tains, in an orderly form from the pathologist's point of view, a review of the recent findings with respect to the diseases discussed. Some of the material is excellent. The chapter headings give an excellent idea of the scope of the volume: "Diseases of the Gastro-intestinal Tract," "Diseases of the Liver and Biliary Tract," "The Anaemias," "Diseases of the Blood, the Clotting Mechanism," "Hypertension," "Diseases of the Kidney and Genito-urinary Tract," "Adrenal Diseases," "Diseases of Iodine Metabolism," "Diseases of Bone and the Parathyroid Gland," "Diseases of the Nervous System," "Diseases of Muscle," "Diabetes Mellitus and Hypoglycaemia," "Disorders of Nutrition," "Miscellaneous Disorders of Metabolism: I. Some Abnormalities of Amino-acid and Haemoglobin Metabolism," "Miscellaneous Disorders of Metabolism: II. Connective Tissue Disorders," "Miscellaneous Disorders of Metabolism: III. Porphyrias," "Miscellaneous Disorders of Metabolism: IV. Haemochromatosis," "Miscellaneous Disorders of Metabolism: V. Glycogen Storage Diseases and Galactosaemia," "Miscellaneous Disorders of Metabolism: VI. Lipidoses," and "Disorders of the Reproductive Organs."

ROGER J. WILLIAMS
University of Texas

Stress and Strain in Bones. Their relation to fractures and osteogenesis. F. Gaynor Evans. Thomas, Springfield, Ill., 1957. 245 pp. Illus. $6.50.

In this short monograph the author has attempted to bring together most of the data, including his own extensive researches, pertaining to the mechanical behavior of various bones, the structural characteristics of bone as a tissue, and the relationship of these mechanical data to osteogenesis, fracture healing, and the production of fractures.

He has wisely included a simple and easily understood introductory chapter on the elementary principles of mechanics and stress analysis and a glossary of engineering terms at the end of the book. Nine of the 14 chapters (not including the introduction) are devoted to the mechanical behavior of bones and bone, including methods and mathematical analyses. The rest are devoted to the correlation of these data with biological phenomena.

Throughout the book the author has very carefully and critically evaluated the vast literature in the field and has correctly pointed out a number of errors, both in semantics and interpretation, which have been perpetuated for many years; in doing so he has done the field a distinct service. I believe, however, that the sections on the purely mechanical aspects of the problem could have been improved if the author had included a small section, with diagrams and illustrations, on the external force systems causing stress and strain in bone—that is, gravity, inertia, ground forces, and muscle forces—demonstrating how they produce stress and strain in bone. This is particularly true of muscle action, since failure to include the effect of muscle action vitiates much of the published data on the stress distribution, stress magnitude, and so forth, on intact long bones. Most of these tests have been carried out on statically or dynamically loaded femurs by means of one applied force—for example, on the head of the femur.

Since muscles act not only by increasing the magnitude but by changing the line of action of the resultant force, and exert their effects only between their origins and their insertions, the resultant stress distribution and the magnitude of the stress can be markedly altered. Static or dynamic tests, therefore, on firmly fixed femurs, for example, loaded through the femoral head, with the opposing force only at the tibial end, have very little in common with the actual distribution in the femur *in vivo*. The author is aware of this, since he included some of Pauwels' work on models, in which various braces were applied to simulate certain muscle actions, but I do not think he emphasizes sufficiently the deficiency of data collected on *in vitro* loading and the impossibility of correlating this with the actual conditions as they are *in vivo*. The studies of the author and his collaborators recording strain directly from living animals should make it possible, in the future, to circumvent a great many of these difficulties.

The mechanical data which the author has compiled from his own and other researches on the structural characteristics of various bones and on bone as a tissue should prove very valuable to workers concerned with the safety and tolerances of the human body under circumstances of mechanical stress (as in automobiles, airplanes, and so forth) and should help these groups in designing safer vehicles.

The section devoted to fracture production should prove valuable to orthopedic surgeons, particularly in the evaluation of the type of internal or external support to be used in immobilizing fractures and in protecting against the type of bone stress most likely to disrupt continuity of the opposed bone surfaces.

In the sections which will most interest biologists—those on the relationship between mechanical stress, osteogenesis, bone architecture, fracture healing, and so forth—the author is unavoidably hampered, not only by the lack of previous critical experiments, but also by the fact that in the past the problem has not even been defined conceptually in terms of modern biology. Attempts to correlate trabecular orientation of spongy bone and computed or *in vitro* determined stress lines in models and intact long bones is quite naive, and this is well brought out by the author. Unfortunately, most of the literature in the past has focused on gross architectural changes such as trabecular pattern in spongy bone, but little has been done with ultrastructural changes in compact bone. For the most part, the experimental work in the past has not been very critical or conclusive. Most of these deficiencies are well discussed by the author, including the lack of any good suggestions about the mechanisms involved whereby mechanical stress alters bone architecture, healing, and so on. Again, I believe the author might have improved this section with some more pointed comments on the need to consider the biological effects of mechanical stress at various ultrastructural and structural levels. The orientation of collagen fibrils, primitive fibers, fibers, fiber bundles, and so forth may be quite different even in compact bone, and the reaction to mechanical stress at these different levels may be quite different. The same is true of the collagen in trabeculae. There may be no relationship between the orientation of the gross trabeculae, the orientation of the ultrastructural components of the trabeculae and their relative behavior to mechanical stress. If mechanical stress does affect the production and resorption of bone and the ultrastructural arrangement of the components of bone, it does so by physiochemical means not yet even defined conceptually, let alone demonstrated experimentally.

In his well-written monograph, Evans has, by assembling the data, critically evaluating them, and pointing up deficiencies in the biological approaches to this important problem, pointed the way, and this book should do much to stimulate more basic research in this field.

MELVIN J. GLIMCHER
Massachusetts Institute of Technology

William Harvey. His Life and Times: His Discoveries: His Methods. Louis Chauvois. Philosophical Library, New York, 1957. 271 pp. Illus. $7.50.

The celebrations of the tercentennary of William Harvey's death in 1957 may have motivated many to look for an adequate biography of the physician of Charles I, who made what is probably the greatest physiological discovery of all time. They will have discovered to their surprise that no recent work of this kind exists.

Louis Chauvois' book fills this gap quite well. It contains what the title promises. It gives a very scholarly and many-sided account of Harvey's times. It summarizes all the known data on Harvey, adding some that are new. Chauvois, a scientist himself, gives a very clear and original analysis of the scientific problems involved. His genuine enthusiasm for his hero is such an asset to the book that one gladly overlooks a few minor exaggerations, injustices, and omissions and gets used to a style the superlatives of which should sound better in French than in English.

ERWIN H. ACKERKNECHT
University of Zurich

Building an Engineering Career. Clement C. Williams and Erich A. Farber. McGraw-Hill, New York, ed. 3, 1957. x + 299 pp. Illus. $4.75.

Some 30 or 40 years ago, the professors of electrical engineering decided that young electrical engineers ought to learn something about the science of illumination. After all, most modern lights were electric, weren't they? About the same time it was decided, also, that such students ought to learn something about electric railways because of their growing importance in transportation. Unfortunately, no one knew enough about either to construct a full 16-week semester course from his material. A compromise was, therefore, reached, in which a course in "Illumination and Electric Railways" was put together. This strange marriage of subject matter was copied by other schools, and eventually such a course appeared in many engineering catalogs. It has long since gone the way of courses in stereometry, for which we can all be thankful.

A new trend, one that is probably only 15 or 20 years old, is to teach a course on "what every young engineer ought to know." This course usually includes the history of engineering, an insight into the "engineering method" (some engineers still think they have a patent on quantitative thinking), a discussion on how and what to study, a preview of all engineering courses, a taste of ethics, and a glance into the future. Such things as how to get a job and how to run a slide rule are sometimes included, if the book doesn't get too thick and heavy.

This volume does not contain all these features but does contain most of them. It is divided into three major parts, the first of which is intended to tell the student how to get his education, and the second, to give him some historical background. The third, called "Engineering Achievements," (its purpose is not at all clear to me), recounts, almost in encyclopedia form, some of the wonders of engineering. Apparently this section is supposed to be a "come-on" to convince the student, while he is studying mathematics, physics, chemistry, English, and all the other subjects that seem to be only remotely connected with his engineering goal, that all is well, the faculty is not leading him astray, and eventually he, too, will design a bridge and rocket off to the moon.

There must now be dozens of little books aimed at guiding the student's first unsure steps toward professionalism. I have grave doubts that any of them really accomplish their purpose. There must be many good teachers who, early in their students' careers, inspire them and help them to see more clearly what they may accomplish in their four years at college. But this kind of inspiration is a personal thing, and any attempt to catch the full flavor in a written document is fraught with danger.

This little book, which was originally written by Clement C. Williams, an engineer who in his later years was president of Lehigh University, has been brought up to date, and certain new material has been added. It is a textbook that undoubtedly goes hand-in-hand with a series of lectures. It is not a book that may be expected to inspire the casual reader or the unguided student.

ERIC A. WALKER
Pennsylvania State University

The Physiology of Fishes. vol. I. *Metabolism.* Margaret E. Brown, Ed. Academic Press, New York, 1957. xiii + 447 pp. Illus. $12.

Young physiologists have often remarked to me that they were writing a physiology of fishes. Encouragement was never possible because of the tremendous difficulty of the venture. But the need for such a work has been increasing sharply in recent years, and volume I, *Metabolism*, of *The Physiology of Fishes*, by Margaret E. Brown and coauthors, is very welcome. It is no surprise that the contemplated single volume had to be published as two, or that the work is not a textbook in the teaching meaning of the term. If the work may be said to have a shortcoming, it is in the limited integration of such factual knowledge as is now available. Whether for printing economy or by choice of the authors, there is insufficient histology in the first volume.

Much more may be said in praise of the enterprise. An admirable group of authors were persuaded to participate, and the work clearly reflects the authority of its members. (As an aside it may be noted that the authors were drawn six from Great Britain, three from Canada, and one from the United States. To an administrator in this wealthy country it is sobering to think that, in spite of the large number of workers engaged in practical fisheries in this country, perhaps we do not provide a proportionate number of leaders in so basic an area as physiology. But of more than 1000 basic literature citations, about 37 percent are from journals edited in the United States—a figure that is reassuring, though perhaps smaller than might be expected from the large sums of money spent here on fisheries research.)

From the first chapter, that by F. E. J. Fry on the aquatic respiration of fish, there emerges a truism that is generally borne out through the work. One might assume that greater complexity would always be encountered in a study of mammalian function than in that of piscine function. But, as is revealed in Fry's careful analysis, the metabolic rates of fishes must adapt over a wide range of environmental temperatures, and the additional parameter of temperature adaptation leads not to simplicity but to complexity. Similarly, the combination of gill respiration with gut, pharyngeal, and lung respiration, treated in a later chapter, reflects itself in the properties of the blood and the adaptations of the circulatory system. The subject of fish physiology is therefore revealed as being exceptionally challenging, and it is to be hoped that this valuable book will stimulate ever wider interest and activity in the subject.

Space will not permit description of individual chapters. Coupled with the chapters on the systems supporting metabolism are chapters on skin and scales, on development and hatching, and on growth. Volume II will present the nervous and sensory systems, behavior, and such special topics as electric organs, swimbladder, luminous organs, color changes, and physiological genetics. It may suffice, then, to say that the book will be required reading for all professional fisheries investigators, to whom the carefully selected bibliography alone will be worth the cost of the volume. In addition, the book is highly recommended to every student and scientist interested either in fish or in comparative physiology or biochemistry.

ARTHUR W. MARTIN
University of Washington

A History of Industrial Chemistry. F. Sherwood Taylor. Abelard-Schuman, New York, 1957. xvi + 467 pp. Illus. + plates. $7.50.

After an introductory summary, the author devotes about one-third of his book to the "prescientific" period and two-thirds to "the scientific chemical industries." The first part is an interesting survey of the older chemical industries,