or profit margins to be sought), the allocation of resources, personnel promotions, and so on are shared or could feasibly be shared by all organizational levels in a significant fashion.

In view of these attributes and the concern to maximize productivity, a cynical critic might dismiss this book as Establishment; but I think that would be unfair and neglectful of the constructive and evolutionary directions implicit in this work. I think Likert is helping to develop in this field, particularly among those who are psychologically oriented, greater sensitivity to the significance of group structure and to the necessity of finding ways of institutionalizing innovation and openness. In the evolution of social science, this may well mark the beginning of important breakthroughs, both in our understanding of human action and in the liberation of new energies in society. The turn of the century saw such breakthroughs in the personality sector, particularly with Freudian theory and psychiatry. The '40's and '50's saw similar developments at the small-group level, with sensitivity training and group therapy leading the way. Perhaps the changes occurring these days in the relationship between students and universities or schools and communities signal the beginning of parallel achievements at more collective levels. The work of Likert and his colleagues should provide one suggestive base out of which may come a sound blueprint for the liberation of men within their organizations and society.

ANDREW EFFRAT
Ontario Institute for Studies in Education, Toronto

Radiobiology

Actions Chimiques et Biologiques des Radiations (The Chemical and Biological Action of Radiations). 12th series. M. HAÏSSINSKY, Ed. Masson, Paris, 1968. iv + 340 pp., illus. 148 F.

Six contributions from well-known radiation researchers comprise this 12th volume assembled by M. Haïssinsky. As in previous volumes in this series, the topical material is broad.

The papers are arranged roughly in the order of increasing biological complexity. The influence of water in modulating radiation effects, mainly in microbes, is discussed by E. L. Powers and A. Tallentire; H. S. Kaplan deals with radiation-induced inactivation of bacteria and phage; A. H. W. Nias and L. G. Lajtha discuss the influence of radiation on cell kinetics; J. Read reviews repair mechanisms in bacteria and unicellular organisms; J.-F. Duplan analyzes the immunology of radiochimeras; and M. Tubiana and A. Wambersie are concerned with tumor therapy and related radiobiological findings. The book has an international flavor, since the first four contributions are in English and the last two in French.

For a number of years Powers, Tallentire, and their associates studied the dependence of the killing of bacterial spores on the gaseous environment. More recently their studies have been extended to the influence of water content, and along with their own results they review those obtained with vegetative cells such as bacteria and yeasts, and more complex systems such as plant embryos and brine-shrimp eggs. The extent to which O_2-dependent inactivation is influenced by moisture is impressive and indicates that radical formation and quenching play an important role in wet systems. While it is true that the applicability of the approach of these authors is limited to systems which can survive dehydration, the likelihood that their conclusions may have more general applicability should not be overlooked.

Questions of generality also arise in regard to the departure taken by Kaplan. His underlying thesis is that double-strand breaks, in the DNA of bacteria and two-stranded phage, are the principal cause of radiation inactivation and probably of mammalian cell killing as well. Although radiation produces many single-strand breaks, these are lethal only in single-stranded phage and possibly in those bacteria which lack single-break repair systems. A considerable quantity of data in support of this hypothesis is reviewed; in most instances, but not all, the evidence is internally consistent and impressive, particularly as it pertains to bacteria and phage. For more complex cells, such as somatic mammalian cells, the picture is not at all as clear, although in view of the central position, and therefore the biological amplification, available to the genome of a cell, damage registered therein is very likely to be important. Aside from function, differences in the structure, replication, and means of expression of the genetic material of mammalian cells as compared to bacteria and phage may underlie their differences in response to radiation.

An ultimate relevance of questions of mechanisms comes out in the chapter by Tubiana and Wambersie. These authors address themselves to the real life question of cancer treatment, earnestly seeking ways of improving radiotherapy by means of radiobiological studies. They review the principal findings available thus far—findings which in the main were not known 15 years ago—and identify many of the complexities that face the therapist. The chapter on cell kinetics by Nias and Lajtha complements well these considerations. For scientists and physicians more comfortable with French than English, this chapter in French will be of particular value, since most of the studies reviewed were originally published in English.

In the tradition of annual reviews, Haïssinsky's 12th volume is diverse and timely.

M. M. ELKIND
Laboratory of Physiology, National Cancer Institute, Bethesda, Maryland 20014

The Uses of Insects

Insects and Physiology. Essays presented to Sir Vincent Wigglesworth on his retirement from the Quick Chair of Biology and Directorship of the Unit of Insect Physiology in the University of Cambridge. J. W. L. BEAMENT and J. E. TREHERNE, Eds. Elsevier, New York, 1968. viii + 378 pp., illus. $25.

Nature in its bountiful goodness has provided more species of insects than of all other animals and plants combined. This great diversity is not without its uses. For every biological problem there is an insect to serve as the ideal experimental animal. Sir Vincent Wigglesworth, early in his career, discovered the endless potential of insects for biological study. This amazing man soon became the father of modern insect physiology. His knack of asking the right questions concerning the physiological problems into which he delved quickly brought respect from his contemporaries. Sir Vincent in one way or another has inspired many men. It seems that those who have been privileged to study under him have been touched in some special way to make great contributions of their own.

Twenty-three of these scientists pay tribute to Sir Vincent by presenting in this volume a series of essays showing that insects are ideal subjects for elucidation of principles of general biology.

The writers review current knowledge of their respective specialties and incorporate new and unpublished material of their own.

The essays range widely over topics important in physiology. There is something for the molecular, the developmental, the environmental, and the behavioral physiologist. I found the eight essays on morphogenesis and neurosecretion particularly interesting. These show that the insect is unrivaled as an experimental animal for the elucidation of the hormonal control of cellular mechanisms. The recent identification and synthesis of the growth hormones of insects will provide the molecular and developmental physiologist with a most powerful tool for rapidly gaining an insight into how a living organism is built.

The essays also provide an overview of other aspects of insect physiology such as the integument, flight, the central nervous system, the sensory organs, reproduction, behavior, and membrane permeability. I have a limited knowledge of behavioral physiology and ion and water transport. Thus it was pleasing to find the essays on these subjects to be relatively easy to read, interesting, and informative.

This volume will be useful to the researcher, the teacher, and the advanced graduate student.

PERRY L. ADKISSON
Department of Entomology,
Texas A&M University, College Station

Antiviral Substances

The Interferons. A symposium, Siena, Italy, 1967. GEO RITA, Ed. Academic Press, New York, 1968. xviii + 269 pp., illus. $12.50.

This book contains the 21 papers presented at an international symposium on interferon held at the Aula Magna of the University of Siena in June 1967. Many of the scientists actively working with this natural antiviral substance participated in this symposium as well as in a Ciba Foundation symposium on interferon held two months earlier in London (*Interferon,* G. E. W. Wolstenholme and M. O'Connor, Eds., Little, Brown, Boston). Consequently there is a certain amount of duplication in the resulting publications. Indeed, some authors gave essentially the same paper at both meetings.

The first eight papers in this volume are concerned mostly with the induction or release of interferon in in vitro and in vivo systems. In the first paper, Merigan reviews his own extensive work with viral and nonviral inducers of interferon. He discusses his studies showing that mice respond with circulating interferon after injection with synthetic copolymers of maleic acid anhydride and derivatives. The point is made that nonviral inducers appear preferable to live agents for induction of endogenous interferon in man for prophylactic and therapeutic purposes, since it is difficult to rule out the presence of adventitious contaminants in biological preparations or to be sure that such preparations will behave benignly in all individuals. In this regard also, V. D. Soloviev of the Academy of Medical Sciences of the U.S.S.R. discusses in a later paper the two approaches to interferon therapy, the stimulation of endogenous interferon and the administration of purified interferon. Other workers in the early chapters review and describe various other nonviral agents which stimulate the appearance of interferon-like substances. Unfortunately, there is no mention of the exciting findings of Hilleman's group that double-stranded ribonucleic acid molecules (natural or synthetic) from a number of sources are efficient inducers of interferon and of resistance to viral infections in vivo and in vitro. Other studies are concerned with the distribution and subsequent fate of interferon in the animal and with the influence of physiologic factors and stress on the enhancement or inhibition of interferon production.

Several papers are concerned with the mechanism of action of interferon. Two papers, one by Levy and Carter and the other by Marcus and Salb, review work done by these authors which indicates that the action of interferon occurs at the ribosomal level. Ribosomes and ribosomal subunits formed in the interferon-treated cell are capable of forming apparently normal polysomes with cellular messenger RNA but bind to virus RNA poorly and translate the polysomes into protein even more poorly.

Other papers presented at this important symposium are concerned with interferon assays, purification, physicochemical properties, and treatment of viral disease with interferon.

GEORGE E. GIFFORD
Department of Microbiology,
University of Florida College of
Medicine, Gainesville 32603

The State University

Higher Education: Who Pays? Who Gains? Financing Education beyond the High School. M. M. CHAMBERS. Interstate, Danville, Ill., 1968. xvi + 304 pp. $6.95.

Author of numerous monographs about higher education, and a long-time student of the subject, M. M. Chambers, who currently is attached to the School of Education at Indiana University, deserves and enjoys widespread respect among administrators of colleges and universities. Indeed, singlehandedly and with considerable success, Chambers each year collects and distributes timely data on state government appropriations in support of higher education, a task which the Office of Education in the U.S. Department of Health, Education, and Welfare has found beyond its capabilities.

The author in his epilogue describes the present volume as a "subjective essay dealing with comprehensive concepts." No reviewer could improve upon this statement. Certainly this book is highly subjective. Chambers has some definite points of view about higher education, and once again he sets them forth with his usual vigor. His impressions may and sometimes do depart from a considerable array of facts which might warrant a different opinion. This circumstance doesn't bother Chambers.

The volume serves a dual purpose. It is a convenient handbook of observations about financing colleges and universities in the United States. In this respect, the author does not explore any new ideas, but he provides a useful summary of current practice and present issues. But the book is even more, as I have suggested, a vehicle for a restatement of personal positions.

First of all, Chambers is a strong defender of the state university and of the state government role in supporting higher education. In all the furor about federal government financing of higher education, there is a tendency to forget that our state governments provide the bulk of available funds for the current operation of higher education in the United States and that state government appropriations in support of higher education have crossed the $5-billion mark in the current fiscal year. Chambers thinks state governments can and will do still more. Those of us who labor in this vineyard hope that 1969 will prove him correct.

Perhaps it is the financial plight of