which deals with the effect of osmotic pressure, solute concentration, and gravitational-force fields on the escaping tendency. The chapter concludes with a discussion of surface free energy which considers force fields generally, and the special cases of capillaries and the tensile strength of water. The second chapter deals first with general principles of water and solute transport and then with phenomena involving interdiffusion, discrimination between water and solute, and movement of water vapor. Special consideration is given to water movement, as related to pressure differences, across systems such as simple membranes and to the problems of composite porous membranes and liquid membranes. The influence of electrical potential gradients and temperature gradients is also considered. The remaining chapters deal with movement into, within, and out of the plant. Consideration is given first to intercellular water movement, extracellular movement, and movement within tissues. Water movement into the root, from leaf to air, and through the soil-plant-atmosphere system is then discussed.

Although the book is short, it contains many valuable ideas and much important information. The approach is that of the physical chemist and biophysicist, but the treatment is such that it should be readily understood by the physiologist or ecologist interested in water-transport phenomena. I regard it as an important and very useful addition to the literature.

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Routes to the Organelle

Enzyme Cytology. D. B. RODYN, Ed. Academic Press, New York, 1967. 607 pp., illus. $25.

For many years cytologists have trudged down pathways into the fertile valley of the cell organelles. Nowadays, investigators, mainly biochemists, traverse a superhighway into the same valley and, while the two routes converge at points, much still depends on the position of the observer and his lingo. Although it is positively ecumenical for a morphologist to refer to $NADH_2$ cytochrome *c* reductase and a biochemist to unit membranes, sometimes they don't speak the language so good.

What comes out for this reader is a sense of ambivalence in this multi-authored book, which includes the following chapters: General Principles; The Nucleus; The Mitochondrion; The Chloroplast; Lysosomes, Phagosomes, and Related Particles; Membrane Systems; Ribosomal Enzymes; and The Soluble Phase of the Cell (which does not have a cytological counterpart). Many aspects of most chapters are well put together. As reviews the chapters are relatively up-to-date and worthwhile collections of integrated information for interested graduate students and for scientific workers whose commitment is peripheral to the field covered by each of the individual chapters. However, I found parts of some chapters within my ken somewhat biased, even incorrect, and repetitious of what has been recently, and better, said elsewhere. As a collection of information concerning enzymology and cytology, the papers appear to slight one or the other of these disciplines, most often the cytological one, and the inclusion of several electron micrographs doesn't correct the deficiency. Although some chapters include significant advances made by cytochemical staining techniques, others ignore this area.

The notion of bringing together information from electron microscopy and from studies on fractions isolated from cell homogenates is good. Too often, however, the information available to the reviewer comes from one field or the other, and it is our (the workers') fault that an adequate "hybrid" (De Duve) state is lacking in some of the information presented. For the moment in this young field, we're stuck with the fact that for years some morphologists have described structure and speculated on function; recently, some biochemists show some preoccupation with the reverse. As a result, a large part of this book would have been better named "Cytological Enzymology."

Thus, I found this volume partly well done, informative but quixotic because sometimes it creaks like rusty armor when facing information situations that are less definitive and more like windmills. Although it is really not too early to get down to vital information in this exciting and growing field, the book in part views the same crossroads through other peepholes, and I wonder how many views of the crossroads have already been recorded by the same publisher. From another viewpoint, the purpose of "sweeping yon clouds from the sky" by combining information of cytology and enzymology is a good one. However, our students who are being trained to think and do in both disciplines may adopt an attitude, concerning parts of this volume, more like that of Sancho Panza.

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The Space Agency as Manager

An Administrative History of NASA, 1958–1963. ROBERT L. ROSHOLT. National Aeronautics and Space Administration, Washington, D.C., 1966. 399 pp., illus. Available from the Government Printing Office, $4.

Our space program has had administrative problems unprecedented in kind and magnitude. NASA administrators have had to innovate in solving such problems as the coordination of the production schedules of thousands of industrial contractors and the allocation of enormous public resources within NASA and among the competing contractors. Other problems have included the creation of an institutional framework within which engineers and scientists would flourish, the maintenance of constructive relations with the Department of Defense, and inspiring the confidence of Congress and the public. NASA, since 1958, has been on the frontier of administering big technology within a complicated context of public financing and private enterprise.

Passage of the National Aeronautics and Space Act of 1958 provided the framework for future administration. The Space Act was the entrepreneurial decision that determined that the nation's space program would be under the jurisdiction of several agencies, with NASA responsible for civilian activities and the Department of Defense for military. It also established that "over-all policy direction" would come from a council chaired by the President (later by the Vice President), and that "Congressional oversight" would be carried on by two new standing committees. It was also assumed from

the beginning—and this was another major entrepreneurial decision—that NASA's work would be done by contract. NASA would act as an allocating, coordinating, evaluating, and planning administrative superstructure, with manufacturing or hardware largely in the hands of private-enterprise contractors. NASA administrators were thus empowered to create an immense, mission-oriented structure using industrial enterprises as modular building blocks, replaceable—it was assumed—as changing mission strategy required new structure. Conceivably the entire edifice could be disassembled at the will of the public with a minimum of damage to the component parts.

Assuming that this will not be the last of big technology, or of public-private enterprise, something of value might be learned from studying the administrative history of NASA. On the authority of a provision of the Space Act of 1958 encouraging the study of long-range effects of the program, NASA has subsidized the writing of its history. Such an effort can be wasteful of public money if the history is not critical. Rosholt's volume, despite the handicaps that the official historian of contemporary institutions must accept, is substantial and critical.

How did Rosholt accomplish this? For one thing, he makes use of NASA's own self-evaluation studies. In February 1960, for example, NASA contracted with McKinsey & Co. for a management study appraising its contracting policies and, among other things, "the report revealed that NASA's record in managing its contract efforts was spotty" (Rosholt, p. 157). Rosholt summarizes the findings of the report as well as NASA's constructive response. Administrator T. Keith Glennan also had a study of NASA's organization made (the Kimpton Report); it seems that NASA—and Rosholt—made good use of this report, even though, according to Rosholt, the report "has developed the reputation of having been too bland." Rosholt does not make this judgment himself; he gathered this impression from NASA officials he interviewed. This is the other means he employs to write a critical and provocative study. He, like others experienced in oral history, realizes that while the participants in events may not know "why," they do know many of the right "why" questions to ask. Rosholt uses oral-history sources to help him formulate the hypotheses. Later, historians and social scientists can pursue the leads and test the hypotheses.

Already Rosholt has stimulated a dialogue that might eventually clarify murky issues. In his foreword, Administrator James Webb, after complimenting the author for the scholarly quality of the study, forcibly questions Rosholt's interpretation of Webb's managerial style in the first year or so of his administration. Webb believes that a more penetrating analysis will show the wisdom of the kind of flexible organizational framework he intially provided; Rosholt, according to Webb, believes that a narrower control would have been better. Rosholt is not as dogmatic as this suggests, however, for he usually provides alternative interpretations of controversial subjects. Yet, Webb and his administrators should have the more penetrating analytical studies, and this provocative survey of organizational structure, administrative procedures, and procurement administration of a momentous public endeavor may well bring them forth.

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Wall-less Bacteria

A Microbial Enigma. Mycoplasma and Bacterial L-Forms. YORK E. CRAWFORD, PAUL F. SMITH, CHARLES PANOS, and RAYMOND J. LYNN. World, Cleveland, Ohio, 1967. 274 pp., illus. $10.

Many investigators concede that mycoplasma may be L-forms in search of a parent bacterial cell and that this is sufficient reason for considering the properties of both forms of cell-wall-less microorganisms in the same context. This monograph makes no such assertion, nor does it attempt to disprove this view. Rather, it brings together detailed information relating to specific areas of current research on these organisms, with no attempt to integrate the diverse material. Each contribution is by an authority in the relevant field and is built around its author's own research interests. This is the intent of the series Monographs in Microbiology, of which this is the first volume.

It is also intended that each contribution contain descriptions of proven techniques that may be used as routine laboratory procedures. This is exemplified by York Crawford in his compilation of methods found successful for the isolation and identification of mycoplasma of man, primarily those of the upper respiratory tract. Experienced researchers may prefer modifications of these techniques, but Crawford's experience is a good guide for those newly about to venture forth.

Various techniques found useful for serological differentiation of mycoplasma are summarized by Raymond Lynn, whose detailed description of the preparation of antigens will enable investigators to avoid the more common pitfalls associated with obtaining suitable antiserums. The more esoteric aspect of serological comparison between L-forms, mycoplasma, and the possible revertant bacteria isolated from such cultures is touched only briefly, for the more recent techniques of nucleic acid homology may give more significant results.

Ranging from the chemical requirements for growth to the principal metabolic and biosynthetic activities, Paul Smith presents an overall view of the physiology of the mycoplasma, stressing those unusual features of the limiting lipoprotein membrane and associated lipids which may allow the mycoplasma to reproduce in an osmotically hostile environment. In contrast, Charles Panos attempts to correlate certain specific properties of stable L-forms with their altered structure and physiology. Of particular interest is his comparison of a group A streptococcus and its derived L-form. The L-form, with its disorganized structure and a much lower growth rate, is nevertheless capable of balanced growth. The ability of protoplast membranes, but not L-form membranes, to incorporate rhamnosyl units, the difference in distribution of monomeric and polymeric rhamnose in the protoplast and L-form, and the elevated fatty acid and increased octadecenoic acid content in the L-form membrane are indications of the bizarre changes that have occurred between the parent cell, protoplast, and L-form. These findings, and many others presented in this volume, will stimulate research to clarify the relationship and role of the wall-less bacteria, whatever their name.

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