characters, descriptions, color, size, developmental stages, habits, relation to man, abundance, range, details of occurrence in the western Atlantic, synonyms, and references. On pages 187–194, Merriman, Olsen, Wheatland, and Calhoun record the life-history and habits of *Raja erinacea*.

Those who use part two will be amazed to find 1388 footnotes on 562 pages. This distracts the reader who must search for the footnotes; at least 80 percent of this material would be better included in the text.

This book includes 27 genera and 67 species, which make a total of 66 genera and 137 species for the two big volumes. On the basis of an estimate of 1000 fish species in the "western North Atlantic," the present rate of completion of this project will occupy the indefinite future, with a minimum of 13 more volumes. The editorial board may need to alter present plans sufficiently to expedite the completion of this important undertaking in a reasonable length of time.

Some ichthyologists may question the authors' concept of a species in parts one and two, since in those few cases where many specimens were available, a statistical appraisal of morphologic characters used in distinguishing closely related forms is lacking. This cannot be considered as a too serious weakness in the first two volumes, for where large fishes are involved, such as sharks and rays, only a few specimens of a species, sometimes only a single specimen, are preserved in museums. Whereas, when small species of bony fishes are involved usually extensive series from numerous localities are available for statistical studies.

However, those who use part two may have complete confidence in this work. The classification and nomenclature are conservative, and the drawings were expertly prepared. The discussions, descriptions, and conclusions were written with mature judgment and are presented with deliberate and painstaking care.

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Feeding Poultry. Gustave F. Heuser, Wiley, New York; Chapman and Hall, London, ed. 2, 1955. viii + 632 pp. Illus. $7.50.

In this edition the author has provided an almost new textbook in that it has been nearly rewritten. It brings together the practices of feeding and the science of poultry nutrition.

On the whole, the book is well organized and clearly written. It begins with the feeding problem and the objectives in poultry feeding, then moves on to a discussion of the nutrients and ingredients used, the essential factors in a poultry diet, and systems and practices of feeding. The last part deals with the feeding of chickens for specific functions and the feeding of turkeys, waterfowl, and other species of birds. A number of recommended rations is included in the appendix.

Although no attempt is made to include all the poultry nutrition studies reported in the literature, an extensive list of references is given at the ends of the chapters for the interest of those who wish additional information. The author has attempted to evaluate contradictory information, thus saving the reader the time and effort of interpretation.

Heuser states that the book is designed to meet the needs of poultry students, practical poultrymen, feed dealers, and others interested in poultry feeding. Since he has emphasized the practical more than the technical phases, he has accomplished his objective.

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Linear Equations in Applied Mechanics. H. F. P. Purday. Oliver & Boyd, Edinburgh–London; Interscience New York, 1954. xiv + 240 pp. Illus. $3.50.

Much of the mathematical structure underlying the physical theories that the engineer deals with in the fields of mechanical vibrations, flow of fluids, heat, electricity, automation, and so forth, is linear analysis. The common structure of linear algebraic equations and functional equations of various kinds has been recognized and exploited for a long time.

According to the author's preface, "The object of this book is to help readers with an elementary knowledge of the calculus to get acquainted with the easier aspects of linear algebraic equations, difference equations, ordinary and partial differential equations, and integral equations as well as the associated ideas of matrices, determinants, invariants, vectors, tensors, conjugate functions, orthogonal functions, series, etc." This is a very worth-while undertaking, and the book is the more valuable because it includes an account of the more elementary methods of solution by numerical, mechanical, and electric means of computation. A good deal of numerical work applied to actual engineering problems is given in full.

No attempt is made at mathematical rigor, and mathematical proofs are almost entirely absent. This is as it should be in a book of this kind. On the other hand, one would expect that strict mathematical reasoning would be replaced by appeal to intuition, by emphasis on analogies, and by extensive motivation of the procedures described. However, there is very little of this in the book. Tensors are introduced as quantities that transform according to a certain rule, but why this rule is chosen and no other is nowhere explained. The product of matrices is defined as an arbitrary convention with no mention of the fact that it follows logically from the result of successive linear substitutions.

The unifying concept of all linear analysis, that of linear transformation, is not discussed at all, and the term *linear operator* is not even mentioned. Matrices are employed only for convenience of notation, with no allusion to their operational aspect. Because of this lack of logical integration and motivation, the book has the character of a technical manual. One also questions the didactic value of its organization. The elementary arithmetic of complex numbers is taken up in some detail close to the end, with a two-page treatment of integral transforms including Laplace's following a few pages later and a few brief paragraphs on the theory of linear integral equations at the end.

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Le Magnétisme des Corps Célestes. vol. 1, **Magnétisme Solaire et Stellaire Couronne Solaire et Lumière Zodiacale.** vol. 2, **Variations et Origine du Géomagnétisme.** parts II and III of *Physique Cosmique*. A. Dauvillier. Hermann, Paris, 1954. vol. 1, 171 pp. Illus. + plates. Paper, F. 1600. vol. 2, 161 pp. Illus. + plates. Paper, F. 1500.

These two volumes by the well-known professor of cosmic physics at the University of France have as their object "to present succinctly what is known about cosmic magnetic phenomena and attempt to coordinate it . . . to try to bring some clarity into a little known and very controversial subject." In accomplishing the first of these three objectives, the author is fairly successful, and consequently the two volumes serve a useful purpose for those who would like a summary of some of the literature in this field during the past few decades. Although the books are written in French, the style and language employed present little difficulty for an English reader who has a limited ability with that language.

The subject matter covers a very wide range. The first volume begins with an excellent presentation of the Störmer theory of the motion of high-energy charged particles in the field of a magnetic dipole and continues with discussions of the magnetic fields of the sun and stars, of the solar corona, and of the

zodiacal light. The second volume deals more fully with the magnetism of the earth—its origin, its variations, and its association with cosmic radiation—followed by two highly speculative chapters on magnetic phenomena associated with the moon and comets. In covering this wide field much of the material has been brought up to recent date, even including some of the current thinking on radio astronomy.

There are serious shortcomings in that the author has omitted much important research and has included much that is trivial and much that is not favorably regarded by outstanding investigators in the field. The interpretations that the author places on facts of observation and the conclusions that he draws regarding the nature and origin of the phenomena he describes are in many cases in disagreement with my opinions and those of others. For this reason, the reader is warned against accepting statements in these two volumes without critical examination.

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Sponsored Research Policy of Colleges and Universities. A report of the Committee on Institutional Research Policy. American Council on Education, Washington 6, 1954. vii + 95 pp. $1.50.

The academic world, if not the general public, has been made increasingly aware that research, especially scientific research, is getting to be expensive business. An ever-increasing share of this expense is being borne by nonuniversity funds directed to universities. Two years ago, recognizing the problems growing out of these trends, the committee authoring the present report was appointed. It is refreshing to find a committee reporting so promptly and concisely.

The document is short and, although somewhat repetitious, it is interesting reading. According to it, universities, colleges, and such institutions exist to extend, conserve, and disseminate knowledge. They ". . . have a heavy responsibility to encourage the free exercise of intellectual curiosity . . ." without worrying overmuch about distinctions between basic and applied research. "It is crucial to the National Welfare that research in Educational Institutions be continued and increased, and sponsored research is indispensable to this end." However, it should be recognized that even the best of men and institutions may be tempted by the glitter of gold, and the report laudably warns against the dangers of diverting scholars from their basic ends. The report offers various examples of ways in which outside funds may be dangerous, while noting the desire of all concerned to contribute the maximum to the public good, in normal or in emergency times.

I think that the average reader would agree with me that the over-all impact of the book would be more accurately portrayed by the title "Fiscal Policy Related to Sponsored Research of Colleges and Universities." This is understandable since the committee was composed of men with varying but appreciable degrees of interest in matters of administration as contrasted with meeting classes or working in the laboratory. According to standard bibliographic references available to me, the "administrative quotient" (man-years administration/man-years teaching-research) approximates 1, but since the average tenure of the members in administrative posts is near 10 years, the academic aspects are necessarily more remote. A plea, to which I heartily subscribe, is made for administration and faculty to get together to arrive at a mutual understanding of fiscal (that is, overhead) problems.

Much of the report appears to assume an equivalence of contract-type support and grants-in-aid. To the committee, the major differences, as is noted in Chapter 5, would appear to be with respect to overhead. Referring to grants-in-aid: "Normally indirect costs under this system have ranged up to 15%. These policies and the grant-in-aid method, when carried out on an extensive scale, are held to be harmful by institutional representatives." Perhaps so, but I suspect that the average recipient of a grant-in-aid from the U.S. Public Health Service would be a little appalled to learn that he is harmful to his institution. Private foundations are gently chided for not allowing overhead; ". . . the Foundation grant cannot escape the criticism that it is imposing an undue burden on the educational institution by requiring it to participate in the cost of conducting the research covered by the grant-in-aid."

When the contractual policies of the Armed Services Procurement Regulations are spoken of by the committee with fondness, they signify approval of a system derived by modifications of procedures devised to procure material for our military units. Administration of research funds by officials of the various agencies of the Department of Defense has been, by and large, very acceptable to scientists, as witness the effective program of the Office of Naval Research. However, the fact that research can be handled this way does not mean that universities have to accept schemes devised for completely nonacademic purposes, for buying units of research unless they wish to. A recent Congressional committee report (Riehlman report) is considerably more illuminating with regard to the impact of armed forces policies on scientists than is the present report of the committee of the American Council on Education.

The committee remarks: "Basic research is analogous to a checking account in a bank. If such funds are withdrawn and not replaced, the account will soon be overdrawn." Prosecuting basic research is not analogous to depositing money in the checking account (p. 5) and the "account" is never "overdrawn." I fear the analogy used by the committee illustrates a point of view not uncommon in universities, including the policy of operating research as a personal-type checking account where the depositor is charged a fee for each unit.

Perhaps modern academic institutions must, for some reason not known to faculty members, regard research as a commodity subject to depletion by use and withdrawal. For my part, I like to think that when I study a sodium pump in frog muscles I am providing a minor facet of light in our existing body of knowledge that will endure and illuminate other problems and will lose its impact, not by being "overdrawn," but by being superseded by better research.

The report speaks rather longingly of what it terms "institutional non-project type" grants. Federally sponsored research in agriculture is offered as a desirable example. Although it is true that funds to land-grant colleges under the Morrill Act of 1890 amount virtually to free endowment, others (such as Hatch, Adams, and Bankhead-Jones) have varying degrees of limitation, may provide no overhead, and may carry "matching fund" clauses. Bankhead-Jones projects are also closely audited on a yearly basis. Thus, from the example offered it is hard to tell what the committee is approving as policy.

Policies more basic than fiscal are touched upon primarily with reference to a quotation from President Dodd's delightful remarks about "projectitis."

A committee of the National Science Board is currently studying matters related to the impact of outside funds on universities and colleges and it is to be hoped that, building on the present report, they can delve into matters of basic policy. Certainly university policy is being formed willy-nilly or otherwise, in large part because of the almost explosive intermingling of university scholars and fund-granting agencies over the past decade. In the life sciences alone thousands of grants-in-aid are made to scienitsts, mostly by foundations and agencies, which, in turn, rely in large part on the advice of hundreds of university scientists. The scholars themselves are thus squarely in the middle of an expanding program, not just on the receiving end. Administrative officials should take great