information is more detailed than that available for nondomesticated eutherians, and the book will be an important reference source and literature key to the physiology of these groups. In its pursuit of the other goals, the book is understandably less successful. Primitive mammals as a group have either too much or too little physiological diversity to permit easy generalizations. As examples, the authors in the locomotory and endocrinological sections uniformly agree that no major common features separate primitive from advanced mammals. In contrast, the metabolic energetics and digestive physiology of individual species are so diverse even within restricted groups of primitive mammals that it is impossible to sort primitive from derived features. One of the authors likens attempting to visualize the course of mammalian physiological evolution by examining one species after another to painting a tree one leaf at a time. This volume contains many well-drawn leaves and a few twigs, but the tree is still vague. The grand syntheses do not emerge, and it is not for the customarily offered reason that too few species have been examined. Comparative physiology alone will evidently not answer questions concerning the evolution of primitive mammals.

The most extensive and interesting section concerns metabolic level and thermoregulation. Although many primitive mammals maintain a lower body temperature (28° to 35°C) than do advanced eutherians (37° to 40°C), both groups remain good homeotherms when confronted with thermal stress. The unanimous conclusion of the authors is that these thermoregulatory systems are not primitive in the sense of being inadequate. Whether low body temperatures and low metabolic rates were traits possessed by early mammals is more controversial. C. R. Taylor maintains that these are in fact primitive features in this sense. Other authors (T. J. Dawson, A. J. Hulbert, A. Shkolnik) point to diversity of metabolic level within individual groups of primitive mammals as a factor that complicates generalization. It was once held that metabolic rate and thermoregulatory ability both increased during the sequential evolution of the monotremes, marsupials, and then placentals. This view has been abolished by recent data, but it has not been replaced by a similarly simple and beguiling pattern.

Many of the papers concerning locomotion touch only briefly on primitive mammals. Hopping in kangaroos receives much discussion, but this is of course not a primitive feature. The general conclusion is that these mammals do not show primitive locomotory traits and are not distinguishable from advanced placentals in such features as locomotory efficiency, elastic energy storage in muscle and tendon, or muscle fiber type.

The sections on digestion and comparative endocrinology are less satisfying. The papers on the structure of the digestive systems are good introductions, but those dealing with digestive physiology concentrate too heavily on individual species and on a single function (passage time). Little synthesis is attempted. The endocrinological papers are dense compilations of experimental results with little explanation or interpretation for nonendocrinologists. The significance of the conclusions is generally not made apparent (except in the chapter by P. J. Bentley). I expect that the papers in both these areas will be of interest to specialists but not to other comparative physiologists.

The book is generally well written, given the difficulties of getting 40 authors to move in the same direction at once. Some of the chapters are truly excellent, particularly those of A. W. Crompton, H. C. Heller, and A. J. Hulbert, being brief, informative, and provocative all at once. This is a useful compendium of information on diverse groups of mammals, the physiology of which is rarely discussed in more general texts.

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Shallow-Water Ecosystems

Marine Benthic Dynamics. Papers from a symposium, Georgetown, S.C., April 1979. KENNETH R. TENORE and BRUCE C. COULL, Eds. Published for the Belle W. Baruch Institute for Marine Biology and Coastal Research by University of South Carolina Press, Columbia, 1980. xx, 452 pp., illus. $27.50. Belle W. Baruch Library in Marine Science, No. 11.

The importance of the benthic community as a component of estuarine and coastal marine ecosystems cannot be overemphasized. The cycling of material through the benthic system is directly coupled with the productivity of these ecosystems, and an understanding of such processes is paramount in evaluating the effects of the anthropogenic and natural perturbations routinely imposed on them. This symposium volume presents a compilation of recent thinking regarding the dynamics of shallow-water, soft-bottom benthic communities and provides a much-needed update on this rapidly expanding field of study. Although many of the processes discussed also occur in deep-sea and hard-substrate communities, such communities are largely ignored.

One significant but largely unknown factor in the cycling of nutrients through the benthic community is the rate of anaerobic metabolism. Pamatmat has painstakingly developed a direct calorimetry method to evaluate the importance of this process in several species of benthic macrofauna. Application of this technique to a wide variety of benthic organisms and the community as a whole will provide necessary information regarding these rates and the importance of anaerobiosis in the overall dynamics of this system.

Bell and Coull examine the interaction of two significant groups of benthic organisms, the juvenile macrofauna (temporary meiofauna) and the permanent meiofauna. Their exploratory experiments have shown that the meiofauna have a significant adverse effect on recruitment of the macrofauna. Such interactions must be considered in evaluating rates of population recruitment and mortality.

Nixon and associates report seasonal data indicating that one nutrient cycle, that of phosphate, is dominated by sediment-water exchanges. In a unique cross-fertilization of geochemistry and biology, Aller has examined the importance of tube-dwelling macrofauna on the fluxes of nutrients across the sediment-water interface. He reports that the activities of these animals and their burrows significantly influence the flux rates of various nutrients.

Another stimulating paper in this volume is that of Hobbie and Lee, who present the novel hypothesis that extracellular mucopolysaccharides produced by microbes, and not the microbes themselves, constitute the most important food source for many benthic animals. In examining the interaction of microorganisms and infauna, Yingst and Rhoads present an equally exciting hypothesis that faunal bioturbation of the sediments stimulates bacterial growth, which in turn enhances the food supply of the bioturbating animals.

Among the other 17 contributions to the volume are thought-provoking reviews of secondary production (Warwick), population and community patterns (Dayton and Oliver), fluxes and utilization of organic matter (Hargrave), and availability and utilization of detritus (Tenore and Rice).

In general, I find this volume a timely contribution to the field of benthic ecology and to the study of shallow marine ecosystems in general. Approximately a third of the contributions provide new insights that will influence the direction of future research in the field.

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Synthetic Gemstones

Gems Made by Man. KURT NASSAU. Chilton, Radnor, Pa., 1980. xviii, 364 pp., illus., + plates. $28.50.

Kurt Nassau's *Gems Made by Man* received extensive prepublication publicity, and its readers will not be disappointed.

Gems Made by Man is written with a scholarly attention to detail in both its technical and its historical sections. The treatments of the commercial development of processes for the growth of gemstones and of current commercial practice are particularly thorough. Much of the subject matter has been described in articles by Nassau, particularly in the *Lapidary Journal*, and there is, of course, considerable overlap with the reviewer's *Man-Made Gemstones* (Halsted [Wiley], 1979), but there is also an extensive amount of original material.

The book consists of 26 chapters arranged in eight sections. The first section is introductory and includes brief details of growth techniques and gem testing. A relatively long second section deals with the growth of ruby and sapphire, stressing particularly the work of Auguste Verneuil, who can be considered the originator of the modern synthetic gemstone industry, and the development of his flame-fusion technique from its less successful predecessors. Section 3 covers quartz, with chapters on the growth of colorless and colored crystals (amethyst, citrine, and so on). Section 4 deals with emerald, with mention of other beryls. Section 5 deals with the growth of diamond. Diamond substitutes are treated in section 6 with particular emphasis on cubic zirconia but with detailed discussion also of synthetic garnets and earlier alternatives to diamond. Section 7 treats a range of materials and topics, with a brief discussion of alexandrite, turquoise, and the like, which are grown on a fairly small scale, and a fairly detailed discussion of opals, imitation gems, and the treatment of gemstones by heat and irradiation. The final section contains a survey of crystal growth techniques and a detailed and authoritative chapter on the origin of color in gemstones.

The book contains for each material a section of technical data, with a useful summary of properties and structure together with notes on the choice of conditions of preparation, and so forth. Suggestions for additional reading are included with each chapter, but serious readers may be irritated at the absence of a comprehensive list of references. On the other hand, the patent literature is referenced comprehensively. *Gems Made by Man* is well-illustrated, interesting reading even for nonspecialists.

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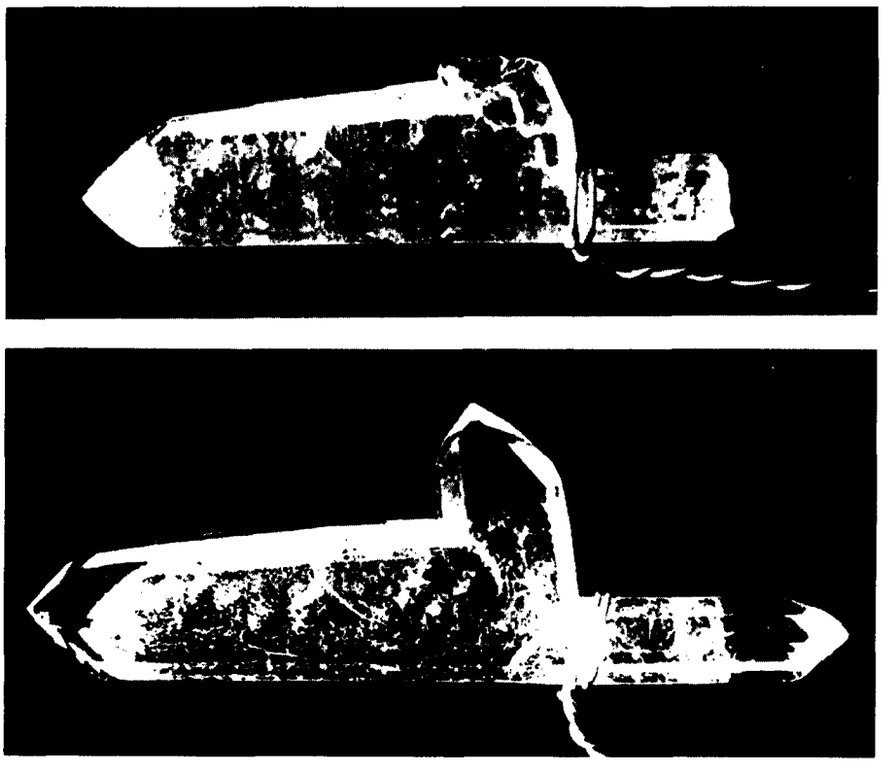

A natural quartz crystal 2½ centimeters long, and the same crystal after a 5-month hydrothermal growth experiment by Giorgio Spezia in 1908. Quartz was the second gemstone material to be synthesized in useful size (ruby was the first). Though not the first to grow quartz by a hydrothermal process, Spezia did the key work, published in a series of reports in 1898 to 1908. "Spezia supported his seeds with silver wire in a steel pressure vessel lined with silver. Growth occurred under pressure from a hot water solution containing sodium silicate . . . , using crushed natural quartz as the feed material. A typical growth run lasted 199 days and produced, at most, 15 mm (⅝ in) of new growth. Curiously enough, Spezia placed his hotter feed-region at the top and his cooler growth-region at the lower end of this growth vessel. He expected the denser solution to move downward, but this was opposed by thermal convection and explains his very slow growth rate. All he would have had to do to obtain much more rapid growth was to turn his vessel upside-down." [Reproduced in *Gems Made by Man* courtesy of P. F. Kerr and E. Armstrong (E. A. Wood)]

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