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"There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

(Hamlet, Act I, Scene V, lines 166-167, by William Shakespeare).

One cannot deny the fundamental interdependence of structure and function in biology and medicine. This is now a hoary and possibly boring adage. But is it also recognized that structure and function determine the characteristics of disease? Is it understood that diseases are experienced, measured, and classified as they are mainly because of the anatomic parts affected? The history of quackery depends largely on the lack of this perception. How else would anyone accept an elixir not only as a panacea—a cure for countless ills of all sorts—but also as a preventive against any disease? Yet, a little sensible reflection on the complexity and detailed specificity (that is, the fine anatomy and physiology) of the human body can prevent the frauds of quackery. Severed nerve fibers are not induced to regrow and to function normally again by the action of an odoriferous nostrum. Metastatic cancer will not be overcome by an extract of fruit pits. There is no advantage in overdosage with vitamins. The only likely victory over disease lies in seeing it for what it is and this means looking at it, possibly with old and simple tools or perhaps with new and subtle tricks. But look at it we must; otherwise we are only charlatans whether we admit it or not.

There is one more reason to study histology, a purely hedonistic reason—the beauty of it. If museums and art collections can be devoted largely or entirely to the external human

R. L. Bacon et al., Medical Histology

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form, which is so readily accessible to examination by anyone, how much greater is the value in the internal components of the body, particularly when magnified. Of course processing and staining also help in the study of tissues. The world of histology is truly a magnificent one. So let us consider it not as an ugly or maleficent ogre whose shadow, the final exam, darkens our lives and causes our subsequent and often permanent revulsion. Let us accept it as a valuable aid that may make our lives, and in them the science and the practice of medicine, more enjoyable as well as better understood.

We present these ideas at the end of our book rather than at the beginning because we think they may be an incentive to application and further study of this subject after completion of the course in histology. We intend them only to introduce concepts which extend from our basic subject of histology and which may play leading roles in subsequent courses.

The Concept of Normality

The physician should first identify and then treat disease. In order for one to make a diagnosis he or she must hold a clear concept of normality and of its range. It is not enough to know that the apex beat of the heart is normally most forceful to the left of the sternum. The doctor should be able to state how far to the left is acceptable; also in which intercostal space(s) the beat should be; and how forceful it should be and how different physiologic conditions may affect it. And regarding physical stature, is one man less normal than his brother because he is fatter? or shorter? or less muscular or less athletic? Clearly rigid limitations present some disadvantages. In histology, just as in physical examination, we are obliged to present not simply the single ideal normal but some range of what is acceptable.

The traditional concept of normal human biology ignores many variations in form and substance. Problems arise because there is no satisfactory definition of normal. When does one cross the border into disease? Students often recognize and appreciate this confusion. They can openly discuss such questions as: "Isn't baldness (or pulmonary anthracosis, solar tanning of skin, pregnancy, menopause) normal?; "Is this about the usual degree of arteriosclerosis for a 70-year-old man?"; "Why do some children outgrow their hypersensitivities?"; "What is the prevalence of incidental malignancy or tuberculous Gohn complex?"; and ultimately, "What is normal, anyway?" (Fig. 20.1).

Aging

As histology represents structure in life we are obliged to recognize that this structure

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Fig. 20.1. Histogram. Frequency distribution of hematocrit values in adult white females in the United States (1960–62). (From Miale, John B: Laboratory medicine: hematology, ed. 6, St Louis, 1982, The C. V. Mosby Co.; data from National Center for Health Statistics, 1967.)

Fig. 20.2. Carcinoma of the prostate. This is formed of small irregular glands. It was an incidental finding at the autopsy of a 66-year-old man. Concretions in nonmalignant glands are visible at left. ×85. (Courtesy of K. Schmidt.)

Fig. 20.3. Arteriosclerosis with near occlusion of the common iliac artery, a lesion often present in the elderly. ×7.5.

Fig. 20.4. Lymph node in youth is full, complete, and cellular and has germinal centers. ×20.

Fig. 20.5. Lymph node in old age is largely replaced with fat and has few and indistinct germinal centers. ×10.