book is a greatly simplified system of nomenclature for the principal metamorphic facies. The complex system of subfacies found in Turner's earlier works is here abandoned with the recognition, following Miyashiro and others, that each sequence of facies, and possibly each facies, is unique. A facies can, in this view, be fully characterized only by the total array of mineral assemblages found in it. Under such circumstances the possibilities for subdivision are virtually endless, and this reviewer agrees with Turner that any useful generalized nomenclature must be a simple one.

The last three chapters of the book will perhaps be the most valuable part to most readers. They contain an updated summary of naturally occurring metamorphic facies as found in various parts of the world, followed in the last chapter by a discussion of the temperatures and pressures required for their development, and of their geologic setting both in time and space. Turner concludes here (and this reviewer agrees) that the ultimate source of the energy needed to produce metamorphism on a regional scale must be in the deep crust or upper mantle. In this view the granitic plutons characteristic of most metamorphic terranes are to be regarded as the ultimate end products of the metamorphic process rather than as its cause.

JAMES B. THOMPSON, JR.
Department of Geological Sciences,
Harvard University,
Cambridge, Massachusetts

Craniology

The Human Face. An Account of the Postnatal Growth and Development of the Craniofacial Skeleton. DONALD H. ENLOW. Illustrations by William L. Brudon. Harper and Row, New York, 1968. xvi + 304 pp., illus. $20.

In this interesting book the author sets out "to describe and illustrate a particular, fundamental mode of approach to the study of cranio-facial growth." This method, based extensively on the interpretation of variations of osseous histology, has been described previously by Enlow in some detail, and the present work is a compilation and an extension rather than a presentation of new concepts. Abundantly and clearly illustrated, the text provides a vivid description of the author's thoughts and deserves to be widely read by all students of craniology. Indeed, the clarity of the exposition tends to conceal certain hazards to those readers who have an empirical, clinical need to know but who may be less than firmly grounded in the totality of current craniofacial theory.

The decisive point of Enlow's argument derives from his definition of growth: "Overall enlargement in the size of any bone involves two basic processes: growth and remodeling. Growth itself represents the sum of actual increases in size," while remodeling is a process of "sequential, progressive adjustment that functions to maintain the shape and proportions of the bone. . . ." The text specifically states that combinations of osseous deposition and resorption are the only processes involved in growth according to this restrictive definition. The author goes on to establish a dichotomy between "displacement" and "growth." This is precisely the issue of criticism. Although Enlow acknowledges that "virtually all changes that a bone undergoes during growth are brought about by the various soft tissues associated with the core," it is evident that these same soft tissues are conceived of as operating only by means of their effect on osseous depositions and resorption. The thesis of this book is that changes in the size and shape of bones are brought about by the functional activity of soft tissues, but that changes in the spatial position ("displacement") of these same bones are only a secondary result of these same osseous processes. Other current theories of cranial growth present a more comprehensive definition of growth which includes not only changes in size and shape brought about by periosteal activity but also changes in spatial position. Further, these same theories emphasize that such "displacements" of bones occur passively, being brought about by the volumetric expansion of the functioning neural, orbital, oral, nasal, and pharyngeal spaces. When Enlow's description of direct, active periosteal transformations is added to the concepts of indirect, passive spatial displacements of these same bones, a unified and essentially correct picture of cranial growth is obtained.

Although the secondary, compensatory nature of sutural area growth is correctly recognized, as is the current devaluation of the concept of cranial "growth centers," there is still an equivocation in Enlow's account of the role of the cranial cartilages in facial growth. Admittedly this is a subject of active investigation and contention, but here again the "particular approach" of the author leads to a less than complete discussion of the available data.

This important book should be widely read. It is regrettable that it is not more comprehensive in its outlook. Recognition of its self-imposed limitations will do much to increase its usefulness as the clearest presentation to date of one half of the story of cranial growth.

MELVIN L. MOSS
Department of Anatomy,
Columbia University,
New York, New York

Refractory Materials

High-Temperature Materials and Technology. IVOR E. CAMPBELL and EDWIN M. SHERWOOD, Eds. Wiley, New York, 1967. xii + 1022 pp., illus. $27.50. Electrochemical Society Series.

Advances in important areas of technology such as power generation, aerospace propulsion, and materials production depend critically upon the behavior of materials at high temperatures. This book, a revision of the earlier *High-Temperature Technology* (Wiley, 1956), attempts to cover the properties, phenomena, and techniques characteristic of temperatures so high that many room-temperature solids would be molten, but below the point where only gases or gases and liquids remain (melting point of hafnium carbide, 4160°K; boiling point of tungsten, 6200°K). Beginning with a section on the fundamental thermodynamics and chemistry, the text proceeds to a series of chapters on the important classes of refractory materials, a series on various aspects of technique such as attainment of high temperatures, containment of hot matter, and fabrication, and a final series on measurement of temperature and of mechanical and other properties at high temperature.

The two editors have assembled 27 chapters prepared by two colleagues at Westinghouse, eleven at Battelle, and other contributors at the Air Force Materials Laboratory (three), General Electric (three), five universities, and eight other corporations. The book must be viewed as a committee product, in the knowledge that systems designed by committees are sometimes deficient in virtue. The consequent catechism elicits moderately favorable responses: Is the content complete, accurate, and up-to-date? Reasonably so;