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.

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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.

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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-