tant secondary and explanatory literature.

Since the 17th century was the time in which the concepts of classical physics were clearly formulated, Dugas' excellent book has a strategic importance for our understanding of physics itself. It deals with the work of great intellectual giants —Kepler, Stevin, Galileo, Descartes, Huygens, Newton, Hooke, Leibniz—and enough information is supplied about the mechanical theories in antiquity and the Middle Ages to enable the reader to set the theories of the 17th century in proper perspective. Although Dugas uses the excellent method of allowing his main participants to speak for themselves, he manages to convey the spirit of invention that characterizes creative work in science, and he shows the delicate connections between brute experience, contrived experiments, logical formalism and mathematics, hypothesis and intuition, and even metaphysics.

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Traité de Zoologie: Anatomie, Systématique, Biologie. vol. XII, **Vertébrés:** Généralités, embryologie topographique, anatomie comparée, caractéristiques biochimiques. Pierre P. Grassé, Ed. Masson, Paris, 1954. 1145 pp. Illus. Paper, F. 9800; cloth, F. 10550.

Although it is primarily devoted to vertebrate morphology, this volume departs from the usual treatment in two obvious respects. Novel inclusions are represented by the two short concluding chapters, one on vertebrate chromosomes (Matthey), the other on biochemical features of vertebrates (Florkin). On the other hand, several missing topics such as adult digestive and respiratory systems, endocrines, and musculature (to be treated in five subsequent volumes devoted to the various vertebrate classes), prevent this volume from serving as a complete comparative morphology textbook.

Vertébrés consists of a series of authoritative chapters contributed by Belgian, French, and Swiss authors. A short introductory chapter by Brien and Dalcq stresses the need for understanding the dynamic developmental processes resulting in adult form, since viable inherited changes in patterns of development represent "amendments to the laws of development" underlying evolutionary change. The authors then proceed to brief considerations of general features of early vertebrate development, adult morphology, and general aspects of vertebrate evolution. A well-illustrated section on comparative vertebrate embryology by Dalcq and Pasteels follows, and, where possible, the descriptive details are based on the dynamic relationships, such as relative movements and inductive interactions, among embryonic parts.

Most of the remaining chapters in this volume are devoted to detailed comparative accounts of the morphology and evolution of vertebrate organs and systems. They include the central and peripheral nervous systems (Cordier), the eye (Rochon-Duvigneaud), statoacoustical (Cordier and Dalcq) and olfactory (Gérard) organs. Moreover, the skeletal system is considered in several chapters, one on the cranium (Piveteau) and several by Devillers on the vertebral column, ribs, sternum, and paired appendages. The histochemist, Lison, contributes a chapter on the teeth, in which he considers their comparative histogenesis and histology and gives a short discourse on their evolution. This is followed by detailed chapters on the circulatory (Stephan) and urogenital (Gérard) systems.

Literature citations following each chapter vary in completeness; a detailed appendix facilitates the search for specific topics.

Vertébrés, although it is well written, illustrated, and indexed, may not find its way into many private libraries because of its high price and because its complete usefulness depends on its supplementation by the remaining volumes of the series.

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Geology in Engineering. John R. Schultz and Arthur B. Cleaves. Wiley, New York; Chapman and Hall, London, 1955. ix + 592 pp. Illus. $8.75.

There has been a notable shortage of books that treat the application of geology to civil engineering. As a consequence *Geology and Engineering* should be popular as a textbook for introducing engineers to the aspects of geology that are indispensable to sound engineering and as a reference for engineering geologists and practicing engineers.

The wide experience of the authors in the fields of teaching and practicing geology is reflected both in the comprehensive quality of the subject matter and illustrations and in the judicious selection of topic sequences and reference material. There are 22 chapters, the first of which introduces the engineer to the development of the science of geology and its relationship in more recent time to civil engineering.

Following this introduction are 12 chapters dealing rather generally with the engineering significance of minerals, rocks, geologic structure, subsurface water, weathering, erosion, desert land forms, shore lines and beaches, frost action, landslides, volcanoes, and earthquakes. Among these the chapter on frost action is the first good discussion in a textbook of this type of the engineering problems related to perennially frozen ground. Such features as permafrost, active layer, talik, thermal regime, pingo, frost blister, slud and zero curtain should arouse the curiosity of students and practitioners alike and should be studied carefully for their importance in arctic engineering projects.

Chapter 14, "Historical geology," a convenient division mark between the earlier and subsequent topics, might be regarded by some readers as superfluous to the book. However, in the second paragraph the authors make this statement, which might well have been placed in Chapter 1, and which budding engineering geologists should heed if they covet the respect of engineers: "the lengthy elaboration of paleontological and historical data in geologic reports intended primarily for civil engineers has perhaps done more than anything else to discourage the application of geology to civil engineering." The word *perhaps* in the foregoing quotation could be deleted safely.

Chapters 15 and 16 discuss the indispensability of geologic maps and sections and aerial photography as implements for obtaining complete predesign information. Chapter 17, "Soil mechanics," by E. J. Yoder, is a commendable discussion of the engineering classifications and properties of soils and their behavior under various conditions of engineering use. Chapter 18, "Subsurface exploration," may be criticized for devoting only one-fourth of its pages to the conventional and more reliable methods of exploring foundations by small- and large-diameter core borings, while three-fourths of the discussion is given to geophysical methods which, although useful, are limited in their reliability.

The last four chapters conclude the book with discussions on dams and reservoirs, tunnels, highways and airfields, and concrete aggregates; from the viewpoint of the engineering geologist these chapters constitute the main structure supported by the foundation of the preceding chapters of the book.

Weaknesses that are unavoidable in a work of this magnitude are limited chiefly to certain generalizations that should be modified in the interest of students. An example is the statement on page 91 that "Joints oriented approximately at right angles to the working face present the most unfavorable condition." Although this observation is correct insofar as it applies to quarrying or tunneling, the exact opposite is true with respect to a