## A View of an Uneasy Alliance

**Scientists and War.** The Impact of Science on Military and Civil Affairs. SOLLY ZUCKERMAN. Harper and Row, New York, 1967. 191 pp. $4.95.

This book is important. Scientists should not dismiss it because it is short, because the essays in it were prepared for other occasions over the last few years, or because of an almost exaggerated concern for a general reader who requires definitions of seconds of arc and microwave radar. Although a certain importance might be attributed to it merely because of the author's eminent position as science adviser to the present British government, the basic significance stems rather from the ideas it contains and from the place it takes in the continuing Anglo-American dialogue on science policy.

In the first five chapters, Zuckerman describes the uneasy alliance between science and military which has taken shape in the last quarter-century. Distinguishing among basic research, mission-oriented basic research, applied research, and technology, he sketches the main outlines of the present science-based military system both in terms of the development of ever obsolescent and more sophisticated weapons and of the use of operational research. His views on the nature of science are sensible. For instance, while describing the great organizational changes in the conduct of research, he asserts that the "tidal wave of interest in science has made little difference to the nature of the individual research worker." He has no use for the distinction between tactical and strategic nuclear weapons in the age of mutual deterrence, and the "plain fact is that neither the Western nor the Soviet blocs could ever afford to put the concept of strategic nuclear war to experimental test." In his glance at the future he sees "nothing as revolutionary as radar, nuclear weapons and nuclear power, guided weapons and ballistic missiles, communication satellites, or high-speed computers emerging over the next ten, fifteen years." Science's greatest impact on military affairs will stem from political transformations, on which science will have its effect in a general way rather than through the military machine.

Fortunately, Zuckerman goes on to put his view of science and military affairs in a larger frame by considering the social function of science, as he has done before, in July 1940 at the height of the Battle for France. "There are major constraints to the freedom with which the goals of scientific and technological activity can be selected, and whatever the goals that may be chosen, their achievement carries the risk of being associated with unpredictable social repercussions." Here he is bringing up to date the discussion begun in the 1930's by J. D. Bernal on one side and Michael Polanyi on the other. In insisting that science has social consequences and is amenable to planning, Zuckerman is in the Bernal tradition. But he sees that in Britain and the United States planning came to science in the service of freedom and democracy as traditionally constituted rather than in the service of a Marxian revolution. Indeed, without making this book a polemic, he deflates many of the favorite positions of that other who has "reanimated" Bernal, Sir Charles Snow. Snow's views on Lindeman versus Tizard, the moral unneutrality of science, and the possession of prescience by scientists as a group fall under Zuckerman's skepticism. Many of the confusing and unnecessary detours into which one of the great debates of the 20th century has been diverted are thus closed off.

As we confront what some see as the beginning of a time of unprecedented troubles in the adjustment of science to the military and to society, this distillation of the experience of a crucial generation gives a wide audience a chance for informed reflection.

A. HUNTER DUPREE
*Department of History,*
*University of California, Berkeley*

## Vertebrate Nervous Systems

**Evolution of the Forebrain.** Phylogenesis and Ontogenesis of the Forebrain. A symposium held in Frankfurt and Sprendlingen, Germany, August 1965. R. HASSLER and H. STEPHAN, Eds. Thieme, Stuttgart, 1966; Plenum Press, New York, 1967. 472 pp., illus. $28.

In recent decades, a vast quantity of original investigations on living and even fossil vertebrates has furnished many significant data which have contributed substantially to the formulation of current concepts of the vertebrate nervous system. During this period relatively few treatises, conferences, and symposia have been concerned with making comprehensive assessments of these data in the primary context of comparative vertebrate neurology. This conference successfully brought together the variety of topics necessary for such an assessment of the vertebrate forebrain. The proceedings volume includes 42 papers presented by participants from 12 different countries. Most of the articles are written in English and the others in German or French with English summaries. The book, which is indexed, has an excellent format.

The papers, mainly neuroanatomical in scope, analyze phylogenetic and ontogenetic aspects of observations made on many vertebrates. Some contributions present observations and conclusions based on such modern techniques as electron microscopy, autoradiography, and histochemistry. The flavor of the conference may be gauged from several of the articles. The value of topology is emphasized by Nieuwenhuys, who notes that comparisons between the everted forebrain of the teleosts and other actinopterygian fish and the everted forebrain of other vertebrates cannot be made on a topographic but only on a topologic basis. The fundamental similarities of the forebrain of the living fossil crossopterygian *Latimeria* to those of others fishes are analyzed by Millot and Anthony. The fact that many of the main fiber bundles of the forebrain are present in almost all vertebrates, even though the bundles vary in many features, suggests the underlying stability of this pattern (Crosby, DeJonge, and Schneider). Paleoneurology, with its literature of 1500 publications, is represented by an evaluation, based on fossil brain casts, of the evolution of the brain of the Camelidae by Edinger. The basic homologies of the entopeduncular nucleus (cat), the globus pallidus (monkey), and the paleostriatum (chicken) are indicated by their ultrastructural similarities as revealed by electron microscopy (Fox, Hillman, Siegesmund, and Sether). Valuable contributions to unraveling the significance of the limbic system are made by MacLean's demonstration of a direct pathway from the visual system to the limbic cortex (squirrel monkey) and the quantitative studies of Stephan and Andy on the septum and allocortex in insectivores and primates. The analysis of the corti-

cal and subcortical visual centers in 20 different species of primates reveals interesting similarities and differences in these visually oriented animals (Hassler). Phylogenetic aspects of the lemniscal system and pyramidal tract in the higher vertebrates are analyzed by Shriver.

CHARLES R. NOBACK
*Department of Anatomy,*
*Columbia University,*
*New York City*

## Microorganisms

**The Actinomycetes.** A Summary of Current Knowledge. SELMAN A. WAKSMAN. Ronald, New York, 1967. 286 pp., illus. $12.

The publication of a study of the actinomycetes by Waksman is no novelty, for the organisms of this group have been the object of his investigation from the time he was a graduate student. Although he has now retired from active research, he still is vitally interested in and keeps informed about these microbes. Waksman more than anyone else was directly responsible for much of the early information on the actinomycetes, and his researches demonstrating that these organisms produce antibiotics led to his being awarded a Nobel Prize and, more important, resulted in intensive studies of the actinomycetes by his colleagues and in laboratories all over the world.

This book lay on my desk unopened for a long time. What could Waksman say that he had not said previously? It turned out to be a great deal. Certainly, this volume contains much material that he has previously presented —some of it almost in the identical form. But then we have little new ecological data, and the early history as well as basic morphology is still sound. What is important is that here are presented both previously given information and more recent data. For the professional taxonomist who stays abreast of the recent literature, there is little that is new; nor will any of the other specialists be enlightened in his own field. But each of them can be guided by this book into current information in fields outside of his specialty. Furthermore, the previous three-volume series on this subject by Waksman is out of print and, I am informed, will not be reprinted; thus this book fills a hiatus.

The subjects treated in the book include the ecology, morphology, cytology, classification, genetics, physiology or biochemistry, the production of antibiotics, and the pathogenicity of the actinomycetes. Of these subjects the taxonomy receives the most intensive treatment. It is a pleasure to find summaries of the most recent information on genetics and cytology and a recognition of the part that cell wall composition could play in taxonomy.

What one misses in this book is a critical treatment of the subjects described, even where the taxonomy is concerned. There is no lack of mention of new genera such as *Actinopycnidium* and *Promicromonospora*; but are these useful taxa? A number of keys of the classification are given, but we are not told which is the most usable one. There is a general assumption that one can rather readily separate the species of *Streptomyces*, for example. Thus the author writes that it is easy to separate organisms with flexuous from those with straight sporophores. This is not always the case, and the difficulty is compounded when one attempts to separate other sporophore types. One would have appreciated some recognition that the taxonomy of the largest group of actinomycetes, the *Streptomyces*, is not in good shape and that, in practice, keys to this group fail to resolve the species. This failure is in fact the basis for a current large international program to find good criteria and to characterize the species adequately. Furthermore, there is the question whether or not the approximately 600 recorded species are in fact different and whether or not some reexamination and consolidation are in order. There should be some recognition that genera that are based on ecological properties such as growth at different temperatures are not generally approved today even though they were validly and legitimately published.

These minor points do not detract from the prime importance of the book —that it brings up to date the information on the actinomycetes. It is thus an excellent introduction to current aspects of the information about these microbes.

DAVID GOTTLIEB
*Department of Plant Pathology,*
*University of Illinois,*
*Urbana*

## A Demographic Study in Malaysia

**The Population of Borneo.** A Study of the Peoples of Sarawak, Sabah and Brunei. L. W. JONES. Oxford University Press, New York, 1966. 221 pp., illus. $6.75.

This volume provides useful demographic information for Brunei, North Borneo (now Sabah), and Sarawak. In 1963 these states assumed importance because of the new Federation of Malaysia, which united the last two with the Malay states and Singapore. Although these states comprise only one third of the land area of Borneo, they are significant for a number of reasons. The population is predominately indigenous, but has a large, and increasing, economically active Chinese segment. Rich oil reserves make it a valuable part of the Federation and the envy of its neighbor Indonesia. South Borneo, on the other hand, is largely undeveloped and its population pagan and tribal.

Population increases in these states have been spectacular since World War II. Prior to Jones's study census figures were largely informed guesses. During the early decades of the present century the indigenous population seems to have been sparse, with little tendency to increase. The slowness of population growth during that period has been attributed to epidemics of smallpox and cholera, the debilitating effects of malnutrition and diseases such as malaria, sterility resulting from venereal diseases, the practice of head hunting, and tribal wars. In providing us with carefully collected demographic information Jones has erased much of the speculation and ignorance about the populations in these states. Whatever may have been the reasons for the slow growth in the population of the indigenous peoples prior to World War II, the increase since 1945 has been as revolutionary as elsewhere in Southeast Asia. Jones notes that the immigrant population, particularly the Chinese, has also multiplied *in situ* and now forms a major element in an increasing urban population. The population is proportionately young. In 1960 only 13 to 15 percent was over 45, compared with 23 percent in Japan, 28 percent in Australia, and 38 percent in the United Kingdom.

EDWARD P. DOZIER
*Department of Anthropology,*
*University of Arizona, Tucson*