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INTRODUCTION

TWO CURRENT, subtle changes reorient the study of bone away from the classical emphasis on description and terminology. These changes are seldom accorded overt homage in the literature with its often dessicated compilation of fact and method.

The first change: realization that the nature of and rates at which dynamic events occur are more important than the definition of structure. The ceaseless change characterizing bone physiology from macroscopic to molecular levels of organization was long hidden by the structure itself. In the last two generations, now coming to fruition, realization has dawned of the importance of biological kinetics. In the wake of this dawning came the evolution of study of morphology to a means of deducing the kinetics preceding the moment of observation. Thus relegated to the status of research tool rather than elevated on its own pedestal, morphology has evoked fresh interest and power and become the subject of a progressively astute and determined attack by investigators from many disciplines.

The second change: for hundreds of years it was perfectly obvious that bone is unique and exists apart from the soft tissue organs. This view made the study of bone a limited, highly specialized field apart from the main stream of biology.

Now, rather suddenly, bone's claims to uniqueness are crumbling to dust. In common with the soft tissues bone remodels, its cells live a finite and determinable lifetime, its cellular progenitors are affected by opposing and determinable rate controlling mechanisms, its existing cells exhibit progressive changes in function with age and both progenitor and existing cells are subject to a fascinating and possibly epochal superintegration of balance and balance control mechanisms.

Bone does possess unique physical and physiological characteristics. One of these unique features is termed by us the ledger function: biological kinetic processes write a record in bone of what happened in the past. The symbology of this biological shorthand may be translated by suitable study. By reading from this ledger, by correlating, by finding and testing new ways of integrating old facts, understanding increases.

For the above and other reasons the study of bone is emerging as a powerful tool for investigating some basic aspects of human biology. For example, bone yields remarkable insights into the nature of the human aging process, the nature of human endocrinological control integration, the mechanisms of endocrine action, the changes with age in the rates of generation of new and differentiated tissue, the changes with age in the functional competence of single cells, the nature of the space polarizing mechanisms which "instruct" cellular function in three-dimensional space.
In reading the ensuing articles remember these things:

First, most in one way or another adorn the pedestal of biological control, using study of form as a means of detecting the presence and observing the action of these controls. While some mathematics creep in, more will appear in future work following the lines suggested by pioneer thought of others. See Weiss and Kavanau (J. Gen. Physiol. 41:1-47, 1957); Szilard (Proc. Nat. Acad. Sci. 45:30-45, 1959); Roston (Bull. Math. Biophy. 21:271-282, 1959).

Second, our work involves the proper phrasing of some question; once phrased, the question is then put to our oracle of biology: bone. The depth and scope of our questions increase as our own educations and our knowledge of our oracle increase. Of necessity this process involves first an attention to structural detail, second an interpretation of the kinetic mechanism that produced it, third an integration with other facts to arrive at an hypothesis, and last the formulation of the question, the necessary result of the hypothesis, which is then put to human bone to determine whether we are still anchored to reality — or adrift in a puddle of fantasy.

Third, orthopedic surgery has a reputation among nonorthopedists for being a specialty exercising the muscle and memory — and in that order — but not the cortical integrative faculties. Work from many laboratories, this among them, should sufficiently exercise the scope of educational background and powers of comprehension to dispel this image from an objective mind. While it may be easy to become a plebeian orthopedist, becoming an excellent, well grounded and perceptive one is a challenge worthy of the best minds entering medicine. Indeed few living men can claim successful stalk of this game and few entering medicine can bring to their work the courage, industry, objectivity, and intellect necessary for a successful stalk. To too many the "good life" translates into assured good possessions rather than into the highly uncertain conquest of a medical Everest.

However, for those newcomers to medicine in whom this taunt and challenge fans some responsive ember: good hunting!

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