tions but also by creating an atmosphere conducive to interest in the field among the administration, staff, and students.

Bidwell obviously feels that good education in international relations is important, and he amply demonstrates that the present situation is deplorable. His proposed remedies deserve careful consideration by academic administrators, and indeed by everyone interested in a responsible American citizenry, an adequate American foreign policy, and a less dangerous world. Educated leaders are needed, as are educated followers, because "the quality and effectiveness of leadership in foreign policy will in large measure depend on the response of an educated public opinion" (p. 145).

QUINCY WRIGHT
University of Virginia and
Columbia University

Negentropy and Living Systems

Life: Origin and Development. Gösta Ehrensvärd. University of Chicago Press, Chicago, 1962. ix + 164 pp. Illus. $4.50.

Life in the Universe. Francis Jackson and Patrick Moore. Norton, New York, 1962. ix + 140 pp. Illus. $3.95.

The origin and evolution of life and its distribution in the universe are inseparable problems, involving extrapolations far into time and space which are both fascinating and risky. If we start from different basic concepts, very different conclusions may be reached. From a strictly "deterministic" point of view, the emergence of life may appear as a necessary outcome of the accumulation of molecular species, following, in some way, a kind of "law" that also governs the accumulation of those species. From what might be called the "opportunistic" view, life seems to have emerged and evolved as the result of chance events taken advantage of by selective processes. Both approaches have weaknesses—the truth may lie somewhere between.

Both Ehrensvärd's *Life: Origin and Development* and Moore and Jackson's *Life in the Universe* follow closely the deterministic approach. It is important that the reader keep this in mind, the more so because both books are well and convincingly written. Within the limits of their approach both books are critical, particularly the first, which has been long in preparation.

Ehrensvärd's predominantly biochemical treatment emphasizes the seemingly continuous evolution of the kinds of molecular species that characterize life, from the clearly nonliving primordial environment on through the evolution of living organisms themselves. He stresses eloquently the apparent continuity of this record, where one sees no distinct boundary between the nonliving and the living. His admittedly deterministic argument finds its support in this apparent continuity which, viewed from a great distance in time, may suggest a continuously flowing process.

Moore and Jackson are at their best in the astronomical realm. Although they point out that the planets of our solar system, other than earth, seem to offer very unfavorable environments for the kind of life we know, they entertain the idea that life—even intelligent life—may occur in other parts of the universe. This is a logical outcome of the deterministic point of view, and one gains the impression that these authors tend to lean in that direction, although remaining properly uncommitted. They reject the idea that life has been seeded about the universe from some unknown source, which might also accomplish a wide distribution. Implications of the opportunistic approach, which would suggest that the array of living forms we know on earth might find little parallel in life evolving elsewhere, or even that life is unique to our planet, are barely touched upon.

Neither book indicates that the authors have considered their problems in terms of information theory, yet this would seem a cogent means of approach. It would seem that the origin and evolution of living systems, or even the evolution of the organic compounds that became ultimately incorporated into them, must have entailed the accumulation of a vast amount of negentropy. This does not, of course, represent a denial of the second law of thermodynamics, there having been a tremendous increase in entropy in the sun-earth system. But does not the strictly deterministic point of view reflected in these books tacitly assume that the accumulation of negentropy follows a directing principle, and thus inject a note of finalism? The question is far from trivial, and that it is not posed may evidence a limited perspective. But, faced with so troublesome an enigma, may we not be tolerant in this regard?

HAROLD F. BLUM
National Cancer Institute, National Institutes of Health, and *Department of Biology, Princeton University*

A Reader for Chemists

The Nature of Biochemistry. Ernest Baldwin. Cambridge University Press, New York, 1962. xiii + 111 pp. Illus. Paper, $1.45; cloth, $2.75.

The authoritative soundness of Ernest Baldwin's work cannot be questioned, and with his previous books, particularly *Dynamic Aspects of Biochemistry*, he has performed a notable service to the profession.

In the present volume, 111 pages in length, Baldwin seeks to present a picture of what biochemistry is about, and the book is intended, as the author says, ". . . to be read, not studied." His use of language is excellent, and his ability as an expositor is commendable. Even before the reader gets very deep into the book, it becomes obvious that he must be able to read meaning into the complex formulas of organic chemistry in order to comprehend the book. Clearly this book is for those who have some considerable proficiency in organic chemistry and who want to supplement this with introductory knowledge about biochemistry. To such readers the work is recommended.

Some idea of the contents can be gained from the chapter headings: "The constancy of the internal environment," "Respiratory function of the blood," "Proteins," "Physico-chemical behaviour of proteins," "Enzymes," "Fate of amino acid nitrogen," "Carbohydrates," "Fuel for the machine: Carbohydrates," "Fuel for the machine: Fat," "The powerhouse of the cell," and "Nucleic acids and nucleoproteins."

It is not a criticism to say that Baldwin emphasizes the portions of biochemistry that particularly interest him. Every author has a right, indeed an obligation, to present his own point of view; otherwise his book will be dull and unimaginative and of little value. However, it may be said in this case, by way of criticism, that the writer has left out several chapters of biochemistry which to me and to many laymen are of unusual interest, from the standpoint of both science and practical application. Although there is some material on the functioning of amino acids in nutrition, the general subject of nutrition is not treated—that the word *vitamin* is not found in the index is evidence of this. While the vitamin field, as such, is not as active an area of investigation as it was a decade or two ago, there is evidence that these entities were crucially im-