

tention to other cultural activities, especially science, art, and religion, which involve the study of information, style, and beliefs rather than motor behavior. Leo S. Klejn, the lone Russian contributor, is a notable exception; while he considers factors of production to be paramount, he notes that Marxian archeologists are now paying more attention to economics, politics, and ideology (pp. 691–710). Among the non-Marxists, there appears to be an increasing interest in demographic and social, as opposed to cultural, factors. William L. Rathje's paper on Mayan social structure (pp. 731–757) is a complex example.

In this computer age, most of the authors have found it convenient to proceed by examining the variability in artifacts and nonartifactual remains within particular assemblages. By so doing, they focus upon microchanges, which have taken place at particular points in time and space, as opposed to macrochanges, which take place through the dimensions of time and space. The greatest gap in the volume, especially when it is compared with the two previous Seminar volumes, is its failure to deal with macrochange, involving long-term patterns of development—this despite the fact that archeology is especially well suited to the study of long-term patterns since it covers the total range of prehistory and history. Evolution, conceived as the overall pattern of development in nature and man, is scarcely mentioned at all, except by authors like Warwick Bray (pp. 73–92) who draw analogies between paleontological and archeological studies of change.

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Viruses and Chemotherapy

Selective Inhibitors of Viral Functions. WILLIAM A. CARTER, Ed. CRC Press (Chemical Rubber Co.), Cleveland, Ohio, 1973. x, 378 pp., illus. \$39.95.

The purpose of this book is to provide a ready source of references and a better basis for experimental design in investigating antiviral compounds. Another aim is to categorize knowledge on the mode of action of viral inhibitors at the molecular, cellular, and clinical levels. The result is a series of essays that proceed from general aspects of the

limitation of viral diseases to interferon induction and its biologic effects, then to specific groups of drugs that affect viral replication, concluding with inhibitors of some nucleic acid polymerases involved in viral transformation of cells and oncogenesis. An attempt to provide an overview of responses to viral infections fails owing to the largeness of the subject. The consideration given vaccines is not well integrated into the theme. Chapters on inhibitors of specific viral functions provide more than 2000 references and interpret them in a format that is enjoyable to read.

Research on interferon has established it as an integral part of the host defense response. Because of the large number of systems studied, some paradoxical results, and the unavailability of pure interferon, the authors must resort frequently to such phrases as "The mechanism is unknown, but the observations suggest . . ." The result, however, is a good view of the present status of knowledge about interferon and a calling of attention to the many gaps that remain to be filled. The discussion proceeds from the molecular biology of induction of viral replication to differentiation of specific effects, how interferon reduces infections, and the potential for medical application. Naturally the molecular end is hypertrophied by comparison with the clinical. A little disappointment is that the molecular biology presented primarily pertains to chemical inducers and the induced cell. The protected cell in the two-cell system is treated lightly although at least species specificity, viral polymerases, concentration-dependent binding, and varying virus sensitivity are involved. The biologic problems of toxicity, enhancement, hyporeactivity, and immunogenicity of inducers are identified, but few insights into mechanisms are provided. The most provocative challenge is to replace the Jacob-Monod model with one to explain interferon production by eukaryotic cells.

Optimism is expressed that useful chemotherapeutic agents can be evolved through knowledge of chemical inhibitors of viruses that compete for specific active sites in viral replication. Viruses of a single group possess common features subject to biochemical attack. Different mechanisms of inhibition are recognizable among the compounds considered. Amantadine exemplifies attack during entry of the virus into the cell, thiosemicarbozones selective chelation, nucleic acid analogs selective inhibition of DNA precursors,

guanidine and hydroxybenzimidazole reversible inhibition of RNA synthesis, and ansamycins selective binding and inhibition of RNA polymerases. Some presentations simply reiterate molecular dogma; some contain meager biochemical information; pharmacologic considerations are largely ignored. Time restrictions of the drug inhibitory effects, specificity, reversibility, helper activity, and mutational drug resistance exemplify the complexity of the problems facing clinical use.

Some important concepts noted are: formation of empty virions with cytotoxicity during drug blockage of infectious RNA virus, activation of latent virus genomes by drug treatment, and specific bivalent binding of drug to nucleic acid sites and polymerases. An "axiom" suggested by the last of these is that an inhibitor of an essential virus-directed polymerase can be lethal for the virus and therapeutically useful. The book fuels hope for the future of antiviral chemotherapy.

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Metalloproteins

Iron-Sulfur Proteins. WALTER LOVENBERG, Ed. Academic Press, New York, 1973–74. Two volumes. Vol. 1, Biological Properties. xiv, 388 pp., illus. \$33. Vol. 2, Molecular Properties. xiv, 344 pp., illus. \$29. Molecular Biology Series.

In slightly less than 20 years there has developed a vast core of knowledge on the iron-sulfur proteins. Impetus for research on these unusual proteins was provided in 1962 by the discovery of a low-molecular-weight protein from a nitrogen-fixing bacterium, *Clostridium pasteurianum*. This brown iron-containing protein was found to promote the phosphoroclastic reaction involved in nitrogen fixation and consequently was given the name ferredoxin. Interest in relating this protein to other, previously discovered factors that contained iron led to a flurry of research on the biochemistry of these proteins and the nature of the iron-sulfur complex.

It has now become clear that the iron-sulfur proteins are vital for many important biochemical reactions in nearly every organism from the very primitive anaerobe to the highly sophisticated mammal. Indeed, one begins to wonder if all organisms will not eventually be shown to utilize some

form of an iron-sulfur protein. Needless to say, the various iron-sulfur proteins have many fascinating features that warrant the writing of a treatise on the subject, and these two volumes will be received with great interest.

Volume 1 is concerned primarily with the biological roles these proteins play. Chapter 1 leads off with an excellent historical review of the subject, recounting how research on three apparently unrelated subjects led to the interest in iron-sulfur proteins: photo-reactions of chloroplasts, nonheme iron in tissues, and nitrogen fixation in microorganisms. It also points out that the discovery of the extremely labile iron-sulfur proteins, which came rather late, awaited in part the development of gentle handling techniques by the biochemists and the use of nondestructive specific methods of analysis by the physicochemists.

The following seven chapters of volume 1 contain information on the various iron-sulfur proteins as electron carriers involved in nitrogen fixation, carbon metabolism, photosynthesis, and various hydroxylation reactions. The last two chapters deal with the more complex and difficult-to-handle metalloflavoproteins, namely the dehydrogenases and hydroxylases, that contain an iron-sulfur moiety.

Volume 2 is essentially restricted to the physical properties of the proteins. Chapter 1 describes the chemical properties of the ferredoxins as determined by the rather classical biochemical methodology. Chapter 2 is a comprehensive discussion of the primary and secondary structure, structure-function relationships, and evolutionary aspects of the proteins. This chapter has more typographical errors than the others but not enough to prevent it from being absorbing reading.

The five following chapters give clear, concise, and relatively nontechnical descriptions of the theory behind the technique applied in revealing the physicochemical features of the iron-sulfur complex (electron paramagnetic resonance, electron-nuclear double resonance, Mössbauer spectroscopy, magnetic susceptibility, and so on), the near vicinity of the complex (nuclear magnetic resonance), and the entire tertiary structure of the protein (x-ray diffraction). The volume is concluded with a "wrap-up" of all the information (up to 1973) on the active center of the iron-sulfur proteins.

The casual reader should be warned that the historical nature of most of

the chapters can cause confusion unless he keeps in mind that all loose ends will be tied up, or at least explained, in the end. The biochemist will be disappointed by the lack of tertiary structural information for rubredoxin, high-potential iron protein, and ferredoxin.

The two volumes will undoubtedly be useful to the serious researcher and should give the beginner a look into an exciting field for much more research in the coming decade.

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