in 1952, Edwards was well qualified to undertake this project, and he was one of the few writers with the necessary background who have appeared in this field.

The work is divided into four periods —pre-Colonial, Colonial, post-Revolution, and post-Civil War—and this division reflects its organization as a survey of general development. This approach, which differs from the more conventional presentation, made either in terms of the materials used or by major structural systems, permits a clearer discussion of the complex relationships between the practical need for bridges, the current state of technology, the availability of materials, and the influence of tradition.

Several other aspects of the work are unusual and of very real value. One is the great amount of material that Edwards uncovered on American bridges built before and shortly after the Revolution, including several bridges in South America. Since they are, naturally, the least well documented, the bridges of this period have received only the most casual attention from historians, and information on fewer than half a dozen of them has been readily available until now. The inclusion of a number of unbuilt projects in the discussion is unique. The many freak proposals are not mentioned, only those which appear to have been rationally conceived, and plausible, if bold, for their time. Ellet's proposed iron suspension spans for St. Louis (1840) and Georgetown, Maryland (1852), receive a deserved amount of attention. A further interesting sidelight is the description of a little known, unbuilt, iron-bowstring truss designed in 1796 by the civil engineer Robert Fulton. Far from being of marginal value, information of this sort is as essential in a comprehensive study of the history of bridges as description of completed works.

It is regrettable that a need for economy in publishing the volume permitted the inclusion of only a small portion of the material resulting from the author's extensive and very competent research. This same restriction made it necessary to confine the illustrations to a single grouping at the end of the book—a disconcerting arrangement. Careful editing would have prevented the mismatching of two photographs with their captions and with the text.

These are insignificant faults compared to the major contribution Edwards made in a branch of technological history which has received so little serious attention.

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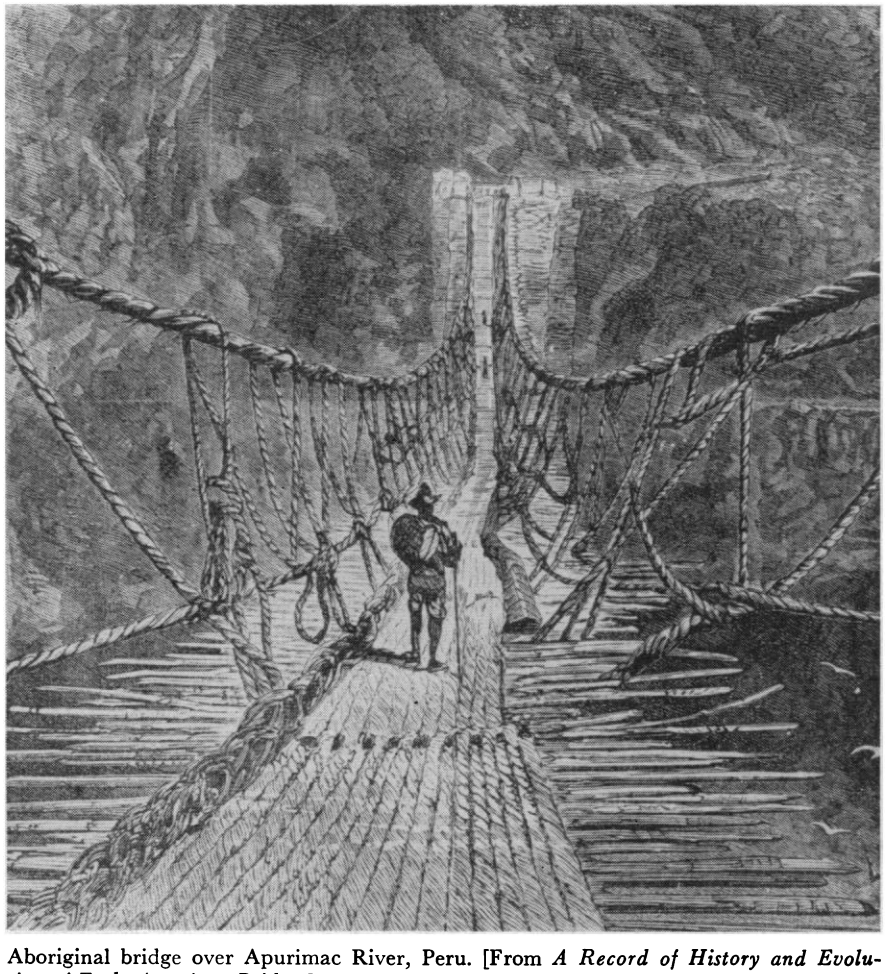

Aboriginal bridge over Apurimac River, Peru. [From *A Record of History and Evolution of Early American Bridges*]

The Cellular Slime Molds. John Tyler Bonner. Princeton University Press, Princeton, N.J., 1959. viii + 150 pp. Illus. $4.

In his previous books, Bonner has displayed a charming gift for light treatment of biological problems. The present work, envisioned in the introduction as "a comprehensive survey of all the different known aspects of the biology of the cellular slime molds" and "a useful summary of all the work done before 1959," is a more scholarly undertaking. It is not nearly so successful.

My most general objection to this book is that, while Bonner takes decided stands in evaluating previous investigations, he does not provide enough factual information about experimental methods and results to enable readers to do their own evaluating. It is an astonishing fact that the 150 pages include one histogram, one semidiagrammatic graph, and no tables at all, to represent what is, by now, a considerable body of quantitative information about slime mold development, genetics, and physiology.

Despite the author's intention of providing a complete survey, a number of pertinent papers and experiments have been slighted. For example, the superb paper of Raper and Fennell on the construction of the fruiting body—which serves as a foundation of the modern description of culmination—is accorded a single short paragraph, on page 107, among pages of observations and considerations of much less import. The recent work of my coworkers and me on the identification of the initiator cell for slime mold aggregation is cited in a footnote on page 89 but is not described, and the experiments which showed a Poissonian distribution of aggregative centers among small population samples, as well as a large body of data concerning synergistic aggregation by cell mixtures of wild type and aggregateless mutants—work which provided the basis

for the initiator cell hypothesis—are not mentioned at all. Wilson and Ross' photomicrographic data, which suggest the possibility of meiosis, are mentioned briefly but are not pictured, and the chromosomal figures are not evaluated. Instead, on pages 39 and 40 Bonner belabors a very dead horse—the original scheme of sexuality that was proposed by Wilson and that died in 1957 by its creator's hand. As one of the pallbearers, I submit that the modified scheme of Wilson and Ross, summarily dismissed on page 41, deserves far more serious consideration than it is granted. Finally, Gregg's stimulating work on the appearance of surface antigens during morphogenesis is covered in a single short paragraph, on page 112, without inclusion of specific data.

In view of the paucity of detailed, quantitative information and the rather superficial treatment of underlying genetic and biochemical problems, this book does not seem to me to be an improvement upon the several reviews of the biology of the cellular slime molds that are now available.

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Exploration Hydrobiologique des Lacs Kivu, Édouard et Albert (1952–1954). Scientific results. vol. 3, fascicule 3. Institut Royal des Sciences Naturelles de Belgique, Brussels, 1959. 196 pp. Illus.

Among the most important of the reports on the fauna and flora of tropical areas published in recent years have been the several extensive series of volumes issued by the Institute of the National Parks of the Belgian Congo. Somewhat in the nature of a companion series are those issued by the Royal Institute of Natural Sciences of Belgium on the natural history of African areas which have been the subject of special Belgian explorations. The current reports on lakes Kivu, Edward, and Albert follow and are comparable to several volumes dealing with the 1946–1947 hydrobiological exploration of Lake Tanganyika.

The present fascicule contains six reports. The first of these, by Jean Verbeke of Brussels, deals with the stomach and intestinal contents of the fish of lakes Edward and Albert. In the brief introduction the relatively impoverished fish fauna of Lake Edward, consisting of 27 species, is compared to the fish fauna of Lake Albert, which includes 41 recorded species. There follow extensive lists and tables of the fish and of their food resources, based on many captures—of 17 and 23 species, respectively—from the two lakes. Details of place, time, condition, method of capture, and so on for each fish examined are well documented and are presented together with an enumeration of the stomach and intestinal contents identified. An ultimate practical objective of reports such as this is evidently the acquisition of sufficient information to make possible the improvement of the fish resources of these lakes, perhaps partly through the introduction of species which do not now occur.

The second paper, on Cladocera (water fleas), is by Vincent Brehm of Lunz am See, who has had over 45 years of experience with the group. It deals with the Cladocera of the three lakes, mainly those taken in and about the lakes but also those removed from fish. The discussion and tabulation concern 24 species, none of which is described as new, though the anatomy and specific characters of several are described and illustrated.

In the third paper, W. D. Hincks, of Manchester, reports briefly on 200 specimens of Dermaptera (earwings), representing 10 species. Except for two poorly known species of *Spongovostox,* those recorded are rather common, widely distributed species.

A rather full report on the Trichoptera (caddis flies) of Lake Albert, by Serge Jacquemart of Brussels, comprises the fourth paper. A total of 25 species are treated, the majority being illustrated; of the 25, three are described as new. About half of the species were not encountered at lakes Kivu and Edward, according to a report by Jacquemart in fascicule 2.

Larvae of Chironomidae (midges) of the three lakes are dealt with in detail by Anna Chrispeels of Edinburgh. Twenty-six species are treated, and all of them are illustrated, but specific names could not be applied with certainty to any of them. Generic or species-group placement must suffice until rearing of the larvae and association of the individuals with identified adults have been accomplished. The Chironomidae are one of the principal foods of the lake fishes, and this situation demonstrates the exacting and time-consuming biological and taxonomic work required for a full understanding of the insects comprising much of the diet of these important animals. The illustrations consist of fine, detailed line drawings, mainly of head structures and terminal portions of the abdomen. Descriptions, identification keys, documentation of collecting stations and material removed from fish, and a bibliography are included. Adult Chironomidae were discussed by P. Freeman in fascicule 2.

The sixth and final paper is a brief account of the Bostrychidae (false powder-post beetles) by J.-M. Vrydagh of Brussels. Sixteen species, in nine genera, of this family were collected near the three lakes. The author expresses the opinion that, while adults sometimes are attracted to light at night, it is a mistake to consider this a general habit.

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Elements of Physical Metallurgy. Albert G. Guy. Addison-Wesley, Reading, Mass., ed. 2, 1959. xvi + 528 pp. Illus. $9.50.

Elements of Physical Metallurgy is a well-organized, well-written book on physical metallurgy. The author has fulfilled his objective of writing a book which can be used as a textbook for science, engineering, and metallurgy students. It should also prove a useful addition to the library of the practicing metallurgist, since it presents the fundamentals of physical metallurgy in a very readable manner and (in this second edition) covers the latest concepts of dislocation theory.

In the first two chapters, the field of metallurgy is defined and surveyed. In the next four chapters atomic theory, crystal structure, phases in metal systems, and phase diagrams are covered. In the latter chapters some industrially important equilibrium diagrams are discussed. With these chapters as a background, the author then discusses the physical properties, elasticity, plasticity, and corrosion (air, water, and liquid metal) of metals.

The last four chapters are concerned with reactions in metals: diffusion in metals; recovery, recrystallization, and grain growth; age hardening; and heat treatment of steels. The book is well illustrated, and each chapter concludes with a list of references as well as a number of problems. Throughout the book, the author shows how the basic principles are applied in industry.

This book covers a great deal of material and should make an excellent text