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Teaching Medical Terminology

Patrick Francis McGuire

Introduction:

This paper reports on a course in medical terminology which was offered to third year students at Keio University School of Medicine, Shinanomachi Campus, spring semester 2009. Though students begin the course relatively familiar with colloquial English phrases for describing medical conditions and anatomy, they are much less familiar with medical terminology, never having studied it systematically. In this spring semester course, students are introduced to the corpus of medical terminology and learn to decode and encode medical terms. This paper reports the course proceedings and provides both a rational and suggested approach for teaching medical terminology. This paper is in three sections, considering, in turn, the following:

I. The Learning Challenge ~

- i. What are the challenges of learning medical terminology?
- ii. How can these challenges be systematically addressed?

II. The Lexis of Medical Terminology ~

- i. What is the lexis of medical terminology?
- ii. How can the lexis be subdivided and presented?
- iii. How do composite word parts combine to form medical terms?

III. A Methodology for Teaching Medical Terminology ~

- i. What are reasonable objectives and time frames for a course of study?
- ii. How and in what sequence should combinant parts be presented?
- iii. What are effective study practices to develop decoding and encoding abilities?

I. The Learning Challenge

Medical dictionaries, which embody the wealth of medical learning and practice dating from antiquity to the present, are tomes of frightful size and cost! They can exceed 2000

pages in length, and are dense in subject matter that is largely impenetrable to the lay reader. Medical students rely heavily on these sources of reference, but comprehending fully the information therein requires that one be literate in the language of medicine. Acquiring proficiency in this specialized language is one of the fundamental challenges of medical studies.

How then do trainee doctors learn the language of their professional discipline? This author's survey of several prominent Tokyo medical schools revealed that few offer a course specific to the study of medical terminology. This would seem a need overlooked. Medical terminology is not commonly taught separately or systematically, but rather as incidental to clinical studies (which typically begin in the fourth year). Acquiring medical terminology, it is assumed, will occur concurrently along with the vast body of clinical information that fourth year students must assimilate. The course described herein focused explicitly on medical terminology, to enable third year students to better cope with the plethora of terminology they encounter in the following year.

Before proceeding to the details of the course, first some rationale regarding the course itself. The course's underlying premise runs somewhat counter to the common practice by which students are introduced to medical terminology. As mentioned, the prevailing practice is to present terminology as tangential to fourth year clinical studies. Certain assumptions are consistent with this practice; namely, that terminology will be learned either by: i) repeatedly encountering a term; ii) inferring meaning; iii) memorizing. Although, through force of effort, students do develop some grasp of medical terminology through repeated encounter, inference and memorization, this paper considers these learning methods inherent in common practice both inefficient and insufficient. Each of these learning methods (and their inherent assumptions) will be considered in turn and contrasted with a more systematic, overt approach.

The first learning method presumes that students acquire knowledge of medical terminology **by repeatedly encountering** terms. This assumes that students come to recognize, understand and remember terms, just as they arise incidentally in medical texts and lectures. Obvious problems with this assumption are: it leaves input to chance; it assumes sufficiently frequent exposure to terms; it requires that students be continuously multitasking - listening for terminology, recognizing and remembering it, while at the same time following the flow of ideas (in seminars, lectures, clinical tutorials, etc) where terms arise. Though such a learning process seems hit and miss, it characterizes how terminology is generally expected to be

learned.

The second learning method is one by which students gradually, without explicit instruction, come to recognize and extrapolate from lexical patterns in medical terms; in other words, terminology will be **learned through inference**. Here also it is assumed that the various terms' parts (prefixes, roots and suffixes) appear with sufficient frequency and context for the learner to infer meaning correctly. This seems to assume that all students are natural linguists and will learn to decode terms through prolonged, variable exposure to medical language. However, would students not learn terminology more quickly and thoroughly if taught explicitly? Relying on inference falls short of providing the requisite proficient, precise knowledge of terminology.

The third method of learning assumes the **memorization of terminology** is possible through persistent study of a medical dictionary. Medical dictionaries are essential references, but provide comprehensive and detailed, not succinct, definitions. Hence definitions require time to isolate, in addition to the difficulty of sourcing terms within the cumbersome volumes. As well as being a time consuming process, memorization has other drawbacks, relying on memory to the exclusion of other cognitive and analytical capacities. Moreover, the alphabetical arrangement of dictionaries runs counter-intuitive to ways in which the mind registers and recalls language, by subject and chronology. While medical dictionaries are essential, this paper advocates teaching students to analyze the structure of terminology, enabling more efficient dictionary use and greater comprehension.

In summary, all three assumptions fail to recognize (and take advantage of) a pedagogically relevant characteristic of medical terminology, namely its consistent and learnable lexical structure. This will be elaborated on in the next section.

II. The Lexis of Medical Terminology

Like much scientific terminology, medical terms are largely derivations of either Greek or Latin origin. To speak of "Medical English" then is something of a misnomer since medical terminology (distinct from colloquial terms) is common to most European languages. A medical term is typically comprised of word parts that are either entirely Latin or entirely Greek in origin; the two derivative languages rarely intermingle to form a given term. Hence, there are numerous duplicate terms - both a Greek and a Latin term which refer to the same anatomical or physiological aspect. For example, the Greek root *nephr* and the Latin root *ren* both refer to the kidney. Generally, Greek-derived terms refer to diagnosis and surgery,

whereas Latin-based terms refer to anatomy and physiology. Emphasizing the categorization of terms according to origin is the sort of pedantry some might seize upon, but the question of provenance - though of linguistic interest - is of little practical relevance to trainee doctors.

A central issue in planning a course of this type is deciding what terminology to include and what to omit. The range of terms taught, particularly with regard to roots, must be strictly delimited. Each medical specialization encompasses a sizable corpus of pertinent terminology, putting a comprehensive study beyond the remit, schedule and scope of an introductory course. The weight of a medical dictionary makes the point.

The question then is what terminology should the instructor include? A logical criteria for selection would approximate that applied to other domains of English for Special Purposes; namely, selecting terms for inclusion according to their frequency of use. Here, corpus analysis is invaluable for identifying both frequently used discreet terms and term parts, morphemes as it were. This will be further elaborated on below. As previously explained, the selection of roots is the most problematic issue in delimiting course terminology. It is optimal to include those roots which have multiple combinant forms, whereby the learner's knowledge of terms expands rapidly.

It will be helpful at this point to provide some description of the general lexical structure of medical terms. That structure, since comprised of Latin and Greek derivatives, is typically a variant of the combination of prefix, root and suffix. Terms may be formed with two or more combined roots. Some common formations are: prefix-root-suffix; prefix-root-root-suffix; prefix-root; prefix-root-root; root-root; root-suffix; root-root-suffix.

The typical medical terminology textbook list of prefixes numbers approximately one hundred items. Prefixes specify some aspect of the adjoining root. Prefixes may refer to aspects such as: number and measurement, location or spatial characteristics, color, density, time or time order, severity, and so on. There are common prefix-root collocations, but a given prefix may be adjoined to an array of roots.

The list of common suffixes also numbers in excess of one hundred. Suffixes can be grouped under two categories - grammatical or semantic. In addition to expressing grammatical function - noun or adjectival forms, etc. - suffixes often have a specific semantic role in medical terminology, indicating aspects such as condition, disease or procedure.

Combining forms in terminology are where the vowel 'o' combines two roots and/or prefix and root, or root and suffix (where the latter begins with a consonant). Combining forms have the functional purpose of facilitating pronunciation, as seen in the examples *cerebrovascular*

or *streptokinase*. If a suffix begins with a vowel, the combining vowel is usually omitted - examples: *carditis* (not *cardioditis*) and *gastralgia* (not *gastroalgia*). However, where the root ends with a vowel other than 'o', the combining vowel is often (still) applied - examples: *arteriosclerosis*, *osteoblast*, *cardiodynia*. Two root combinations exclusive of a vowel are often joined with a combining vowel - example: *nephrolithectomy* (not *nephrlithectomy*, which would be unpronounceable).

III. A Methodology for Teaching Medical Terminology

As outlined above, the course described herein undertook to explicitly teach medical terminology. Students were taught to parse terms according to composite parts - prefixes, roots and suffixes as described above - construct meanings from parts, and in turn use composite parts to encode terms. In other words, the goal was to teach comprehension through analysis, rather than sight recognition, inference or memorization.

A class schedule of six to nine weeks proved sufficient for students to learn the rudiments necessary to decode and encode a substantial body of medical terminology. The schedule for a course of study might be organized as follows: commencing with a detailed study of prefixes (2~3 weeks); proceeding to suffixes (2~3 weeks); then introducing roots representative of various medical specializations (2~3 weeks) and consolidating decoding and encoding skills. Teaching terminology in these three stages allows for progress assessment at the end of each stage. Moreover, students learn to recognize the function and semantic value of prefixes, suffixes and roots respectively, and to parse terms accordingly. Experience suggests that the number of roots introduced in a course of this kind should not be exhaustive, but be sufficient to represent and describe the procedures and conditions most common to a range of specializations. A representative list of prefixes as well as an example of a prefix quiz appears in the Appendix.

A general procedure for conducting a weekly lesson might be as follows. Students could be given in advance of each lesson a list of (for example) prefixes to preview for an upcoming class. Students might be asked to list any words they know which contain each given prefix, and try to guess the prefix meaning accordingly. Students might also conjecture which roots and medical contexts a given prefix might relate to. For example, by listing words beginning with "ab" - abnormal, abstract, absent, etc - students might conjecture that "ab" means "different from" or "separate from" and that it might relate to psychology. This encourages students to look for how, perhaps familiar, word parts might apply to medical contexts. At the

beginning of the lesson, students in small groups might compare and pool their lists to reach a consensus regarding the prefixes meanings; the whole class could then consider those prefixes where ambiguity persists. A PowerPoint might then follow, in which the lesson's prefixes are reviewed, along with their common medical cognates presented. Prefixes and suffixes should be grouped and presented according to function and semantic value (indicating color, size, location, etc) as this provides an organizational structure and facilitates their memorization. Decoding and encoding practice exercises in class should also emphasize function and semantic value.

Though introducing prefixes, suffixes, and roots separately appears to facilitate the learning process, it is helpful to give examples of word parts in the context of a complete term, and to do practice exercises with complete terms. Students should learn several common roots at the outset in order to begin recognizing and practice constructing prefix-root-suffix patterns. Introducing common roots - such as *cardia*, *gastro*, *osteo*, *hema*, *entero*, *arthro* - proves helpful in teaching students to encode and decode terms. Students can experiment with combining newly-studied prefixes and suffixes with familiar roots to form medical terms, adding a purposeful, creative dimension to the lesson.

There are numerous possible sources for the body of language one might introduce during a nine week course. Wikipedia and Creative Commons are among several open sources where lists of parsed medical terminology is available. Medical terminology texts generally present vocabulary in a glossary list format. Glossary lists are often subdivided according to component word parts - prefix, suffix and root. Prefix and suffix lists are then usually alphabetically arranged; roots might be grouped according to anatomic or diagnostic category. Studying a glossary thus, students can soon become familiar with the component parts which combine in a multitude of forms to comprise the lexis of medical terminology. An excerpt of a glossary list might read as follows:

	Prefix	Meaning	Example	Definition of example
1.	ecto-	outer, external	ectoderm	tissue on the skin surface
2.	endo-	within, inner	endoscope	instrument to view inside
3.	epi-	upon, over	epigastric	on or over the stomach
4.	eu-	normal, good	eupnea	normal breathing

Along with glossary lists, labelled diagrams are another method of presenting vocabulary common to textbooks. The animation capabilities of websites makes them a particularly effective medium for illustrating certain word components, such as prefixes referring to a process or a movement of location. Other instructive and engaging web-based learning tools are: electronic-glossaries, flash-cards, click and drag matching exercises, fill-in-the-blank exercises, recorded pronunciation models, spelling B's, and so on. An instructor's teaching resources therefore need not end with hand-outs and power-points. Interestingly, some on-line learning resources (such as many flash card websites) are student authored - medical students who have generated flash card sets for self-study and have contributed them to the public domain. A number of medical schools such as Des Moines University (<http://www.dmu.edu/medterms/overview/>) and the University of Minnesota (<http://msjensen.cehd.umn.edu/Webanatomy/>) host public domain websites with substantial learning resources devoted to medical terminology.

To exercise their growing knowledge of term components, students benefit from extensive practice in decoding common medical terms. Decoding strategy involves first identifying a medical term's composite parts (prefix? suffix? one root or two? etc). One recommended strategy is to read a term from right to left; that is, beginning with the suffix and working back to the beginning of the word. As each term part is identified and colloquially defined, the overall term meaning emerges. Giving students adequate in-class practice, working solo or in pairs and checking answers, consolidates their learning. Examples of a decoding exercise:

- ***myelodysplasia***: (suffix) *plasia* - development of (root) *dys* - difficulty
(root) *myelo* - bone marrow
(colloquial definition) *myelodysplasia*: - a bone marrow disorder
- ***pericarditis***: (suffix) *itis* - inflammation of (root) *cardi* - heart
(prefix) *peri* - area around
(colloquial definition) *pericarditis*: inflammation of peripheral heart membrane
- ***hyperlipidaemia***: (root) *aemia* - blood (root) *lipid*- fat (prefix) *hyper* - too much
(colloquial definition) *hyperlipidaemia*: excessive fat in the blood

Students generally find encoding more challenging initially as it involves recalling the correct Greek or Latin derivative. To assist students with encoding, instructors might use a

scaffolding method: first provide the root, then ask students for the medical term matching a stated colloquial condition. This enables students to employ their suffix and prefix knowledge in constructing whole terms. Examples of assisted encoding exercises:

- Cephal is head. What is the medical term for headache?
- Arth is a joint. What is inflammation of the joints?
- Acr are the extremes of the body. What is the enlargement of these?
- Carcin is cancer. What is a cancer tumor?

Encoding without a root or other component prompt, easier problems serve well initially:

- A doctor who treats children
- A condition of low blood sugar
- The study of the elderly
- Hardening of the arteries

The ability to decode is especially useful as students begin to encounter more specialized, often polysyllabic, terminology. Rather than be perplexed or daunted by hitherto unknown terms, students can rely on their analytical ability. Following adequate practice in word analysis, terminology is demystified and students can accurately decode and encode medical terms.

Conclusion:

As this paper suggests, there is no inherent obstacle to teaching medical terminology within the scope of an English course. Even lecturers who are not specialists in medical sciences will find teaching the course, using the many existing references and resources, rather straightforward. Students, moreover, recognize the utility of this knowledge and are motivated to learn. Hospitals in Tokyo provide medical services to an international community, hence trainee doctors realize that medical terminology could prove useful in clinical work. Aspiring medical researchers recognize that this language is integral to participation in international clinical conferences and research. In short, lecturers will serve their students well by including medical terminology instruction in their course of study.

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Appendix

Excerpt of prefix glossary:

Prefix	Form	Meaning Example (Definition)
alb-		white <i>albino</i> (person without any skin pigment)
chlor-	chlor/o	green <i>chloroma</i> (greenish cancerous tumor)
cyan-	cyan/o	blue <i>cyanosis</i> (abnormal condition of being blue)
erythr-	erythr/o	red <i>erythrocyte</i> (red blood cell)
leuk-	leuk/o	white <i>leukocyte</i> (white blood cell)
melan-	melan/o	black <i>melanocyte</i> (skin cell with black pigment)
	purpur/o	purple <i>purpura</i> (purplish skin bruises)
	rose/o	rose, pink roseola (rose-colored rash)
rube-		red <i>rubella</i> (viral infection with red skin rash [measles])
xanth-	xanth/o	yellow <i>xanthoderma</i> (yellow skin)

Suffix Quiz

Match number and prefix

- | | | | |
|---|---------|-------|--------|
| 1 | poly | _____ | circum |
| 2 | medi | _____ | contra |
| 3 | anti | _____ | duo |
| 4 | peri(o) | _____ | endo |
| 5 | ambi | _____ | meso |
| 6 | ante | _____ | mono |
| 7 | hemi | _____ | multi |
| 8 | intra | _____ | pre |

Write number beside prefix that matches meaning on left

- | | | | |
|----|-----------|-------|-----------|
| 1 | red | _____ | ab |
| 2 | black | _____ | across |
| 3 | green | _____ | ad |
| 4 | blue | _____ | chlor(o) |
| 5 | white | _____ | cyan(o) |
| 6 | trans | _____ | dorso |
| 7 | left | _____ | epi |
| 8 | back | _____ | erthry(o) |
| 9 | after | _____ | latero |
| 10 | upon | _____ | leuco |
| 11 | away from | _____ | melan(o) |
| 12 | towards | _____ | post |
| 13 | side | _____ | sinistro |

Match prefix to the correct meaning

- | | | | |
|----|--------|-------|----------------------|
| 1 | sym | _____ | walk about |
| 2 | schizo | _____ | down, remove |
| 3 | retro | _____ | in addition, outside |
| 4 | primi | _____ | below, under |
| 5 | pan | _____ | backward, behind |
| 6 | oligo | _____ | within |
| 7 | nulli | _____ | none |
| 8 | neo | _____ | little, few |
| 9 | meta | _____ | first |
| 10 | mal | _____ | above |
| 11 | iso | _____ | new |
| 12 | infra | _____ | outside |
| 13 | exo | _____ | painful |
| 14 | eu | _____ | together |
| 15 | endo | _____ | good |
| 16 | ecto | _____ | bad |
| 17 | dis | _____ | across |
| 18 | de | _____ | equal |
| 19 | ambulo | _____ | split |
| 20 | para | _____ | removal, absence |
| 21 | dys | _____ | beyond, near |

Write prefixes with opposite meanings

- eg: micro macro
- | | | |
|---|-------|-------|
| 1 | hyper | _____ |
| 2 | brady | _____ |
| 3 | mal | _____ |
| 4 | homo | _____ |