

from the earliest known occupations to the end of the Archaic at approximately 1000 B.C., when the hunting-gathering economies were transformed by the acceptance of plant cultivation. Chapman makes use of a sequence of four periods and for each characterizes the cultural traditions present in each of five physiographic regions of the state.

His Early Man period, ranging from the time of man's first entry into North America up to 12,000 B.C., is characterized by an unspecialized hunter-gatherer tradition and is based largely on evidence derived from outside the state of Missouri. Even though these dates and associations have been the center of much controversy, Chapman synthesizes them into a new hypothesis regarding the migration of peoples from Asia to America. He suggests that, perhaps as early as 40,000 years ago, the first migrants moved down the west coast of North America by boat. These nomads brought with them a technology of stoneworking that included the production of bifacial laurel-leaf and bipointed projectile points or knives, these being the basic forms from which others, such as the distinctive fluted points, were derived. Inland penetrations from the early coastal migration occurred in the Puget Sound region and the Columbia River valley, but it was mainly in central Mexico that there were rapid movements inland and a population explosion. It was a later movement northward from Mexico in the Early Man period that provided the initial peopling of the eastern United States. The Early Hunter tradition of Chapman's Paleo-Indian period (12,000 to 8,000 B.C.), known in Missouri mainly from the distribution of fluted points that are the local equivalents of Folsom and Clovis, represents a complex whose region of origin he does not specify except to place it somewhere in a broad region from Mexico and the southwestern United States to Florida. This tradition manifests an adaptation to hunting land-based big game at a time as late as 18,000 to 16,000 B.C.

While the Early Hunter period is seen as a time of cold climate in Missouri, the Dalton period (8000 to 7000 B.C.) spans a shift to temperate conditions and the beginning of a transition from hunting to foraging as a primary means of subsistence. Only with this period and the subsequent Archaic (7000 to 1000 B.C.) do excavated sites yield a wider range of artifactual data. The Foraging tradition of the Archaic is marked first by a broadening of subsistence activities, with an increase in the importance of small game animals relative to the moderately large ones that provided more of the diet during the Dalton period. Only by the Late Archaic period (3000 to

1000 B.C.), when climatic conditions were drier, do we see a shift to a greater use of vegetable foods and an appropriate tool technology for their exploitation.

Whether or not Chapman's hypotheses are accepted, they will stimulate discussion and refinement of a broader interpretative framework. On the local scene, the lavish illustrations—comprising both excellent photographs and drawings accompanied by an appendix describing the major types of projectile point, the most distinctive implement found on the early sites—make the volume useful as a guide to identification of forms and traditions. Chapman has fully documented his account of Missouri archeology, previously covered only in popular handbooks, and has provided a stimulating challenge to some of the accepted ideas of his professional colleagues.

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## Bacterial Viruses

**RNA Phages.** NORTON D. ZINDER, Ed. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1975. x, 428 pp., illus. \$28. Cold Spring Harbor Monograph Series.

In the development of our understanding of gene action at the molecular level bacterial viruses (bacteriophages or phages) have held a preeminent place. Much of what we know about mutation, nucleic acid replication, genetic recombination, and gene expression at the transcriptional and translational levels has been the result of precise genetic and biochemical experiments with bacterial viruses, beginning with the T phages of *Escherichia coli* in the 1940's and continuing with coliphage lambda and even simpler phages. Among those viruses whose study has contributed so much are the tiny RNA-containing phages specific for male strains of *E. coli* discovered in 1960 in the sewage of New York City by Tim Loeb and Norton Zinder. I well remember the excitement at the Rockefeller Institute when one of their isolates was found to have an RNA genome. This discovery came at a time when investigations of the replication of RNA animal viruses (such as poliovirus) were already hampered by the technical and biological complexities of animal cells in culture; with an RNA virus that reproduced in the well-studied *E. coli* one could expect rapid progress. Moreover, Nirenberg had just succeeded in showing that *E. coli* extracts could be programmed to synthesize specific polypep-

tides in response to added polyribonucleotides. If the phage RNA served as a messenger for protein synthesis in such extracts, a pure, natural messenger RNA would be readily available for use in the analysis of the complex process of protein synthesis. That all of these early expectations—and more—were realized in the ensuing years is documented in *RNA Phages*.

The book is a collection of reviews (14 in all) summing up more than a decade of active research on nearly all aspects of RNA phages, including the physical and chemical properties of the phages and their RNA and proteins, phage genetics, the early interactions between phage and *E. coli*, replication of phage RNA, protein synthesis directed by phage RNA and its control, morphogenesis of phage particles, and RNA phages of bacteria other than *E. coli*. The layout of the volume is attractive, the print is large and easy to read, and the figures are clear except for the electron micrographs, many of which are poorly reproduced. A few chapters are summaries of research from a given author's laboratory and contain a good many primary data; most are broader reviews of specific subjects. The latter should be particularly useful, for nearly all of them are succinctly written and amply referenced. The review by R. I. Kamen on the structure and function of RNA replicase is an especially lucid account of the subunit structure of this complex enzyme, which, as was first shown by Spiegelman and his colleagues, specifically replicates phage RNA. What role each of the subunits plays in the replication process is one of the most important unanswered questions in the RNA virus field. As is inevitable in a review volume dealing with an active field, a few of the articles (some of which were written in 1972 or 1973) are no longer up to date. Two examples are the chapter by J. A. Steitz on ribosome recognition of initiator regions in the phage genome and the chapter by W. Fiers on nucleotide sequences of phage RNA. (At the time of writing, the nucleotide sequence was about half completed, but it is now complete.) Nevertheless, these two chapters are among the most interesting in the book, for they illustrate how nucleotide sequence data on phage RNA have provided a deeper understanding of the mechanisms of translational control and point up the importance of this approach to future efforts to understand replication of phage RNA. Perhaps also inevitable in a field in which problems have been approached from different angles by a sizable number of able investigators are the extensive overlap and repetition evident in some of the chapters. There are also a few omis-

sions, the most notable a thorough presentation of the generation of variant RNA molecules by phage replicase in the presence and absence of templates, an aspect of RNA phage research that may bear on the origin of polynucleotide templates and their evolution. Altogether this monograph demonstrates in an impressive and useful way how concentrated effort on one of the simplest viruses has resulted in major insights into fundamental genetic processes. For the specialist and the nonspecialist alike it will serve as a convenient source of background material and references, and for those who are working in related fields it may help determine new directions of research.

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## Exploring the Brain

**Handbook of Drug and Chemical Stimulation of the Brain.** Behavioral, Pharmacological and Physiological Aspects. R. D. MYERS. Van Nostrand Reinhold, New York, 1974. xviii, 760 pp., illus. \$37.50.

The book under review is a comprehensive and critical survey of published research related to chemical stimulation of the brain. The book is well written and clearly organized, providing a wealth of information for workers in pharmacology, physiology, psychology, neurology, and biochemistry. It has continuity and can be read with pleasure, and yet, because it is clearly indexed, it can also serve as a ready reference source.

The first chapter is an excellent introduction to chemical stimulation of the brain. It discusses the rationale behind the technique, deals with the key concepts of chemical sensitivity and chemical receptors, and provides basic information on the neuroanatomy and neurochemistry of the brain. The chapter concludes with a description of the purpose and limitations of the helpful Master Summary Tables that appear at the end of each subsequent chapter. These tables summarize the drugs, doses, species, and injection volumes and sites used in the studies presented in the particular chapter.

The second chapter describes the methods used for applying chemicals directly to the brain and follows with a comprehensive discussion of the various problems (such as drug diffusion, dosage, and cannula lesions) associated with these techniques.

The following ten chapters present the results of the vast number of central injection studies, organized according to the different types of physiological and behavioral responses involved. They cover cardiovascular, respiratory, gastrointestinal, and other autonomic functions; adrenal and thyroid hormonal systems and growth hormone; reproductive functions and sexual behavior; temperature regulation; hunger and feeding behavior; thirst and drinking behavior; sleep and arousal; sensory and motor systems; emotional behavior; and learning and memory.

Myers presents this material clearly. He focuses on key issues with a critical and experienced eye, continually stressing the importance of anatomical mapping, dose-response analyses, determining pharmacological specificity and species differences, and using a diversity of drugs to explore a given neurochemical system. He discusses the weaknesses of particular studies, such as the use of large injection volumes or high doses or failure to provide proper controls or present adequate histology. This critical approach helps the reader to evaluate the material presented.

The reader should bear in mind two additional points. The first is that most of the studies covered in the book were published before 1972 (a few 1972 articles are cited). In some cases, the problems or controversies surrounding these studies have been at least partially resolved by advances made in subsequent research. The second is that the book focuses, by design, on studies employing the central injection technique. To properly evaluate our knowledge of brain neurochemical mechanisms, one must also consider the important contributions made through the use of other experimental techniques, such as lesioning, electrical stimulation, iontophoresis, or histochemistry. Although the book mentions these results, it does not (and could not) give full representation to such broad areas of research.

Chapter 13, the epilogue, provides the perspective needed for a well-rounded view of the literature on brain neurochemical mechanisms. Here Myers discusses such important issues as anatomical specificity and center versus "primary monitoring zone," presents data on the *in vivo* release of humoral factors, and discusses and further defines the key concepts of neurochemical coding and neurotransmitter function.

Because of the range of the relevant research, a survey of this field is a major undertaking. Myers's book is a commensurate achievement.

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## New Particles Considered

**Theories and Experiments in High-Energy Physics.** Papers from a meeting, Coral Gables, Fla., Jan. 1975. ARNOLD PERLMUTTER and SUSAN M. WIDMAYER, Eds. Plenum, New York, 1975. x, 486 pp., illus. \$39.50. Studies in the Natural Sciences, vol. 9.

The conference of which this book is the proceedings took place soon after the spectacular series of discoveries, at Brookhaven and at Stanford, of several new, high-mass, subatomic particles with somewhat unexpected properties. The organizers therefore wisely invited a number of theoretical and experimental physicists closely associated with these developments to describe the discoveries and to discuss some of the ideas that had been prepared to understand them. Most of the papers in the book deal with these topics.

The papers of Lynch and of Hofstadter are a valuable summary of the experimental situation concerning the new particles as it was in mid-January 1975. They describe in detail the basic properties of the 3.1-GeV and 3.7-GeV resonances, emphasizing their production in electron-positron collisions. Omitted, of course, from these accounts are the more recent discoveries of other particles in this energy range that occur as radiative decay products of these two resonances.

Among the theoretical contributions concerning the new particles, the most useful is the review by Gilman of the theoretical analysis of electron-positron scattering and of the interpretation of the new particles as bound states of heavy quarks that carry some new quantum number. This interpretation has received additional support from the more recent discoveries. Also of interest is the outline by Greenberg of an alternative approach to understanding these particles, the color meson hypothesis, which now seems untenable.

The book also contains a fascinating discussion by Dirac of the reasons for, and implications of, his proposal that the Newtonian gravitational constant varies with the radius of the universe and so is time-dependent.

In spite of these positive features, it is difficult for me to recommend buying the book, as its usefulness is likely to be transitory because of the rapid development in particle physics and the price seems exorbitant. Perhaps it would be of interest to research libraries who want a summary in hard covers of the recent excitement in particle physics.

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