whole _____
3. having to do with the outermost layer of skin _____
4. pertaining to the chest _____
5. shaped like a star _____
6. related to the heart _____
7. to moisten, to add water to _____
8. having human characteristics or form _____
9. pertaining to or producing motion _____
10. to destroy tissue by burning (via heat or chemicals) _____

## III. Evoryone Makes Mistakes

*The following words have errors in their suffixes. Provide the correct form.*

1. antagonate: to irritate _____
2. cleidomastode: related to the clavicle and the mastoid process _____
3. caustal: corrosive, inducing burns _____
4. geoid: an "earthlike" mass of mineral matter _____
5. botanicic: having to do with the science of plants _____
6. amorphistic: lacking shape or form _____
7. nauseize: to cause a sickening feeling _____
8. pediatrian: relating to the treatment of children _____
9. protozoous: related to a unicellular organism (lit. "first animal") _____
10. gastral: having to do with the stomach _____

## IV. Fill in the _____

*Complete the following words to match the given meaning.*

1. _____oid resembling a male
2. _____cranial having to do with the clavicle and the head
3. _____ode leaf-like (esp. of tumors)
4. _____hydrous not containing or deprived of water

5. _____iatric — related to old people or the treatment of the aging
6. oxygen_____ — to supply with oxygen
7. amphibi_____ — able to live in both water and air
8. calisthen_____ — a system of gymnastics used to improve strength and agility
9. dendr_____ — a "tree-like" structure (e.g., in a neuron)
10. rheumat_____ — having to do with rheumatism (i.e., inflammation or degeneration of connective tissues of joints and other structures)

## V. Matching

*Definitions for the following terms are included in the right-hand column. Put the letter of the corresponding definition in the blank by the appropriate word. Each term has only one correct answer.*

| | | | |
|---|---|---|---|
| 1. _____ | hypodermic | a. | the ability to assume all shapes (as an amoeba) |
| 2. _____ | typhoid | b. | situated near or around a tooth |
| 3. _____ | lysosome | c. | the branch of medicine dealing with women's health |
| 4. _____ | plastic | d. | beneath the skin |
| 5. _____ | periodontal | e. | the branch of science dealing with celestial bodies |
| 6. _____ | megacystis | f. | of a parasitic animal living within the body of its host |
| 7. _____ | epileptic | g. | resembling typhus, a group of infections that produce, among other symptoms, fever and stupor |
| 8. _____ | gerontology | h. | a whitish discharge or flowing |
| 9. _____ | entozoal | i. | the study of aging and its related issues |
| 10. _____ | pantomorphia | j. | characterized by not having a head |
| 11. _____ | leukorrhea | k. | related to or susceptible to having seizures |
| 12. _____ | acephalous | l. | a "dissolving body" responsible for intracellular digestion |
| 13. _____ | carpopedal | m. | an abnormally large urinary bladder |
| 14. _____ | gynecology | n. | capable of being molded; tending to build up tissue |
| 15. _____ | astronomy | o. | related to the hand (lit. "wrist") and foot |

## VI. Back to the Bases

*Use the following pairs of words to guess the meaning of each base.*

1. amnesia, mnemonic — *mne-* _____
2. carcinogen, carcinoma — *carcin-* _____
3. arthropod, arthritis — *arthr-* _____
4. schism, schizophrenia — *schis-*, *schiz-* _____
5. hypnosis, hypnotherapy — *hypn-* _____

## VII. The Wordsmith

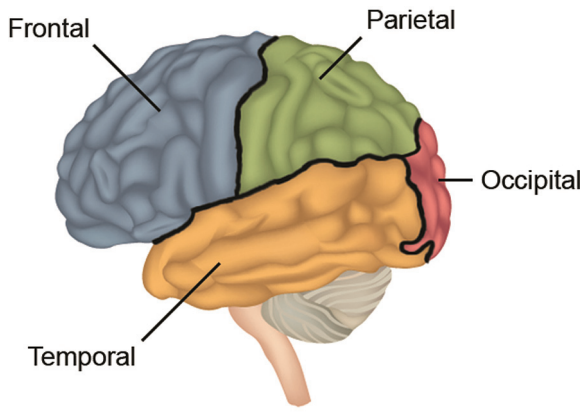
*Now that you have begun to study Greek suffixes, you are ready to create entire words on your own. For each entry, use a combination of prefixes, suffixes, bases, and combining vowels to come up with a suitable word for each context. If you have trouble, remember that you can consult the Guide to the Exercises for suggestions.*

1. Events of great significance are metaphorically said to be "earth moving" or "_____" experiences.
2. An instrument used to measure children is called a _____.
3. Animals with excessively large teats could be called _____.
4. To avoid musty smells, some rooms are designed to promote _____, the flowing of air.
5. Two athletes who can lift the same amount of weight are _____; that is, they are equal in strength.

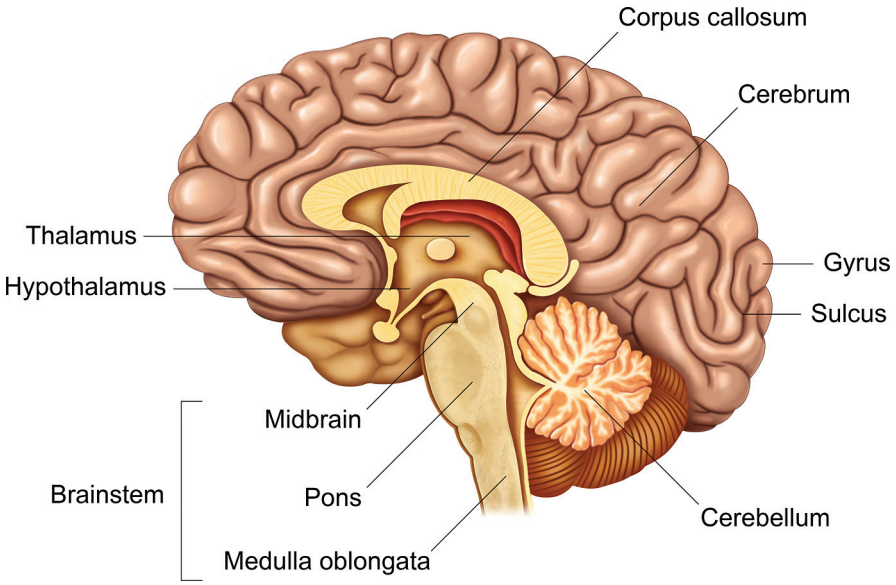

### Know Yourself

It should be taken for granted that a structure as complex as the brain could hardly be covered in detail in the space of about a page, but the following will give you etymological information about some of its key features. The inferior portion of the brain is called the "brain stem," which is composed of the midbrain, pons, and medulla oblongata. The midbrain (a.k.a. mesencephalon) is responsible for, among other things, the auditory and visual systems. The pons (Lat. "bridge," also called *pons Varolii* after Costanzo Varolio, who first described it) links the midbrain to the medulla oblongata (Lat. "lengthened marrow"), which is a cone of nerve tissue that connects the spinal cord to the cerebral hemispheres and that regulates respiratory and circulatory functions.

Directly posterior to the pons is the cerebellum (Lat. "little brain," dim. of *cerebrum*), which controls the coordination of movement and balance. Superior to the midbrain is the diencephalon (Gk. *di* + *en* + *cephalon*, "interbrain"), which contains the thalamus and hypothalamus. The thalamus is a sort of relay device that transmits signals from the lower parts of the brain to the cerebral cortex, and the hypothalamus is responsible for the regulation of body temperature, water balance, sleep cycles, blood pressure and heart rate, endocrine activity, and more.




The main portion of the brain is the cerebrum, which is divided into two hemispheres, each with four lobes named according to location. The frontal lobe (Lat. "pertaining to the forehead") is responsible for reasoning, memory, and other high-level cognitive functions. The parietal lobe (next to the parietal bone, so called because it is reminiscent of a "wall") deals with spatial and sensory awareness. The temporal lobe (Lat. *tempor-*, "temple [of the head]") occupies the lower lateral




space of the cerebrum and has a role in language and in processing sensory data. The occipital lobe (Lat. *occiput*, "back of the head") is located on the posterior end of the cerebrum and is the primary area for the control of the visual system. The entire cerebrum is covered with an outer layer known as the "cerebral cortex," a thin layer of gray matter folded into gyri (Gk. "rings"), which are separated by sulci (Lat. "furrows").

The two hemispheres of the cerebrum are separated by what is called the "longitudinal fissure," but they are joined deep in this fissure by the corpus callosum (Lat. "hard-skinned body"), an arched mass of white matter that links the hemispheres of the cerebrum and allows communication between them (it is also known as the "colossal commissure"). The corpus callosum has been the subject of much debate because of its possible connection with gender identity.

## Medicine in Antiquity

### Surgery I: Procedures and Practices

1. Pseudo-Galen, *Introduction or The Doctor* 14.675K

   *It is likely that much information about surgery was discovered by the first doctors* [in Egypt] *through the dissection of corpses for mummification.*

2. Sextus Empiricus, *Outlines of Pyrrhonism* 3.236

   *Imagining something terrible is worse than actually experiencing it. For example, it sometimes happens that people who undergo surgery or some other such thing can endure it, whereas those who are standing around them faint at the very thought of what is going on.*

3. Celsus, *On Medicine* 7.7

   *In preparation for eye surgery, a patient should be put on a light diet. For the three days before the procedure, he should drink only water and eat and drink nothing at all on the day before it. The operation should be performed in a room with good lighting. The patient should be seated facing the light, opposite the surgeon, who should be at a slightly higher elevation. An assistant should stand behind the patient, holding his head firmly, to keep it immobile, for even a slight movement can destroy the sight permanently. The other eye should be covered with a wool patch, as a further way of ensuring that the eye to be operated on does not move. The left eye should be operated on with the right hand, the right eye with the left hand.*

4. Celsus, *On Medicine* 7.16

*The entrails sometimes roll out as the result of a wound to the stomach. . . . If the smaller intestine is pierced, there is nothing that can be done. The larger intestine can be sutured: there is no great likelihood of success, but an uncertain hope is better than certain hopelessness. . . . When he puts the entrails back in, the surgeon must always reverse the sequence in which they fell out. When the entrails are all inside again, the patient is to be shaken gently, so that each coil may return of its own accord to its proper position and settle there.*

5. Oribasius, *Medical Compilations* 46.11

*In cases of skull fracture involving lesions in the dura mater, if the patient is in distress, we use fetters during surgery. The attendants should sit close to the operating table, with one of them holding the patient's head, and the other seeing to whatever arises during the procedure. The patient's ears should be blocked with wool, to prevent him from being alarmed by the noise of the bone being chipped away.*

As you know by now, human dissection was generally forbidden in the ancient world. The practice was probably permitted for a brief period in Alexandria in Egypt during the 3rd century BC, but it may be assumed that ancient doctors had limited opportunity to explore and learn about the internal workings of the human body, and this would have had a pronounced effect on surgical practices. Indeed, the first passage cited above seems to make this very point, as it is assumed that many surgical practices were developed in a context in which dissection was common (i.e., via the process of mummification in Egypt). The prospect that ancient doctors would have been even partially ignorant about human organs does not inspire a great deal of confidence in ancient surgical procedures: with limited knowledge of how internal structures function, how could a doctor reasonably be expected to fix those structures when something went wrong if he had to rely on trial and (inevitably) error?

Ancient patients, of course, did not have any idea of modern surgical procedures and would have accepted their situation as the norm, and, as Celsus suggests, undergoing even a dangerous operation could be preferable to the alternative. Sextus Empiricus argues further that some procedures seem worse to the observer than they do to the patient, and this may in fact be true of our own perception of antiquity: was it as bad for them as it seems to us? Celsus' description of preparations for eye surgery seems reasonable enough: dietary protocols for the patient, good lighting, an assistant to ensure safety, a patch over the other eye—such things might inspire confidence in the doctor's skill, and surgeons with years of experience could reasonably be expected to know what they were doing, even if that meant only knowing which types of operation would be the most dangerous to perform and would accordingly be advisable only in great necessity.

Even so, some aspects of ancient surgery seem too shocking to ignore. The suggestion that the doctor should be prepared to operate with both his left and right hand, for example, is disquieting. In the absence of an ambidextrous doctor, what patient would be satisfied receiving surgery on an eye from the doctor's weaker hand? And surely despair would take hold of someone afflicted with intestinal wounds, especially if this person were forced to watch his or her insides pulled out, sutured, and then stuffed back into the abdomen. Of course, you might consider this preferable to undergoing trepanation, the creation of a burr hole through the cranium (Gk. *trypanon*, "borer, auger"), especially after you have read Oribasius' description of that operation. Factors such as this seem to justify fully the concerns that ancient people had about surgical procedures. As Julius Africanus states, "Many people fear the pain involved in the cure more than they fear the damage that will come if they do not receive attention" (*Cestoi* 1.4). One thing is certain: the surgical status quo will have caused people in antiquity to think very carefully about what constituted "necessary treatment."

## Guide to the Exercises

### I. Word Analysis and Identification

| | | |
|---|---|---|
| 1. | *a + sthen + ic* | lacking strength or energy, weak |
| 2. | *andr + o + gyn + ous* | related to or characterized by sexual ambiguity (either physical or psychological) |
| 3. | *somat + ic* | having to do with the body; pertaining to the body wall as opposed to the viscera |
| 4. | *anthrop + oid* | resembling a human being |
| 5. | *spir + al* | winding about a center like a coil or the thread of a screw; a winding structure |
| 6. | *aer + ate* | to charge a liquid with air or gas; the exchange of carbon dioxide for oxygen by the blood |
| 7. | *cyst + ic* | pertaining to the bladder (esp. urinary bladder or gallbladder) |
| 8. | *asthmat + ic* | having recurrent attacks of paroxysmal dyspnea (i.e., sudden difficulty in breathing) |
| 9. | *aden + oid* | resembling a gland; used substantively, a name for the pharyngeal tonsil |
| 10. | *acou + stic* | having to do with sound or hearing |

### II. Name That Term

1. carpal
2. synthesize
3. epidermal
4. thoracic
5. asteroid
6. cardiac
7. hydrate
8. anthropomorphic
9. kinetic
10. cauterize

3: "epidermic" is also acceptable

### III. Evoryone Makes Mistakes

1. antagonize
2. cleidomastoid
3. caustic
4. geode
5. botanical
6. amorphic, amorphous
7. nauseate
8. pediatric
9. protozoan
10. gastric

### IV. Fill in the _____

1. android
2. cleidocranial
3. phyllode
4. anhydrous
5. geriatric
6. oxygenate
7. amphibious
8. calisthenics
9. dendrite
10. rheumatic

10: "Rheumatism" is a blanket term for a variety of disorders, and "rheumatic," its adjectival form, is similarly vague. "Rheumatoid" ("resembling rheumatism") usually refers more specifically to rheumatoid arthritis, a specific kind of rheumatism.

### V. Matching

| | | | | |
|---|---|---|---|---|
| 1. d | 4. n | 7. k | 10. a | 13. o |
| 2. g | 5. b | 8. i | 11. h | 14. c |
| 3. l | 6. m | 9. f | 12. j | 15. e |

13: Note that here the *ped-* base is *not* the one learned in this chapter but rather a Latin base meaning "foot"; "carpopedal" is one of very many bilingual words in medical vocabulary (see Chapter XXV).

### VI. Back to the Bases

1. to remember
2. cancer
3. joint
4. to split, to rupture
5. sleep

### VII. The Wordsmith

1. geokinetic
2. pedometer
3. megalomastic
4. aerorrhea
5. isosthenic