of alcohol. The residue thus obtained when dissolved in isotonic saline showed a total loss of the anticoagulant activity. The protein content of the residue at this stage was found to be about 48 mg%.

Simple dissolution of the crude extract of the leech heads in distilled water, separation of proteins by coagulation at 80°–85° C for 20–30 min, filtering and evaporating to dryness on a water bath, and leaving in a desiccator overnight gave very satisfactory results. Usually, after 8–10 such treatments, the residue obtained was easily soluble in water, yielding a clear solution. An isotonic saline solution of the residue showed an effective anticoagulant activity. The protein content of the anticoagulant at this stage was found to be about 90–100 mg%.

In yet another case the crude extract, after treatment at 80°–85° C for 20–30 min, was mixed with isotonic saline and left overnight. Next morning it was filtered; the solution showed an active anticoagulant property, and the protein content was found to be approximately 80 mg%. This method seems capricious, however, as it gave variable results.

Attempts to obtain a completely protein-free substance were not successful. Even when the biuret test was negative, the estimations done by a biophotocolorimeter using Greenberg's phenol reagent method indicated the presence of small traces of protein. Glass-distilled water (pH 7–7.2) was used in the above experiments, which were performed at room temperature (100°–108° F), and thymol was used as a preservative. Further work on the biochemical estimations of the anticoagulant is in progress and will be published later.

Reference

1. LAL, M. B., and CHOWDHURY, N. K. *Nature*, **166**, 480 (1950).

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Book Reviews

Time's Arrow and Evolution. Harold F. Blum. Princeton, N. J.: Princeton Univ. Press, 1951. 222 pp. $4.00.

"To what extent has the course of evolution been determined by strictly physical factors that have permitted no exercise of natural selection and to what extent have the former set limits within which the latter may act?"

"How, when no life existed, did substances come into being which today are absolutely essential to living systems, yet which can only be formed by those systems?"

Most readers will agree that Dr. Blum has made a profound contribution in his formulation of these questions and in his presentation of the facts bearing upon their answers. The problem is like a great jigsaw puzzle in which small areas of the picture have been put together but whose final solution will require many trials and failures before the correct combinations are discovered. The book will cause vigorous discussion, and its virtues lie in the areas where the author has offered clarification of these broad questions.

Blum suggests that "time's arrow," the second law of thermodynamics, is the unyielding warp upon which the great tapestry of evolution has been woven. Many experts in the field of thermodynamics will not wish to apply the second law to a single photon, in the form of an x-ray, acting upon a gene to alter the process of evolution. Irving Langmuir has called this a divergent phenomenon and concludes "In a world in which divergent or quantum phenomena occur we can have no absolute relation of cause and effect." However, the author is certainly correct in emphasizing the restrictions that chemistry and possible chemical changes have placed upon the course of evolution.

The origin of the compounds in the first living cell is, indeed, a problem of singular difficulty. In a cosmic cloud, with its large excess of hydrogen, the compounds in living matter are generally unstable with respect to methane, water, and ammonia. The earth's early atmosphere was doubtless water, carbon dioxide, and some ammonias. High energy photons acting upon these compounds certainly produced many free radicals, and the combination of these radicals gradually led to more and more complicated molecules. The author assumes that compounds as complicated as adenylic acid were formed in the first billion years. This conclusion also will be a point of controversy, but the existence of living matter surely gives weight to his contentions.

Time's Arrow and Evolution will interest readers from all fields of science and a discussion of its propositions should broaden the attack upon these fundamental problems.

WENDELL M. LATIMER
Department of Chemistry
University of California, Berkeley

Metallurgical Thermochemistry. O. Kubaschewski and E. Ll. Evans. New York: Academic Press; London: Butterworth-Springer, 1951. 368 pp. $6.00.

This book presents an extensive collection of thermodynamic data, an introduction to their use in metallurgical calculations, and descriptions of experimental procedures by which they are determined. In explaining the title the authors state that

since heats of reaction are no longer studied in isolation from the other thermodynamic functions, there appears to be no reason why we should not revert to the older term *thermochemistry*.

Even if this change in terminology were desirable, according to current usage the title fails to indicate the full scope of the book.

This volume is the first in a series of monographs on metal physics and physical metallurgy. The series is not inappropriately launched with a predominantly chemical topic—when it is recalled that scientific metallurgy has its beginning largely in the work of physical chemists. Physical metallurgy, although moving gradually into the orbit of physics, still depends on the methods and results of several branches of physical chemistry.

The first chapter is a résumé of chemical thermodynamics. It is surprising to find an almost complete disregard for the concept of standard state in a book primarily aimed at calculations. There is ample room for further disagreement, for example, concerning the meaning of thermodynamic activity.

The second chapter is an excellent introduction to experimental procedures, including calorimetry, electromotive force measurements, and the determination of vapor pressures and other equilibria. The value of this section is enhanced by good drawings of typical apparatus. The authors' wide experience lends authority to their evaluations of different methods. Methods for the estimation of thermodynamic quantities are included in another chapter. This subject demands a feeling for empirical relations as well as mastery of the theoretical background. The authors have made a contribution in this still underdeveloped area, but some of their propositions are likely to be subject to further revision.

The central section of the book consists of tables of thermodynamic data for elements, some alloys, and many inorganic compounds. The tables are based on original and secondary sources; an extensive list of references is included. The authors caution against uncritical acceptance of published data and wisely suggest that estimated values may be better than some experimental observations. They do not favor one experimental method at the expense of another and stress that each measurement must be judged on its own merits. How far their tables come up to this standard can only be ascertained by protracted critical use. Sample numerical treatments of different types of metallurgical reactions are presented in the final chapter.

Aside from its value to metallurgists, this book unquestionably belongs in chemical libraries as a source of data and references. It also should attract some deserved attention to the field of metallurgical chemistry.

MICHAEL B. BEVER

Department of Metallurgy
Massachusetts Institute of Technology

Crops in Peace and War. The Yearbook of Agriculture, 1950–1951. Alfred Stefferud, Ed. Washington, D. C.: Supt. of Documents, GPO, 1951. 942 pp. $2.50.

For a book that attempts the almost impossible task of appealing to both laymen and scientists, *Crops in Peace and War* does a thoroughly commendable job. The more than 150 articles impressively illustrate the tremendous range of research activity of the Department of Agriculture in fields relating to the utilization and improvement of products of the plant and animal kingdoms. Chemurgy is covered in such a comprehensive manner that the yearbook will undoubtedly become a source book for all interested in this subject. Other areas such as food and fiber technology, although reviewed less completely, contain material that will frequently be referred to by professional men. The book will also have a great appeal for the farmer and the average citizen.

Somehow, the majority of the almost 200 scientist-collaborators have managed to present their material in a readable, interesting, and often narrative form that will carry the nonscientific reader through the more technical aspects. On the other hand, technically trained men desiring a comprehensive background will find it easy to skim over the more elementary paragraphs. Only those scientists expecting to find scientific minutiae in the specific fields of their interest will be disappointed. Even these, however, may find a surprising amount of technical detail in some articles.

The yearbook is organized into sections that, considering the range of topics, are arranged about as logically as is possible. The reader is likely to feel that there is an apparent overemphasis on some subjects. This becomes reasonable when one remembers that the work, after all, is essentially a reflection of the various research emphases in the USDA. Indeed, the balance achieved is a tribute to the resourcefulness of the yearbook committee.

The majority of the papers have been well and carefully written. Sections are introduced by simple but clever drawings intended to embody the essence of the succeeding material. A series of 8 illustrations with written amplification, showing a few of the activities within the regional laboratories, are especially well done and should prove educational to the lay reader. The short biographical sketches of the authors are not only interesting but undoubtedly will lead to exchanges of correspondence that should result in new ideas. The glossary of technical terms should be very helpful to those of limited scientific background. The most unique and attractive special features, however, are the small tidbits of pertinent information contributed as space fillers.

It is a pleasure for this reviewer to recommend *Crops in Peace and War* to scientists everywhere.

PETER C. DUISBERG

Desert Products Company
Silver City, New Mexico