A common assertion of health providers and institutions such as the World Health Organization (WHO) is that their focus is on health promotion and disease prevention (8). The motivation comes from various quarters decreeing the so-called disease model of healthcare, which tends to focus only on pathology as opposed to avoiding disease in the first place, i.e., health promotion. Yet, if one looks for a universally accepted definition of health, one is faced with numerous circumlocutions, often redounding to the absence of disease. Indeed, the WHO’s Constitution defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (8). However, what constitutes “well-being” is not defined. This is especially disconcerting given the widespread use of the term in media and marketing, thus allowing for definitions from the serious to the mundane. (Ironically, we speak of “health” professions, not “disease” professions.) A possible solution to this situation is to identify normal physiology as the proper place to understand “health.”

A cursory look at the curricula of most preparatory programs for the health professions fails to include any course work dealing with health as a unique science-based concept. Certainly, the idea may be included in various courses, but none that systematically deals with the concept in a scientific framework. If pressed, most faculty members and students would identify physiology as being in some way related to pathology. Yet, a current trend is to include in courses and textbooks clinical disease case examples to demonstrate (and perhaps motivate) the importance of understanding normal physiology. Although these efforts are laudable, they indirectly support the importance of pathophysiology and provide no guidance as to what “healthy” physiology is. Certainly, it may be argued that the only rationale for studying physiology is to understand pathophysiology. To be sure, this approach has been criticized before; however, contemporary trends in physiological research may now provide a justification for allowing the study of physiology to be a primary vehicle for understanding health (4, 5).

To a certain extent, physiology has been hampered by the time-honored notion of homeostasis repeated in countless textbooks. Certainly teachers of physiology understand that it is not really a static variable, but this fact is rarely explored. Homeodynamics is a term that has been suggested but is not widely used (9–11). The idea behind homeodynamics is that “health” changes with environments and age. What is appealing regarding the concept of homeodynamics is that a definition of “health” can be obtained through an analysis of the stability of biological systems. Such a perspective, for example, may be able to deal more effectively with the observed age-related decline of organ systems. For example, consider the aging heart: our maximal heart rate (HR) decreases almost linearly with time, yet stroke volume (SV) increases linearly so as to compensate for cardiac output (CO; the key variable) to keep CO unaffected, perhaps for years. The relation can be viewed as a biological version of conservation of mass (HR × SV = CO).

Related to the notion of dynamics is the current discovery and emphasis on “systems biology.” Certainly, many of us have long thought that we were teaching systems biology. But the new version emphasizes genomics and the implication that abnormal genes can be responsible for a variety of illnesses. Most knowledgeable scientists have known for a long time that this is an overly simplistic view. Instead, a more reasonable view is that no one gene is responsible for a bad outcome; rather, genes work in concert with other genes and/or proteins and the environment, as has been so eloquently argued by Lewontin (7). Furthermore, epigenetics and proteomics suggest that important phenotypical alterations can be exhibited without a substantive change in DNA (2, 3). What then constitutes health if a woman’s gene configuration results in, say, a 20% chance of breast cancer? What if the situation is further compli-

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cated by the same woman’s gene configuration that results in a 40% chance of being obese? Is health then a matter of probabilities? Even more controversial is the area of neurotransmitters in the brain. Neurotransmitters can often have receptor alleles that may result in different personality traits. Are traits determined to be “bad” from a societal perspective pathological?

A much more intriguing aspect of systems biology is its emphasis on “emergence” (1, 6, 13). The idea, of course, is that the whole is more than the sum of its parts and that a system expresses features not present in any one of its elements. Illness is a disruption of one or more parts of the system, thus preventing the expression of one its “emergent” properties. Currently, much of the emphasis is on fairly circumscribed systems such a gene regulatory networks, but there are efforts at enlarging the system perspective to the whole body. Clearly, if instead of “case studies” were presented in physiology textbooks, more integrative, nonpathological perspectives could be developed. Consider some examples:

- There is no universal “normal” genome. Genomes change from person to person and group to group. The phenotypical expression presents a challenge in terms of what constitutes health.
- Aging constitutes significant changes in body function. For example, cardiac function is said to decline with age. At what point does normal cardiac decline become congestive heart failure?
- Neurocognitive decline is said to be forestalled by activity and exercise. Are there irreversible processes involved; are they genetic?
- The “athletic heart” is characterized by hypertrophy as a result of exercise conditioning. How does it differ from pathological hypertrophy?

Certainly, many of these examples cannot be fully answered with the current state of the art (12). Nonetheless, they do provide a focus for a discussion of what healthy physiology is. If health promotion is really a concern of the health professions, the study of physiology should be identified as the proper discipline for its understanding.

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