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Neuroscience Advances

During the past few years our understanding about the brain and the nervous system has been progressing at a rapid pace. The articles in this issue are a sampling of one facet of the exciting new developments in the neurosciences, the cellular and molecular aspects. Other areas of neuroscience research involving the mechanism of perception, behavior, memory, learning, and emotion have also seen considerable advances.

An increasing number of talented scientists are doing their research on the nervous system. More of our brightest students are taking their advanced degrees in neurobiology because of its fascination, challenge, and widening opportunities. Many universities and research institutions have or are in the process of establishing neuroscience departments. Why did this surge of interest and activity come about?

In the past there has been an intellectual and technical separation among scientists working in neuroanatomy, electrophysiology, neurochemistry, neuropharmacology, and cell biology. During the 1970's the barriers among these disciplines have fallen. Neuroscientists have also borrowed heavily from molecular biology, biochemistry, biophysics, immunology, genetics, and cell biology to do their work. The ingenious application of new technologies made it possible to ask more sophisticated and penetrating questions regarding the nervous system. Simple organisms have provided productive experimental models to study learning and behavior, how neurons make decisions for synaptic connections, and the isolation of receptors.

Among the many advances made in the neurosciences during the past decade one of the most prominent has been the discovery of numerous neurotransmitters, the chemical messengers released from neurons. About 10 years ago only three or four neurotransmitters had been recognized; now about 50 or so have been identified. The greatest number of neurotransmitters have been found to be peptides which arise from the processing of larger polypeptides. It now appears that the brain is also a complex endocrine organ that releases a variety of hormone-like peptides. The functional significance of most neuropeptides is still unknown, but some have been found to be involved in reproductive activity, behavior, pain, and appetite.

The enthusiasm of investigators in the neurosciences is not only directed to the understanding of fundamental mechanisms of brain and nerve function but also to how this information is used clinically. The discovery that certain areas of the brain are depleted of the catecholamine neurotransmitter dopamine, first in animals with experimentally induced Parkinson-like syndrome and then in patients with this disease, led to the introduction of L-dopa for the effective treatment of Parkinson's disease. Myasthenia gravis is now known to involve the presence of antibodies to the acetylcholine receptor. Powerful tools such as molecular genetics and brain-imaging techniques are becoming available to understand the nature of Huntington's and Alzheimer's and other neurological diseases. Mental depression has been shown to be relieved by drugs that interfere with the action of biogenic amine neurotransmitters, and schizophrenic symptoms can be abated by drugs that block dopamine receptors. These observations provided a framework by which biological approaches to the understanding of mental diseases are actively being sought.

The momentum of research in the neurosciences will no doubt continue. Many more neurotransmitters will be discovered. The complex cascade of chemical events whereby neuronal signals are transduced will be clarified. The functions of some of the brain-specific genes will be understood. The molecular mechanisms by which growing neurons make connections with their target cells will be elucidated. More nerve growth factors will be found and their actions explained.

Recent discoveries in neuroscience are just the beginning; they should serve as stepping-stones to future research leading to the understanding of higher mental functions and disorders of the nervous system.—JULIUS AXELROD, *National Institute of Mental Health, Bethesda, Maryland 20205*