strates and organometallic reagents in terms of common reaction mechanisms (established or proposed). This "mechanistic approach" provides a cohesiveness that is lacking in the other two commonly encountered monographs on organometallic chemistry.

The coverage of the literature (through 1972) is not meant to be comprehensive and reflects the author's personal view of the topics he considers important and interesting. The emphasis is exclusively on homogeneous catalytic and stoichiometric reactions. Heterogeneous reactions, which are less well understood, are mentioned only in passing.

The subject is logically and systematically developed. In chapter 1 bonding, structure, and nomenclature in organometallic chemistry are briefly discussed. Ligand dissociation reactions are presented in chapter 1, and most of the other basic reactions (oxidative addition, reductive elimination, migratory insertion, alkylation via metal anions, radical reactions, and demetalation) of organometallic chemistry are introduced in chapters 2 and 3, which concern the preparation and chemistry of the metal-hydrogen and metal-carbon σ-bonds. Because of the pervasiveness of these two types of bonds in organometallic chemistry, these chapters are the key to the material in the subsequent chapters. Hydrogenation, in certain respects one of the best understood of the organometallic reactions, is discussed in chapter 4. The isomerization, addition, elimination, dimerization, oligomerization, cyclization, and substitution reactions of alkenes, polyenes, and alkynes are dealt with in chapters 5 through 8. The preparations of organic carbonyl compounds derived from the aforementioned substrates and carbon monoxide are discussed at length in chapter 9. Finally, dinitrogen, dioxygen, carbene, and sulfur dioxide complexes are dealt with briefly in chapter 10.

The mechanisms of the relatively few well-understood organometallic reactions are presented in detail. On the basis of these studies and product analyses, mechanisms for other organometallic reactions are proposed. The mechanistic rationalizations are reasonable in all instances and utilize the set of basic reactions introduced in chapters 2 and 3. At no time does the author leave the reader confused as to what is established fact and what is conjecture. The mechanisms are illustrated in reaction schemes that help the reader greatly. Despite the complexity of some of the schemes, there are no serious typographical errors. Stereochemistry and asymmetric induction by organometallic reagents are discussed where appropriate.

The treatment in chapter 1 of metal-ligand bonding, which is cursory and based entirely on symmetry considerations, does not reflect current bonding theories. For example, the reader is told that π_1 and π_3^* of the allyl anion are strongly bonding to the metal and that π_2 may also be bonding to the metal. On the basis of the energy of the ligand and metal orbitals and the structures of η^3-allyl complexes, it is more likely that the bonding between π_2 and the *d*-orbitals of the metal dominates the metal-ligand bond in η^3-allyl complexes and that π_1 and π_3^* are weakly bonding to the metal.

At the end of each chapter there is a list of more comprehensive review articles. References to the primary works are given in the chapters. There is an author index and an extensive and useful subject index.

The book clearly illustrates the versatility and potential of organometallic reagents in organic synthesis. It is a useful and illuminating introduction to organometallic chemistry.

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Chondriosomes

The Biogenesis of Mitochondria. Transcriptional, Translational and Genetic Aspects. Proceedings of a conference, Bari, Italy, June 1973. A. M. KROON and C. SACCONE, Eds. Academic Press, New York, 1974. xxii, 552 pp., illus. $19.

This book is divided into three parts: Mitochondrial Transcription; Characteristics of the Mitochondrial Protein Synthetic Machinery; and Synthesis of Mitochondrial Proteins. Discussion of mitochondrial DNA and its replication is excluded. Part 1 is the least cohesive section, since it includes papers on such diverse topics as transcription in mitochondria, gene products of mitochondrial DNA as identified by DNA-RNA hybridization, the use of coupled systems of transcription and translation, mitochondrial genetics, and the characteristics of mitochondrial RNA polymerases. Part 2 is largely concerned with mitochondrial ribosomes. The best section is part 3, which deals with the participation of mitochondrial and cytoplasmic protein synthesis in the assembly of specific inner membrane components, notably cytochrome oxidase and the adenosine triphosphatase.

Perhaps the major conclusion that can be drawn from the book is that the proteins translated in the mitochondrion are limited in number, very hydrophobic, and associated with inner membrane enzyme complexes, notably cytochrome oxidase and the adenosine triphosphatase. However, these enzyme complexes also contain proteins synthesized on cytoplasmic ribosomes. These conclusions derive from the elegant experiments of Schatz and Tzagoloff on yeast and of Bucher's group on *Neurospora*. The findings pose two major questions. First, where are the messages for the mitochondrially synthesized polypeptides coded? Second, how do mitochondrial proteins synthesized in the cytoplasm enter the mitochondrion and become assembled into enzyme complexes of the inner membrane together with those products made in the mitochondrion?

Although it is generally assumed that the messages translated on mitochondrial ribosomes are largely, if not entirely, mitochondrial DNA transcripts, it is evident from the papers in part 1 that direct proof is lacking. Although mitochondrial genetics in yeast had reached a sophisticated level at the time of the conference of which this book is the proceedings and mutations had been isolated that altered components of mitochondrial ribosomes, the adenosine triphosphatase, and cytochrome oxidase, in not one instance had an altered mitochondrial protein been associated with a mitochondrial gene mutation. Similarly, the use of coupled systems of mitochondrial DNA transcription and translation in vitro has yet to reach the level of sophistication necessary for the identification of specific mitochondrial proteins. The strongest indirect evidence that mitochondrial ribosomes are principally engaged in translation of mitochondrial messages comes from Mahler's work with yeast, which takes advantage of the fact that formylmethionine-transfer RNA_F is used in chain initiation in mitochondria as it is in prokaryotes and formylmethionine is retained in the NH_2-terminal position of nascent polypeptides on mitochondrial polysomes. These experiments show that virtually all translation on mitochondrial polysomes is blocked by ethidium bromide under conditions in which cytoplasmic translation proceeds normally. If ethidium bromide is acting solely as a transcriptional inhibitor and not as translational inhibitor, these experiments show that mitochondrial polysomes for the most part transcribe mitochondrial messages.

The answer to the second question may emerge from the finding of Kellems and Butow that yeast mitochondria have cytoplasmic polysomes bound to their outer membranes that apparently engage in vectorial translation of nascent polypeptide chains into the mitochondrial membranes or intramembrane spaces.

A review such as this cannot do justice to the vast array of subjects discussed in

this volume, but a few other high points can be noted. It is evident from the work of O'Brien *et al.* that the mammalian "mini-ribosomes" of the mitochondrion contain normal numbers of ribosomal proteins even though they have smaller than normal ribosomal RNA's. Attardi *et al.* discuss the evidence for polyadenylate sequences in HeLa cell mitochondrial messenger RNA and review their experiments on molecular mapping of 4*S* and ribosomal RNA of mitochondria. Linnane, Slonimski, and Rabinowitz discuss gene purification in genetically marked petite mutants and the molecular markers (transfer RNA's and ribosomal RNA's) retained in specific petites, as well as the amplification and the structure of repeated sequences in petite mitochondrial DNA. There are also papers on various aspects of mitochondrial genetics in yeast, *Neurospora*, *Paramecium*, and tissue culture cells.

All in all, this is a very useful volume and indispensable for students of organelle biogenesis. Many of the papers are excellent, and the book gives a general picture of the state of the field at the moment and of the problems that lie ahead.

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Cellular Defense Mechanisms

Activation of Macrophages. Proceedings of a conference, Günzberg, Germany, Oct. 1973. W.-H. WAGNER, H. HAHN, and R. EVANS, Eds. Excerpta Medica, Amsterdam, and Elsevier, New York, 1974. xii, 346 pp., illus. $34.60. Workshop Conferences Hoechst, vol. 2.

In the course of infections such as tuberculosis macrophages may become metabolically activated and acquire an enhanced capacity to kill even unrelated microorganisms and, possibly, tumor cells. Thus activated macrophages could play an important role in defense of the host against malignancy as well as infection. This book deals with selected aspects of the physiology of macrophages, its modification by drugs and biological materials, and the interaction of macrophages with infectious agents and tumor cells.

This volume makes apparent some of the problems that have slowed progress in this field. One source of confusion is the lack of definition of what constitutes macrophage activation. Although it is now recognized that the widely dispersed macrophages of the body have a common hemopoietic origin, the cells of the mononuclear phagocyte system (MPS) can display considerable biosynthetic activity and express a wide variety of responses to stimuli in their environment. It is therefore essential to define macrophage activation in relation to a particular in vivo or in vitro model.

The classic models of *Listeria* and bacillus Calmette-Guérin (BCG) infection in the mouse were developed by Mackaness and North and their colleagues. These workers here summarize important new findings on the regulation of macrophage activation. Although activated macrophages represent the effector arm of cell-mediated immunity against *Listeria*, specifically sensitized T lymphocytes play a key role in mobilizing and activating monocytes, which migrate from the bone marrow, and in stimulating the proliferation of macrophages in infected foci. The control of T lymphocyte activation has also been studied in relation to the delayed type of hypersensitivity to sheep red blood cells. Circulating immune complexes inhibit activation of T lymphocytes in heavily immunized animals, but this effect can be counteracted by pretreatment with BCG, which increases removal of complexes by the MPS and also stimulates T lymphocyte proliferation, or by depressing antibody production with cyclophosphamide.

Although a variety of in vitro test systems has been devised to study the microbicidal activity of activated macrophages, their use has been restricted by technical difficulties. Mauel and his colleagues describe an attractive new model in which mouse macrophages can be activated by lymphocyte products to destroy intracellular amastigotes of the protozoan parasite *Leishmania enriettii*. Similar models for macrophage-mediated cytotoxicity against tumor target cells have been developed by Lohmann-Matthes and Evans and their collaborators.

Unfortunately, this volume also illustrates our ignorance of the cellular properties of the activated macrophage. For example, although Huber and Wiener present a useful review of current knowledge of macrophage membrane receptors, little is known about plasma membrane function in activated cells. The absence of suitable biochemical markers has hitherto been a particular handicap in the study of macrophage activation. The more recent discovery that induction and secretion of specific neutral proteinases, such as plasminogen activators, collagenase, and elastase, accompany macrophage activation not only should provide such markers, but also suggest a mechanism by which the activated macrophage could perform some of its effector functions.

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