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# **Medicine and Clinical Engineering**

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**BERTIL JACOBSON**

**JOHN G. WEBSTER**

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## **Preface to the Swedish Edition**

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This book presents an introduction to medical diagnosis and therapy. The contents explain how the physician works and the problems that face him. There is an emphasis on the technical aspects of medicine. Medical terminology is introduced throughout the book so that the language of the doctor is readily understood.

The book is intended for medical engineers and other workers in the medical field who are concerned with clinical medicine, including radiophysicists, scientists, physiotherapists, pharmacists, and administrators. The engineering sections may be of interest both to the physician and the surgeon.

The material is arranged to give the reader a picture of what actually happens in the various departments and laboratories of a hospital, rather than according to a logical classification of material. Thus, sections on physiology are found in several of the chapters. The dominant theme is the care of the patient.

The questions inserted in the text serve two purposes; to test knowledge and to present examples. Programmed learning has been somewhat modified to help check the reader's knowledge and to provide further information on typical cases.

The author has found this system more instructive than a strictly programmed presentation. Because these questions contain many new facts, they are also of interest to the reader who does not read the text primarily to answer them.

The preparation of this book has only been made possible by the assistance of many colleagues. Each chapter has been scrutinized by at least two specialists, and the author is indebted to them for their constructive criticism and suggestions. Several hundred students have also made their contributions to improved clarity.

Sylvi Morén typed numerous drafts and the manuscripts of the two editions and read the proofs. Most of the illustrations are ink drawings by Elsa Holmgren made from the author's sketches. He has enjoyed excellent cooperation with them both.

BERTIL JACOBSON

*Stockholm, 1975*

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## **Preface to the American Edition**

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Most of this American edition of the book closely follows the original. This is because medicine in Europe and the United States is practiced according to very similar principles. However, there are subtle differences. These have prompted certain changes, deletions, and additions. Since our aim was to present a book of general application, we felt it necessary in some parts to describe more than one principle, followed by a clear statement of the application areas. The alterations have also resulted in the addition or revision of a few figures. Some of the questions have also been rewritten in the hope of increasing their pedagogic value.

In the Swedish edition, the internationally accepted SI units have been used throughout. In this American edition, we have often retained old units according to current usage and have added SI units in brackets. A conversion table is given in the Appendix.

A preliminary American version of this book was class-tested in a course at the University of Wisconsin-Madison, and in this connection, various chapters were read by specialists. The authors are grateful for the numerous corrections and

improvements which resulted. Particular thanks are due to Myrna Larson who rewrote a number of paragraphs in Chapter 7 on blood transfusion problems. Many students also made their contributions.

Again, Sylvi Morén typed, and corrected the manuscripts and read the proofs, and Elsa Holmgren drew new figures and relettered all the previous figures. Their help is greatly appreciated.

The authors welcome suggestions for improvement in concept, emphasis, and clarity.

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## **chapter 1**

# **Medical Terminology**

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A common language is essential for meaningful communication. To be able to best cooperate with the physician it is important for supporting personnel to possess a knowledge of medical terminology.

The physician's language is often regarded as unnecessarily obscure. So far as the actual terms are concerned, however, the difficulties largely disappear once a knowledge has been acquired of the word-stems, prefixes and suffixes. The medical terms are simply constructed, and unlike the words in engineering specialities, they have the advantage of being international. With a working knowledge of a foreign language a medical text can therefore be read, as long as the internationally accepted medical words, derived from the Greek and Latin, are familiar.

For anyone concerned with the field of medicine and medical research some acquaintanceship with medical terminology is therefore essential. This does not mean, however, that one should prefer the less commonly known expression. In fact, it is important to avoid this where possible until an adequate knowledge of

## 2 Medical terminology

the nuances and the appropriate use of the words has been acquired. To be able to speak a language, one needs more than just to understand it.

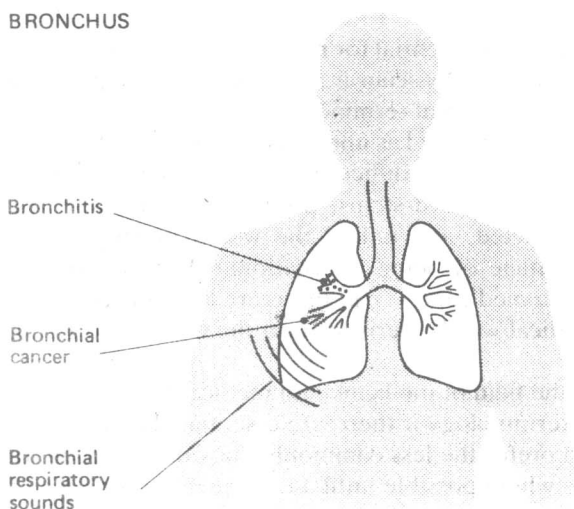
To provide an introduction to medical nomenclature, some fundamental concepts in anatomy, physiology and pathology are described in the main body of this chapter. A background of these basic sciences is important for an understanding of all other branches of medicine. The principles applied in investigations in clinical engineering are to a large extent linked with the anatomy and physiology of the organs, and the names of the methods used with these organs are usually derived from their anatomical and physiological terms. Before dealing with the special terminology of the organ systems, certain general principles of the structure of medical language will be outlined.

### GENERAL MEDICAL TERMINOLOGY

Medical words and terms are constructed from word-stems, prefixes and suffixes. Use is commonly made of words borrowed from Greek and Latin, a reflection of the fact that so many fundamental discoveries in anatomy and pathology were made during times when these were the languages of the learned. The terms for the organs and organic systems thus provide a structural basis for medical language.

From the nouns are derived the adjectives and adverbs. For instance, a principle division of the windpipe is known as the **bronchus**, which has the adjective **bronchial** and the adverb **bronchially** (Fig. 1.1). Bronchial cancer is a malignant tumor of the windpipe. Bronchial respiratory sounds occur in the

#### BRONCHUS



**Figure 1.1** Example of the structure of medical language.



windpipe and can be heard with the aid of a stethoscope by the physician performing a lung examination.

Word-stems are often modified. For example, the word for mouth is **os**, but in the genitive **oris** and in the plural **ora**. A medicine to be administered by mouth is said to be taken **per os** (per, through) or, in the adverbial form, **perorally**, and in the adjectival form by the **peroral** route. In the same way, **abdominal** is the adjective for **abdomen**, **thoracic** for **thorax** (the chest) and **rectal** for **rectum**.

As is evident from the above examples, many originally Greek or Latin nouns and their derivatives are now anglicized in their spelling and endings.

Many words are formed by using prefixes. A medicine injected into a vein is said to be given **intravenously** (intra, in). Certain vaccines are injected into the skin so that a blister forms; they are given **intracutaneously** (**cutis**, the skin). Other vaccines and many drugs must be given **subcutaneously** or in the **subcutis** (sub, under).

In compound words the endings have greater weight than the prefixes. A chicken hawk is a hawk that hunts chickens, not a chicken that hunts hawks. **Hematuria** is the term for a pathological change in the urine when it contains blood (**hemat-** denotes blood and **-uria** urine); it does not describe the condition when the substances normally excreted in the urine collect in the blood. When this occurs—that is, when the kidneys are unable to eliminate the body's waste products from the blood—the state is known as **uremia** (the ending **-emia** denotes blood).

Many endings are known from general usage. For example, **-logy** denotes a subject and **-logist** a specialist dealing with this subject, biology—biologist. The prefix **oto-** denotes ear so that **otology** is the branch of medicine dealing with ear diseases and an otologist is an ear specialist. The ending **-itis** denotes inflammation, as in **bronchitis**. Inflammation of the ear is known as **otitis**. The word for nose is **rhino** (cf, rhinoceros) so the common cold is called **rhinitis**. The cavity at the upper end of the windpipe is the **larynx**, and inflammation at this site is known as **laryngitis**. The ending **-spasm** denotes cramp; in the larynx this is known as **laryngospasm**, and in the bronchus, as occurs in asthma, **bronchospasm**. The physician's language is thus simply and logically constructed.

The text is followed by a compilation of important facts presented as questions, and further informative material is often presented as brief case histories. Cover the page below each question and try to answer it. When the following square is exposed, the answer to the question will be found on the right. If you did not answer the question correctly refer back to the text.

Question	Answer
1.1 Medical terminology contains many words borrowed from ..... and .....	
1.2 One such foreign word is "os" (genitive, oris), which means .....	Greek Latin