volved? Is it really beyond our powers to suggest which questions are the more fundamental and to consider the data and methods required to pursue them? Is it relevant for our society's emerging needs to focus so largely on competence? Or is that focus too narrow—too reflective of an individualistic, secular, liberal outlook in a period in which there is fresh awareness of the limitations of that outlook and of the degree to which all socialization is a political act: the degree to which it is an effort to control as well as to equip, and a selective allocation of skills rather than merely a general enhancement of our personal powers? I do not know the answers to those questions, but I hope that this committee, or another, will be willing to attempt them. The discussions in this book, and its authoritative bibliographies, will be a resource for that attempt.

GUY E. SWANSON
*Department of Sociology,*
*University of Michigan, Ann Arbor*

## In the Wake of the Torrey Canyon

**The Biological Effects of Oil Pollution on Littoral Communities.** Proceedings of a symposium, Pembroke, Wales, Feb. 1968. J. D. CARTHY and DON R. ARTHUR, Eds. Field Studies Council, London, 1968 (distributor, Classey, Hampton, Middx.). viii + 198 pp., illus. Paper, 45 s.

This little volume deals with the observations made on the fauna and flora of oil-polluted shores and salt marshes of Milford Haven on the Cornish coast. Essentially, this work is an extension of the short-term studies conducted by the staff of the Plymouth Laboratory following the *Torrey Canyon* disaster in March 1967 (for a review of an earlier publication see *Science*, 23 Aug.). The area covered by the present investigations extends over 140 miles of the coastline, and the studies have been continued for several months after the major oil spill in March–April. Information given in the 18 articles by various authors materially broadens our knowledge of the effects of crude oil on plant and animal communities, of the chemistry of oil and detergents used to combat pollution, of the role of bacteria in degradation of oil in the sea, and of the pathological consequences for birds poisoned by oil. Of particular interest is a brief article describing the effect of certain pure hydrocarbons derived from crude oil on cellular membrane of amoeba, paramecium, and other cells. The major part of the book reports many ecological and toxicological features which had not been disclosed by previous investigations. Ecological observations of animal and plant communities in the polluted zones reveal great differences in tolerance among various species. In this respect they fully confirm the findings made in this country and in Europe. A new and interesting approach is used to demonstrate the deleterious effect of crude oil and detergents on littoral communities by determining the potential productivity, expressed in kilograms of dry weight per unit area, of the communities. For instance, the following significant figures are given for kelp forest ecosystems: 236 kilograms in clear water and 101 and 20 kilograms, respectively, in slightly and grossly polluted zones.

A study of metabolism of oil hydrocarbons by bacteria and the isolation of the most active bacterial species from polluted sediments are of scientific interest and also are important from a practical point of view as providing a promising approach to combating oil pollution by increasing the rate of oil degradation through bacterial activity.

It is apparent from the text that our knowledge of the physiological effects of various components of crude oil and of the factors that determine plant and animal growth and affect tolerances of marine species is deficient. It is clear that the detergents used in England in major oil spills are so toxic that their application is not desirable except under special emergency conditions, and there is an urgent need for comprehensive laboratory and field studies in order to formulate practical methods of controlling oil pollution. Because of great complexities of ecological relationships in polluted areas, great differences in the chemical compositions of oil, and an obvious necessity to conduct long-term bioassays at different seasons with various species, work of such magnitude and difficulty could be undertaken only by a large and well-financed organization. It is hoped that the present publication, in which these subjects are discussed, will stimulate the implementation of such research.

PAUL S. GALTSOFF
*U.S. Fish and Wildlife Service,*
*Woods Hole, Massachusetts*

## Plants, Mammals, and RNA

**Control Mechanisms in Developmental Processes.** Proceedings of a symposium, La Jolla, Calif., June 1967. MICHAEL LOCKE, Ed. Academic Press, New York, 1967. xiv + 302 pp., illus. $12. Society for Developmental Biology Symposium No. 26. *Developmental Biology,* supplement 1.

At a time when there is rapid progress in the application of new concepts of molecular biology to developmental phenomena and in the application of modern techniques to classical experimental systems, it is increasingly important to have available the concise summaries of specific aspects of development that the symposia of the Society for Developmental Biology have come to represent to biologists around the world. The present volume is a notable addition to the series. The theme announced by the title of the volume is treated in three sections: The Role of Cytoplasmic Units, The Role of the Nucleus, and Regulatory Mechanisms. The second subject receives the greatest attention, in four chapters occupying about half of the book; the last section is comprised of three rather brief chapters. It is of special interest to the botanist that the first five of the ten chapters are concerned with control mechanisms in plants—ranging from mitachondrial control of fungous morphology (Tatum and Luck) and flagellar development in mutants of a green alga (Randall *et al.*) to plastid ribosomes in plastid development (Bogorad) and gene action in higher plants (McClintock on pigmentation patterns in corn and Stebbins on barley morphogenesis).

In four of the five other chapters, mammalian systems are explored (interspecific somatic hybrids in rodents by Ephrussi and Weiss, erythroid cell differentiation by London *et al.*, development of immunocompetence in the thymus by Auerbach, and estrogen control of development in the rat by Segal). A particularly long, comprehensive, and doubtless controversial chapter by Tyler on masked messenger RNA, especially as it has been studied in sea urchin embryogenesis, completes the list.

Each of these chapters provides sufficient background information to be comprehensible to the advanced student. Most chapters include new experimental data and stress the relationship between these data and current concepts of developmental control. Inevitably, these concepts center around molecular mechanisms controlling protein synthesis in cells, that is, DNA and the hierarchy of

RNA's of the cell which lead to protein specificity and the differentiation of cells. The volume brings together provocative examples of control mechanisms acting during development. Clearly, this subject will be the center of attention for many more symposia during the next quarter century.

JOHN G. TORREY
*Biological Laboratories, Harvard University, Cambridge, Massachusetts*

## Between Neuron and Neuron

**Physiological and Biochemical Aspects of Nervous Integration.** A symposium, Woods Hole, Mass., 1967. FRANCIS D. CARLSON, Ed. Prentice-Hall, Englewood Cliffs, N.J., 1968. viii + 392 pp., illus. $7.

The nervous system is an accumulation of cells which are organized in highly specific functional relationships. The long axonal and dendritic processes of many neurons permit direct contact with a large number of other cells. These intercellular contacts are what the nervous system is all about. Excitatory and inhibitory impulses converge on and diverge from neurons and result in the highly integrated process which is behavior.

Because each neuron may interact directly with so many others, studies of interneuronal relationships are extremely difficult. Many of the researchers confronting this problem participated in the symposium recorded in this volume. Their presentations, which are often summaries of published experiments, show that much of the work attempts to answer several crucial questions: What are the details of neuronal circuitry which combine the activation of a number of neurons into an integrated response? What are the mechanisms for establishing specific interneuronal relationships, and how specific are they really? What are the biochemical correlates of the establishment of interneuronal relationships both in embryonic differentiation and in the finer differentiation which occurs during learning?

Although the answers to all these questions are extremely incomplete, the answer to the first of them is at a comparatively advanced stage. Not only have there been important analyses of integration in the vertebrate visual pathway, as described here (rather briefly) by Hubel and Wiesel, but there have also been a considerable number of important studies in invertebrates. Because the number of neurons present in invertebrate ganglia is relatively small, it is relatively simple to identify, in the living state, individual neurons, some of their axonal branches, and other neurons with which they make functional connections. Many of the components of "simple" pathways can thus be identified and activated experimentally. Here then are systems in which the interaction of neurons can be studied in a fairly detailed way. In this volume, there are a number of reports of the usefulness of this approach.

Kandel and Wachtel present the most highly developed example in their study of the neuronal interactions in the abdominal ganglion of *Aplysia*. The influence of periodic endogenous activity in individual neurons on the properties of a network in *Aplysia* is demonstrated by Strumwasser. The ability of single "command neurons" to release complex coordinated patterns of behavior involving hundreds of neurons is analyzed by Kennedy in studies of the arthropod nervous system. The great functional complexity which is possible with even a relatively small number of interacting neurons controlled by relatively few basic mechanisms is strikingly demonstrated. From studies such as these the principles by which neuronal interactions produce complex internal and behavioral responses are becoming known.

Far less advanced is our understanding of the development of such specific neuronal connections during embryogenesis. From interesting studies of the development of retinotectal relationships in Amphibia, Jacobson reports evidence for the establishment of highly specific interneuronal recognition at a specific stage in development. At an early stage of development, individual retinal ganglion cells have the potentiality to make synapses with any cell in the optic tectum. At a later, well-defined stage, they are directed to specifically choose and make connection with specific partners in the tectum. It appears that each ganglion cell in the retina and each tectal cell is instructed to make contact with a particular partner, and that these instructions are given before the cells involved have met. Although this degree of specificity may not be characteristic of all interneuronal relationships, this study shows how specific these relationships can be in certain systems. This poses the enormous question of explaining how such precise intercellular recognition is brought about.

The biochemical approach to a related problem, the nature of the processes which mediate the development of new functional interneuronal relationships after learning, is also considered in this symposium. Because of its common participation in other biological regulatory processes, protein synthesis receives primary attention. Evidence for the participation of cerebral protein synthesis in memory is presented by Agranoff and Davis, studies of cerebral protein synthesis during learning are discussed by McEwen, and a unique class of cerebral proteins of unknown function is described by Moore and Perez. Horridge and M. Cohen, among others, consider behavioral responses in invertebrates which might prove appropriate for studies of learning in relatively small ("simple") nervous systems.

The remaining reports describe still other significant discoveries which may all contribute to the solution of the core problems which I have identified. As one reads this collection of papers, one gets a feeling for the concepts and techniques with which one must struggle in order to come to grips with the complex functioning of the nervous system. Because it may be difficult for many readers to integrate these diverse studies, the book would have benefited from a critical summary. However, the participants speak well for themselves and will educate all readers who have a fundamental background in neurophysiology and biochemistry.

SAMUEL H. BARONDES
*Departments of Psychiatry* and *Molecular Biology, Albert Einstein College of Medicine, Bronx, New York*

## Pacific Archeology

**Prehistoric Culture in Oceania.** A symposium of the 11th Pacific Science Congress, Tokyo, 1966. I. YAWATA and Y. H. SINOTO, Eds. Bishop Museum Press, Honolulu, 1968. 179 pp., illus. Paper, $7.

Four of the papers in this symposium volume are devoted to Melanesia, three to Micronesia, eight to Polynesia, and one to the status of archeological research in Oceania as a whole. The publication is directed to specialists in the subject, and the reader with a more casual interest may profitably limit his reading to the five interpretative papers by Emory, Heyerdahl, Golson, Green, and Spoehr.

The earliest evidence for human oc-