tions of visual cortex in cats are outlined. These descriptions are useful, but they are not closely tied to the main theme. Except for a brief description of the response properties of neurons in area 17 of macaque monkeys, such research on mammals other than cats is largely ignored. Comparative statements about other mammals are few and sometimes seem naïve or motivated by a need to justify research on cats. Yet what the book does well it does quite well, and there is no comparable review of visual cortical processing and coding in the three main visual areas of cats.

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Molecular Neurobiology

Molecular Neurobiology. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1983. xxii, 921 pp., illus. Cloth (in two volumes), $125; paper, $68. Cold Spring Harbor Symposia on Quantitative Biology, vol. 48. From a symposium, Cold Spring Harbor, N.Y., June 1983.

This large volume combines the market appeal of molecular biology and that of neurobiology, the two fields of biology that, along with immunology, have grown the most rapidly during the past two or three decades. As Kandel in his thoughtful epilogue points out, one should not suppose that the publication of the book marks the sudden discovery of neurobiology by molecular biologists, for many turned their attention to the brain more than 20 years ago. It is only in the last few years, however, that rapid progress has begun to be made.

With respect to detailed molecular analysis of a membrane protein of critical importance to the function of the nervous system, studies of the acetylcholine receptor protein must rank as the supreme example so far. The receptor, which controls the fast opening of membrane channels for sodium and other cations in cells receptive to acetylcholine, has been purified to homogeneity, and understanding of the complex molecular architecture is well advanced. This has been achieved both by the classical techniques of biochemistry, the isolation and characterization of the receptor protein, and by the modern techniques of molecular genetics, by which means the entire primary sequences of all four different subunits of the receptor protein can be deduced from the DNA sequences of the cloned receptor genes. At the same time, electrophysiological techniques have advanced to the point at which recording of the opening and closing of a single receptor-controlled membrane channel has become a practical possibility. The studies of the acetylcholine receptor thus combine the most powerful new tools of electrophysiology with those of molecular biology in a most impressive manner, to give considerable new insight into the working of the system.

Also well advanced, along similar lines, are studies of the voltage-sensitive sodium channels present in all nerve cell membranes, which are responsible for the ability of these cells to propagate electrical signals.

Modern nucleic acid technology allows a new range of possibilities in analyzing the macromolecules synthesized in brain. By the use of screening techniques it is possible to focus attention on those mRNA species that are present only in brain and to try to obtain more information about the nature of the gene products that they represent. This is a formidable undertaking, for the number of different brain-specific mRNA species in mammals is high (estimates range from tens of thousands to hundreds of thousands). By focusing on narrower categories (such as brain-specific phosphoproteins), however, progress may be made quite rapidly.

Another approach is to study mRNA species specific for particular key enzymes in neurotransmitter metabolism, such as those coding for tyrosine and dopamine hydroxylases in catecholamine synthesis. Analysis of mRNA species or DNA sequencing of gene families may well be the most powerful tools for identifying novel brain peptides. It is already known that some three dozen small peptides exist in neurons and are probably released as a novel class of chemical messengers in brain. More neuropeptides are being discovered as the approaches of molecular genetics reveal the multiple gene families that specify most brain peptides and the molecular heterogeneity in each peptide family. Thus, the two morphine-like peptides [Met]enkephalin and [Leu]enkephalin are now known to be members of a family of opioid peptides numbering more than one dozen members and specified by three different genes.

Among the most intriguing problems facing neurobiology is to understand the complex mechanisms that regulate the development of the nervous system and the formation of appropriate connections between its individual cellular components. Here the study of nerve growth factors will be of crucial importance, as will the understanding of the neuronal cell-surface markers and adhesion molecules that determine recognition and cell adhesion during development.

The present volume reviews all of this and much more in more than 80 short papers. Overall it is an exciting book. It portrays a field of great scientific promise and intellectual vigor, with just an occasional note of arrogance. The volume is strongly recommended to all who wish to become acquainted with or to be brought up to date in this field.

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CHEMRAWN II. Chemistry and World Food Sup-

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