Neuropeptides

Peptides in Neurobiology. HAROLD GAINER, Ed. Plenum, New York, 1977. xx, 464 pp., illus. $34.50. Current Topics in Neurobiology.

The dramatic impact of the discovery that morphine-like peptides, the enkephalins, are present as normal constituents of mammalian brain led one correspondent to this journal, with only a modest degree of hyperbole, to describe research on these substances as "one of the hottest growth areas in the neurosciences." One spin-off of this latest vogue in the neurosciences has been an intensified interest in the neurobiological significance of the variety of small peptides known to exist in the nervous system.

Research on the enkephalins and the related pituitary endorphins continues to dominate. Nevertheless, the opioid peptides are heavily outnumbered by other endogenous neuropeptides, including the neurohypophyseal hormones vasopressin and oxytocin; the hypothalamic releasing hormones, now known to occur in many regions of the central nervous system outside the hypothalamus; various peptides initially described in the gut, such as substance P, vasoactive intestinal polypeptide, and gastrin; and brain peptides with unknown function, such as neurotensin and the two dozen or so dipeptides and tripeptides that contain putative amino acid transmitters such as glutamic acid, gamma-aminobutyric acid, aspartic acid, and β-alanine. The present volume reviews the overall field of neuropeptide research, and gives an accurate account of the state of the art in 1975 (with an addendum that is a valiant attempt to keep abreast of enkephalins up to mid-1976).

The endogenous peptides found in the nervous tissue are nearly all present in very small amounts, and methods for their analysis at the picomole and femtomole level are crucial for future research. The book has good reviews of the use of column chromatographic techniques, in which sensitive detection is afforded by means of modern fluorogenic reagents, and of the more popular radioimmunoassay approach. These techniques, used in conjunction with microdissection of specific brain areas, and the equally important technique of immunocytochemistry have rapidly advanced our knowledge of the cellular localization of neuropeptides and their distribution in the central nervous system. In all cases studied so far the peptides have been found to occur exclusively in neurons, and they are particularly concentrated in nerve terminals, suggesting that they may represent a new family of central nervous system neurotransmitter substances.

Very little is yet known about the biochemical mechanisms involved in the biosynthesis and degradation of brain peptides. The limited number of examples for which such information is available suggest, however, that neuropeptides are probably synthesized initially as parts of larger precursor polypeptides that are then attacked by specific cleavage enzymes. The inactivation of the peptides following their release in the brain may involve multiple sites of attack by the numerous peptidases present in the central nervous system, although the existence of specific degradative enzymes for individual peptides remains a possibility.

If we know little about the metabolism of neuropeptides, we know even less about their functional importance. A very useful chapter reviews what is known about invertebrate nervous system peptides. About 50 such substances are known (mainly in arthropods and mollusks), and they serve diverse functions, controlling pigmentation, molting, tanning, heart and gut function, sugar and fat metabolism, salt and water balance, and reproduction. These comparative data may provide valuable clues, although one may question how far extrapolation to vertebrates is permissible, since the neuropeptides in invertebrates seem to serve many of the functions assumed by endocrine tissues in vertebrates. Nevertheless, it may be helpful to view the peptidergic neuron as intermediate in its properties between a gland cell and a neuron. The known electrophysiological actions of peptides in the vertebrate central nervous system and their diverse effects on animal behavior are well reviewed. The latter are particularly important, since some of the first clues about the importance of peptides in brain function derive from behavioral observations, although the gulf between such observations and our understanding of the precise cellular distribution and mode of action of peptides within the central nervous system clearly remains immense. The present volume can be regarded as no more than a progress report in a rapidly growing field, but it should provide a useful entrée to the subject for those interested in joining in the fun.

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Acridology in the Uvarovian Style

Grasshoppers and Locusts. A Handbook of General Acridology. Vol. 2, Behaviour, Ecology, Biogeography, Population Dynamics. BORIS UVAROV. Centre for Overseas Pest Research, London, 1977. x, 614 pp., illus. $40.

The first volume of this comprehensive work, covering the anatomy and physiology of the short-horned grasshoppers or Acridoidea and an introduction to their classification, was published in 1966. The second volume is posthumous, since the Russian-British author, Sir Boris Uvarov, died, at the age of 80, in 1970. We are indebted to several members of the London Centre for Overseas Pest Research, who revised and edited the drafts of the chapters left unfinished by the author and assembled the illustrations and bibliography. The work as a whole is an extremely solid contribution to entomological literature, the scientific testament of a man whose life was wholly devoted to the study of locusts and grasshoppers from the standpoint of taxonomy, descriptive ecology, and biogeography and the practical control of pest species.

The second volume deals with the general activities and behavior of the insects, their food and feeding habits, flight, mating, oviposition, life cycles, and the relationship between "life forms" and "life zones" (somewhat vague but useful concepts around which discussion can be organized). Four chapters deal with aspects of "gregarization"—the genesis of migratory behavior in certain species ("locusts" as opposed to "grasshoppers" in Uvarov's sense), leading to the outbreak of swarms.

The major part of the book is concerned with the important locust pests of the Old World, the desert locust (*Schistocerca gregaria*, very closely related to the widespread North and South American *S. americana*), the migratory locust (*Locusta migratoria*, with many races extending from Europe and central Africa to the Philippines and eastern Australia), the South African brown locust (*Locustana pardalina*), and the red locust (East Africa, Madagascar). The review of the literature on these and other, minor pest species of Africa and Asia (some of them, such as the Moroccan locust, *Dociostaurus maroccanus*, not so

minor, perhaps) is extremely thorough. There is also good coverage of the bionomics of North American *Melanoplus* species. Grasshopper ecology, biogeography, and population dynamics are fields in which Soviet entomologists have made outstanding contributions, and these are dealt with thoroughly in this volume, illuminated by the author's firsthand knowledge of the situation in the field.

The book is very much the man himself. Uvarov, despite his 50 years in Britain, remained intellectually a representative of the classical tradition of Russian entomology as it developed in the early years of the century, before it became influenced by genetics, biochemistry, and modern theoretical ecology. To these influences he remained impervious. Thus in some ways his book has a slightly old-fashioned flavor. Moreover, it is, so to speak, a locust's-eye view of "acridology," without comparisons with other insects. The study of locusts, for Uvarov, had much to contribute to general entomology, but the converse was not true.

Uvarov's name will always be associated with two concepts of basic importance in connection with locust plagues—*phase transformation* (from the solitary to the gregarious state) and *outbreak areas*. It is consequently natural that these should be fully dealt with in this book. The idea that swarms originate from localized "outbreak areas," where mass breeding occurs, proved extremely fruitful in the control of *Locusta migratoria*, which has a major outbreak area in the deltaic region of the Niger river in the Republic of Mali. Unfortunately, the concept has rather limited applicability to the desert locust, the number one locust scourge of the Old World.

One of the most interesting features of the book is the history of the development and recession of plagues of *Schistocerca* (1948–1963) and *Nomadacris* (1930–1945), illustrated by maps based on the work of Z. Waloff, Morant, and Symmons. Other maps illustrate the movements of swarms of the various species in relation to climate, seasons, and meteorological conditions.

The final chapter, a general discussion of the problems of locust control, is an expanded version of a paper delivered by Uvarov to the 13th International Congress of Entomology in Moscow in 1968 and originally published in Russian. The salient points of the argument are: (i) the considerable successes of direct insecticidal control measures in Africa and western Asia have been no more than palliatives, and the basic problem remains; (ii) the ultimate solution, different for each pest species, must be the regulation of the population dynamics of the species by deliberate modification of key ecological factors; (iii) new economic problems are continually arising, owing to the development of local grasshopper species into unexpected pests as new agricultural practices in tropical and subtropical countries lead to modification of the general ecology.

Outstanding as an organizer of the overall strategy of locust control, Uvarov never lost his vision that a broad biological approach would eventually reduce populations of these oldest insect competitors of man to a bearable level. He was interested in any facts or ideas that might contribute to that end but impatient of biochemical, physiological, or genetic research which he did not understand and whose relevance to the economic problem was unclear. Speaking of laboratory research on locusts he makes this characteristic comment (p. 531): "Many of these studies throw some light on what actually occurs in nature, but most of them are divorced from reality." For him "reality" was always African peasant holdings devastated by locust swarms, crops wiped out, malnutrition and starvation. Speaking of the present reviewer, he is reported to have said on one occasion: "So—B. is going to work with White! Well, B. is mad, White is mad—*something interesting* may come of it!" That mixture of broad- and narrow-mindedness, of optimism and pessimism, of conservatism and foresight, was the essence of Uvarov's thinking and is the background from which this carefully researched, extensively documented book was written.

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Fused Cells

Cell Hybrids. NILS R. RINGERTZ and ROBERT E. SAVAGE. Academic Press, New York, 1976. xiv, 366 pp., illus. $29.50.

Fusion of somatic cells from different animals and plants to form intra- and interspecific hybrid cells has become an important procedure in cell biology, genetics, virology, tumor research, developmental biology, and comparative studies. In addition, practical uses for somatic cell hybrids are now emerging in medicine and agriculture. Short monographs and several review articles have appeared earlier concentrating on various aspects of cell hybridization research. The present volume integrates the many subdivisions of the field. It is designed to present a broad but detailed view of the methodology of cell fusion as well as the major developments in the applications of somatic cell hybrids. Since the literature of the subject is increasing rapidly, the authors have chosen to present highlights in the majority of instances, and deal more briefly with topics such as gene mapping that have been reviewed extensively elsewhere. Over a thousand references prior to 1976 are cited in the book.

After a historical account of the study of multinucleated and hybrid cells, there are chapters that discuss spontaneous and virus-induced cell fusion, the mechanism of cell fusion, cell fusion at different stages of the cell cycle, heterokaryons, and cell fusion with cellular fragments. These chapters, which constitute roughly half the volume, lay the methodological groundwork for the isolation of proliferating long-term somatic cell hybrids.

Chromosome patterns and phenotypic expression of gene markers in multiplying mononucleate hybrid cells are then discussed. The various chromosome banding techniques and patterns of gene expression in cells with inputs from two genomes are summarized. An interesting but not extensive chapter on the characteristics of organelles in hybrid cells is included. The remainder of the book deals with the important subjects of gene mapping and genetic complementation, analysis of malignancy, and viral infection and rescue in cell hybrids. The book concludes with a useful and timely chapter on the properties and applications of plant cell hybrids.

The goal of the authors was to present their subject so that it could be understood by those with a "basic training in biology." They have succeeded in this. With a glossary as an aid and a brief introduction at the beginning of each chapter, the book need not be read sequentially.

Cell hybrid research is expanding rapidly and is much too broad to permit inclusion of all the fine points and interesting references in a volume the size of this one. The authors have been quite successful in selecting their material. The book is well illustrated and includes many facts assimilated in tabular form. *Cell Hybrids* will be an important source book not only for the graduate student, but also for the investigator with an interest in the subject.

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