well Lecture series at Rice University. In these lectures, the author placed Charles Darwin in the scientific, philosophical, and religious setting of his time and traced Darwin's influence on the development of these three overlapping fields. His treatment is lucid and objective, and it is given in some detail.

We can trace the conflict between revealed religion and Deism back to the time when Sir Isaac Newton first described the universe as operating according to law, rather than according to impulse or whim or a series of unlawful acts. Darwin entered the fray much later, and his contribution to the dispute was made nearer to our own time than to the beginning of the controversy. Darwin's demonstration of how natural selection caused species to evolve helped to undermine all static views of nature. It also helped to destroy any belief in the verbal accuracy of Scripture. But more important than this, Darwin applied the methods of natural science to the study of man as an individual and to the study of human society.

It was inevitable, perhaps, that this application would be accompanied by some confusion. For instance, the "struggle for existence" in nature was assumed by many to be homologous with business competition in a *laissez faire* economy and, if the results of the struggle in nature were beneficial, those in society were also assumed to be good; this in spite of the easily observed fact that social and biological successes were often antithetical! In evolution, biological success consists exclusively in leaving offspring. In human society, the social failures were, in general, the biologically successful because of the number of children they left, sometimes for the state to support.

The author holds that Darwin's influence on social thought has been both good and bad; good in that it showed man's relation to the animal kingdom, bad in that it encouraged Herbert Spencer's emphasis on individual, racial, and national competition and in that it encouraged the idea that the methods of the natural sciences are fully adequate for the study of human nature and human society. Science, the author holds, needs the support of both philosophy and religion before we can use it as a guide.

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Entropy in Communication

Life and Energy. An exploration of the physical and chemical basis of modern biology. Isaac Asimov. Doubleday, New York, 1962. 380 pp. Illus. $4.95.

This introduction to the manner in which living organisms derive energy from their surroundings is written in layman's language and starts with the assumption that the reader will not have even a high school background in physics, chemistry, biology, or mathematics. The first half of the book treats the underlying principles of work, energy, heat, chemical bonding, and kinetics of reaction. The second half, which is appreciably more successful and up-to-date than the first, then uses these concepts to discuss the action of enzymes, the assimilation of foodstuffs, intermediary metabolism, and the role of high-energy compounds in the chemistry of life.

The general organization of topics is excellent, and the author effectively uses concepts already developed to undergird subsequent presentations. The basic principles are illustrated with examples from the more familiar inorganic realm before they are applied to biological chemistry. Isaac Asimov, the author, is well-known for his readable style and his flair for putting scientific concepts into clear, understandable language. Unfortunately, however, that ability was not applied uniformly throughout this book. Marked unevenness in the presentation gives the impression that the volume was too hastily put together. A disappointing number of errors and distorted statements occur throughout the text (and in at least one quarter of the figures). Several of these will confuse readers who have little background in the subject. In general, both the figures and the uses of analogy are quite helpful aids to understanding; but a number of them are confusingly constructed, and the reader will wish for others that are not provided.

The concept of entropy, introduced in the first part and widely used in the second part, suffers from a particularly uninspired explanation. This is especially unfortunate since the average reader initially has little intuitive feeling for this thermodynamic property. The chapters on chemical bonding and on photosynthesis are also less ably written than one would hope for in a book of this kind. In the first part of the book, the author takes great pains to avoid using powers of ten—even Avogadro's number is written out at length. Subsequently he introduces them in a figure, without further explanation, and continues to use them in the latter part of the book.

The presentation is almost entirely historical and descriptive and does not contain the rigor and thoroughness that would be expected of an elementary textbook. Unfortunately, it also neglects much of the excitement of science, by failing to emphasize those areas in which present knowledge is lacking and in which scientists are actively seeking answers to profound questions. Furthermore, there are no references to additional sources for the interested reader. For these reasons, this book is not well-suited to the high school student contemplating a career in science, in spite of the fact that its style of writing might make it seem attractive.

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Packets of Thought

Human Values and Science, Art, and Mathematics. Lillian R. Lieber. Norton, New York, 1961. 149 pp. Illus. $3.95.

This nicely issued and charmingly illustrated small volume consists essentially of two parts. The first half deals with a few key mathematical concepts presented with the conciseness and lucidity for which Lillian Lieber has won her well-earned, if limited, fame, and in the free verse which serves her manner so effectually. She conveys in pleasing phrases the meaning of geometrical systems, the role of the axioms or postulates that constitute their foundations, and the rules demanded of and the freedoms permitted to the superstructures erected upon them. She then elucidates the meanings of truth and functionalism in mathematical exploration and applies her particular gift of lucidity to some of the new systems of algebra, with their novel language and meanings. Even readers familiar with the essence of the modern vistas of mathematical thought, will delight in these lightly uttered free-verse lines, rich in ideas and carrying solid packets of thought and explanation.

Suddenly the reader comes face to face with the last two chapters, of naivest and stalest preachment, based on the fantastic idea that my values are everybody's values, and woe to them who reject, modify, or employ them differently. To take the major issue considered: The author assumes that all war is evil, has been so, and should be for everybody, at all times. Yet, one may well ask, could the Jews in the Warsaw Ghetto possibly have thought so when they preferred death on the streets to death in gas chambers? Others to whom Hitler was not the same menace might well have declared—Better Nazi than Dead. Still others might have wished to say so but chose not to. None of these real situations are taken into account. There is only the dogmatic verdict, uttered not in the name of an absolute God or in the spirit of "We hold these truths . . ." but in the name of Lillian Lieber's final decision upon what is clearly obvious, inevitable, and mandatory. The upshot of her effort is the moral that no one who fails to see the variable of human values and goals should play around with equations which necessarily implicate such unknowns.

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Men and Animals

The World of Animals. A treasury of lore, legend, and literature by great writers and naturalists from the 5th century B.C. to the present. Joseph Wood Krutch, Ed. Simon and Schuster, New York, 1961. 508 pp. Illus. $10.

Discovery: Great Moments in the Lives of Outstanding Naturalists. John K. Terres, Ed. Lippincott, Philadelphia, Pa., 1961. xiii + 338 pp. $6.50.

Both of these anthologies invite the reader to pick them up, savor a short chapter, and set them aside to mull over the significance of the sample. Yet the ideas back of the books are poles apart.

For *The World of Animals*, J. W. Krutch dipped into his vast experience among the published writings of past and modern authors and picked out 120 selections for introduction under general sections entitled Profiles and Portraits, Hunters and Sportsmen, The Wide Wide World, Cruelty and Fellow Feeling, Legends, Fantasies, and Fictions, From Aristotle to Darwin to ?, Destruction and Conservation, and Head and Heart. In section after section, through intriguing prefatory notes and the choice and sequence of selections, this handsome treasury of writings traces the history of ideas from antiquity to the present. Woodcuts, prints, and paintings decorate the book and show graphically how men have regarded animals over the centuries. Readers will recognize many of their own favorites among the selections, and miss some too. The unfamiliar pieces among Krutch's curiosa are sure to delight, for they reflect his wide interests and informed sympathies.

For *Discovery*, John Terres went exploring. He invited 40 distinguished living naturalists each to write a brief account of the most outstanding adventure they had had, showing why the "shock, ecstasy, beauty, wonder, tragedy, or intellectual illumination of that moment, hour, or day" had stayed with them. Three dozen, chiefly ornithologists, found time to do so, and their fresh writings comprise the unrelated chapters.

Some might have been predicted from knowing that Terres edited *Audubon Magazine* for many years. Accounts of whooping cranes, ivory-billed woodpeckers, and South American flamingoes almost *had* to go in. As first-hand, wide-eyed experiences vividly told, they fully live up to the reputations of their several authors. Other chapters on birds tell of paradise parrots in Australia, lammergeier vultures in Baluchistan, crowned eagles and lyretail honeyguides in Africa, wrens and nightingales in Europe, ant-thrushes, Cooper's hawks, eider ducks, killdeers, and the bones of great auks in the New World. Other chapters paint ecological pictures: both J. Dewey Soper and Alexander B. Klots write on areas in the Canadian Arctic; David Lack, on birds and insects migrating through a pass in the Pyrenees; Victor H. Cahalane, on being overwhelmed by the richness of animal life in Kruger National Park; Ira N. Gabrielson, on the death and rebirth of the Malheur National Wildlife Refuge. For exciting adventures, it would be hard to beat Arthur A. Allen's account of the time he was reported drowned in the Gulf of Mexico, or Olaus J. Murie's tale of escape at Three Arch Rocks—or the retelling of George Miksch Sutton's engulfment by a dust storm, or Olin S. Pettingill, Jr.'s honeymoon brush with the sea on Cobb Island, or E. Thomas Gilliard's clamberings on Funk Island, or even Alexander Sprunt, Jr.'s ridiculous adventure: bitten by a dead alligator! But the one we like best, and wish all naturalists and would-be naturalists would read, is F. Fraser Darling's sensitive account of the experiences that led him to become a naturalist.

Both of these books have a timeless quality that will make them stimulating reading for years to come. We wonder how many people will wish the volumes had indexes, to make it easy to find again half-remembered tidbits of special appeal. That the reader will want to return repeatedly for more is an outstanding feature of each volume.

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MARGERY MILNE
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On Virtuosity

The Seeing Eye. H. Asher. Duckworth, London, 1962. viii + 270 pp. Illus. 30s.

Pain, Its Modes and Functions. F. J. J. Buytendijk. Translated by Eda O'Shiel. University of Chicago Press, Chicago, Ill., 1962 (translated from *Over de Pijn*, 1943, 1957). 189 pp. $3.95.

These small volumes are both intended for the general scientific reader, but there the similarity ends. Asher gives us a delightful book packed with provocative but testable scientific theories and precise information. It is clearly the product of his early work in the development of radar and of his subsequent life of love and labor in the Physiological Laboratory of the University of Birmingham (England). His topics embrace a very wide subject matter that ranges from the psychology of vision and the effects on it of alcohol and lysergic acid to directions for producing a great variety of optical effects and measurements, which would be equally at home in the diagnostic clinic or as startling innovations for the after-dinner hour in the rumpus room.

Asher uses over 150 illustrations of conventional and unconventional optical apparatus and experiments, drawn in the style of the "Amateur Scientist" section of the *Scientific American*. Throughout the book there is no page that does not attest to an exuberant and imaginative ingenuity and often to a salty and down-to-earth humor as well. We can readily believe that a colleague