elsewhere, due to their poor color and scanty yield. The key for descriptions of variety, however, might well be adopted by all who attempt to describe varieties of mango.

A brief chapter on the botany and cytogenics of the mango is well done. The balance of this volume (about 40 pages) is devoted to cultivation and to insect pests and diseases. In centuries past, Indian princes used to pride themselves on the possession of exclusive varieties and on large mango gardens. Akbar, the great Mughal Emperor, is said to have had a garden of 100,000 trees. These were chiefly, if not entirely, seedling trees, whereas most plantings now are vegetatively propagated. The book gives considerable detail on methods of vegetative propagation and of top-working, little of which is not well known to mango growers everywhere. Planting, irrigation, and manuring (fertilization) practices are discussed and serve to point up the fact that very little of an exact nature is known regarding the culture of this fruit, despite its antiquity. Irregular bearing of most varieties is a problem in India, as in other areas where mangos are grown. The insect pests and diseases of the mango in India are well presented; in each case the scientific name, the nature of the injury, and the control measures are given. A comprehensive bibliography of 162 citations is useful and also indicates that the authors are cognizant of such scientific work as has been done with this fruit.

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A Pictorial History of Science and Engineering. The story of man's technological and scientific progress from the dawn of history to the present, told in 1,000 pictures and 75,000 words. By the editors of *Year*. *Year,* New York, 1958. 263 pp. Illus. $7.95.

The lack of an adequate, brief, and popular history of modern science leaves unsatisfied an obvious demand which must seek its fulfillment in highly specialized works or in "picture histories" such as this. The editors of *Year* have endeavored to be up to date, even touching—the word should be emphasized—on automation and the Russian satellite. They have also done more justice than might have been expected to the science of antiquity and the other benighted centuries before modern times.

The topical subdivision is well conceived, and the narrative on the centuries up through the eighteenth is excellent, showing commendable concern for accuracy. The 19th and 20th centuries, however, seem to have been the editors' undoing, as they have been the undoing of others who have attempted to deal with them historically. The text here tends increasingly to vagueness—a vagueness liberally salted with names of inventors and inventions.

Many of the illustrations are interesting, but few are spectacular and many are very ordinary. On the whole, the selection of pictures is only fair, and the effectiveness of those that are included is badly marred by the editors' failure to identify them adequately; the reader is thus left free to suppose, for example, that some primordial photographer caught the cave men painting mammoths (page 16). Something more than the technical picture credits would certainly have been in order.

Its determined up-to-dateness will probably lead potential readers to regard the book as being out-of-date next year. This is a pity, for the first part, at least, deserves a longer life. When all is said and done, however, one can hardly expect to learn much more of the history of science from such a book than one could learn of physics from a picture history of that subject.

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Animal Behavior. John Paul Scott. University of Chicago Press, 1958. xi + 281 pp. Illus. $5.

No part in biology is more beset with the pitfalls of scientific methodology than is the study of animal behavior. The subject is intrinsically difficult—dealing, as it does, with the integrated totality of organisms—but because of its familiarity, it seems deceptively simple. Everyone has observed animals at one time or another and formed opinions about what they were doing. Putting these thoughts to paper, however, should quickly reveal that comparative psychology is no place for an amateur. John Paul Scott is a long-time professional in the field, and his book shows the wide range of his experience and knowledge. He has, however, attempted the perhaps impossible task of writing a book meant to serve both as a text and as an introductory account for the nonspecialized reader. Although he has produced the best general introduction to the subject we have ever had—one that can be read with profit by student and layman alike—his treatment lacks the emphasis on aspects of logic necessary to make it a satisfactory text. I should add that, in my opinion, there is *no* satisfactory up-to-date textbook on comparative psychology or animal behavior in existence today.

The study of animal behavior is in a protean condition; the serious student should be informed of this challenging state of affairs. The present volume, however, has little to say about the different points of view on fundamental questions currently under debate. In addition, making such topics as agonistic and allelomimetic behavior, learning, intelligence, and language the primary points of reference, rather than the various phylogenetic groups of animals, tends to encourage looseness of thought. As Scott himself puts it (although in a different context), "What words can we use to say that two animals as unlike as elephants and spiders are doing similar things?" The problem of finding criteria for meaningful similarities among divergent animal forms is one of the knottiest in comparative psychology.

Attention should be called to the fine illustrations, both drawings and photographs, that enliven and enhance this book.

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The Beginnings of Embryonic Development. A Symposium organized by the Section on Zoological Sciences of the American Association for the Advancement of Science, cosponsored by the American Society of Zoologists and the Association of Southeastern Biologists, and presented at the Atlanta meeting, December 27, 1955. Publication No. 48. Albert Tyler, R. C. von Borstel, Charles B. Metz, Eds. American Association for the Advancement of Science, Washington, D.C., 1957. 400 pp. Illus. $7.50, members; $8.75, others.

This volume includes the papers presented at a symposium organized by the Section on Zoological Sciences of the American Association for the Advancement of Science at the Atlanta meeting, 27 December 1955, as well as several chapters, contributed by other embryologists, which are intended to expand the coverage of this general field.

The book begins with an important chapter by W. S. Vincent on a relatively neglected area to which new techniques have been applied in recent years—namely, the differentiation and development of the oocyte, with particular emphasis on the role of the nucleus. The author comes to the conclusion that the nuclear ribonucleic acid molecules are carriers of structural specificity imparted by genetic loci and transferred to the cytoplasm. C. B. Metz discusses the role played by the interaction of specific egg and sperm substances in the fertilization and activation of the egg. While substances such as egg membrane lysin, fertilizin, and antifertilizin are apparently

essential for the approach and initial union of the gametes, evidence for a direct role of these substances in the primary activation reaction is wanting.

The two chapters that follow deal with fertilization in mammals. C. R. Austin and M. W. H. Bishop analyze the highly specialized internal environment in which fertilization takes place. Many integrated processes and reactions ensure the meeting of the gametes in appropriate numerical relations and at the optimal phase of their life-cycle. However, different species of mammals exhibit wide variations in the details of these mechanisms. M. C. Chang deals with the physiological changes at sperm penetration, activation, and syngamy and points out the great gaps in our knowledge of these processes and of the physiology of the Fallopian tube, the corona radiata, the zona pellucida, and the vitelline membrane. Results obtained with marine eggs may not be applied to mammalian fertilization at present.

A. L. and L. H. Colwin contribute a lucid summary of their researches on the importance of the acrosome filament in the initial contact between sperm and egg in echinoderms, molluscs, annelids, and enteropneusts. In spite of these important discoveries, the mechanism of the subsequent movement of the sperm into the egg is still not known. A brief section on changes in proteins of the sea urchin egg following fertilization, by A. Monroy, is followed by an excellent review of nucleocytoplasmic relations in early insect development, by R. C. von Borstel, where the destruction of three of the four nuclei resulting from meiosis in the egg, and the inhibition of the accessory sperms, offer special and intriguing problems. The occurrence of photoreactivation of ultraviolet radiation damage following irradiation of the nucleus, and the absence of such photoreactivation when the egg cytoplasm is irradiated, may make it possible to distinguish between action of the nucleus and action of the cytoplasm in the causation of an embryonic event.

H. E. Lehman summarizes the evidence for nuclear differentiation during development, particularly the results obtained with nuclear transplantation in amphibian eggs, and concludes that progressive nuclear differentiation, presumably imposed upon the nucleus by the cytoplasm surrounding it, must be admitted at least as a possibility.

In the section entitled "Morphogenesis and metabolism of gastrula-arrested embryos in the hybrid *Rana pipiens* × *Rana sylvatica*," J. R. Gregg describes the peculiar biochemical features of hybrid embryos, one of which is the lowered rate of energy liberation from glycolytic processes. Unfortunately, it cannot yet be decided whether this biochemical deficiency is the cause of the arrest of development or is itself a parallel effect of the hybrid constitution of the embryo.

J. R. Shaver discusses the possible role of cytoplasmic particles, particularly of mitochondria, in differentiation. He is critical of attempts to explain differentiation on the basis of ordered distribution patterns of mitochondria, whose existence has not been demonstrated beyond doubt.

Under the uninformative title of "Early determination in development under normal and experimental conditions," S. Ranzi presents evidence that, in the sea urchin egg, fertilization activates certain enzyme systems at the animal pole and that the resulting metabolites lead to development of this area in the animal direction.

G. Reverberi presents an admirable summary of the role of some enzymes in the development of ascidians and other animals, studied by means of cytochemical methods and specific inhibitors. He concludes that there is "reasonable probability" that some enzymes play a role in morphogenesis of "mosaic" eggs, while the evidence for "regulative" eggs is less convincing.

The volume concludes with a chapter on "Immunological studies of early development," by A. Tyler, in which the author reviews recent studies on the detection in the embryo of specific antigens to adult tissues, on the development of antibody-forming capacity, and on the effects of antibodies on development. He relates the results to his well-known autoantibody concept.

The book as a whole contains a wealth of facts and hypotheses on various important aspects of the beginnings of development, which the reader is left free to evaluate and coordinate. I could not avoid having the strong impression that, at this time, it is still impossible to prove the causation of any process of differentiation by biochemical events, and that no new avenues of approach have opened up which would lead to crucial evidence in the near future.

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Electron Impact Phenomena. And the properties of gaseous ions. G. H. Field and J. L. Franklin. Academic Press, New York, 1957. ix + 349 pp. Illus. $8.50.

Important to physical chemists and chemical engineers is the identification of molecules and molecular fragments that follow reactions with catalitic agents, breakdown in intense heat, or dissociation under electron bombardment. The modern commercial mass spectrograph is one of the most important tools at the disposal of the physicist and the chemist for making identifications, and yet the results may not always be unambiguous. It is one of the purposes of this book to discuss, in a critical manner, experiments and experimental techniques that yield data on electron impact phenomena that may help in the interpretation of research investigations of interest to physical chemists in general and physical organic chemists in particular.

The organization of the book follows a logical procedure. First the apparatus and methods are discussed. Then there is a brief discussion of theory, followed by an extensive treatment under the heading "Energetic considerations." These sections constitute approximately one-half of the book and are written in a manner that I consider very effective. Even though there is a minimum of equations and technical description, the subjects discussed are presented concisely and critically. Over 500 references to original researches are given, and the organization of these alphabetically by author at the end of the book is to be commended. The fact that there is a good "name index" and "subject index" permits the reader not only to use the book as an effective reference source but also to locate the sections containing critical evaluation.

Not only will the reader find interesting text; the book contains a vast compilation of numerical data in tabular form, such as critical potentials applicable to many molecules, organic and inorganic. Associated with these data are excellent references, so that the user can evaluate for himself the experimental details on the basis of which the numerical values were determined.

This book will serve as an excellent reference book, useful to both physicists and chemists, and represents an important contribution to the literature.

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Behavioral Goals of General Education in High School. Will French and associates. Russell Sage Foundation, New York, 1957. 247 pp. $4.

The Russell Sage Foundation, The National Association of Secondary School Principals, and the Educational Testing Service, feeling that all learning is evidenced by changes in reactions, have jointly sponsored a volume on behavioral goals for general education in high schools and have organized these under three "maturity goals" and four "areas of behavioral competence." The first two parts of the book discuss the following topics: first, the history, purposes, nature, evidence, and scope of