

ence to the work of historians of science, who have published and interpreted much of this and other relevant correspondence, would have been useful (3). Since historians customarily smother in their own literature what light they produce, Caroe may be pardoned for not knowing their results; but it is dispiriting to think that no one at the Cambridge University Press or among those it consulted could advise her where to look.

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References and Notes

1. "Sir William Bragg, F.R.S. (1862-1942)," *Royal Society of London Notes and Records* 17, 169 (1962).
2. A printed bibliography of the nontechnical writings of both Braggs may be obtained for \$3, prepaid, from the Office for History of Science and Technology, 470 Stephens Hall, University of California, Berkeley 94720.
3. This literature may be recovered through my *H. G. J. Moseley: The Life and Letters of an English Physicist, 1887-1915* (Univ. of California Press, Berkeley, 1974).

Effect of the Cytochalasins

Cytochalasins. Biochemical and Cell Biological Aspects. S. W. TANENBAUM, Ed. North-Holland, Amsterdam, 1978 (U.S. distributor, Elsevier, New York). xvi, 564 pp., illus. \$95. *Frontiers of Biology*, vol. 46.

The earliest reports describing the effects of the cytochalasins on animal cells were published by S. B. Carter, of Imperial Chemical Industries, Ltd., a little more than ten years ago. Since then the number of studies that have appeared on the actions of these drugs, particularly cytochalasin B, is almost mind-boggling. *Cytochalasins* is a collection of 17 papers that review much of this research.

Many of the effects of the cytochalasins on animal cells are truly dramatic, especially those that are visible under the microscope, such as the rapidly produced reversible effects of cytochalasin B on various types of cell motility, on cell contractility, and on the properties of the cell surface. These effects include the cessation of cell locomotion and the inhibition of cytokinesis, of the extension and movement of lamellipodia and microspikes, of membrane ruffling, and of peristaltic wave motions. Especially curious is the ability of cytochalasin B to cause nuclei of mammalian cells to become displaced toward the periphery of the cells. Often the nuclei protrude from the cytoplasmic surfaces of the cells, remaining attached to the cell bodies through thin stalks of membrane-bounded cytoplasm. In several types of

cells the protruded nuclei spontaneously detach, producing anucleate cells.

A powerful influence on the development of cytochalasin B research was the idea espoused by a few early workers that all its biological effects could be explained by an action on microfilaments. This premature notion soon became fixed in the minds of many investigators and led unfortunately to the widespread uncritical use of cytochalasin B as a diagnostic tool for microfilament function in cells. The current view, which is expounded at great length by a number of authors in this book, is that cytochalasin B has multiple sites of action and that we really know very little in molecular terms about the various ways in which cytochalasin B and the other cytochalasins produce their effects.

I think the most valuable aspect of the book is that it describes almost all the known actions of the cytochalasins on cells. The authors review their subjects in depth, and each chapter provides a thorough literature survey. This is the first such review of the cytochalasin literature, and it will be invaluable for investigators using these drugs or contemplating working with them. The many conflicting results concerning the different actions of the cytochalasins are reviewed, often with no attempt to resolve the issues raised but on occasion with considerable insight into possible explanations for the disparate results.

All but a few of the chapters are of high quality. Especially noteworthy are chapters by G. C. Godman and A. F. Miranda on the visible effects of cytochalasin in cells, P. G. W. Plagemann *et al.* on the inhibition of transport by the cytochalasins, G. Poste and N. C. Lyon on the enucleation of cultured animal cells by cytochalasin B, and S. Lin on the interaction of the cytochalasins with the red blood cell membrane and its associated proteins. Studies of the binding of [³H]cytochalasin B have revealed that at least two high-affinity receptors exist for this drug. One of these is most certainly associated with the ability of cytochalasin B to inhibit hexose transport in mammalian cells, and the other seems to be related to the effects of cytochalasin B on cell motility and cell shape determination. Of novel value are chapters by S. W. Tanenbaum on the production of cytochalasins by fungi and by Ch. Tamm on the chemistry and biosynthesis of the cytochalasins. On the negative side there is some redundancy in that the same effects of the cytochalasins on mammalian cells are described by several authors.

It is unusual that a drug whose actions

are so poorly understood on a molecular level be used so extensively as an experimental probe. Most certainly this is because the cytochalasins profoundly influence cell functions that a great many biologists are now studying. These drugs and their actions will continue to attract the attention of biologists for years to come. The hope is that, with the aid of this book, the research will progress in a more rational and cautious manner and the cytochalasins will turn out to be the valuable experimental tools that we initially hoped they would be.

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Cellular Phases

Cell Cycle Regulation. JAMES R. JETER, JR., IVAN L. CAMERON, GEORGE M. PADILLA, and ARTHUR M. ZIMMERMAN, Eds. Academic Press, New York, 1978. xviii, 258 pp., illus. \$23. *Cell Biology*.

This is one of a series of multiauthor books on the cell cycle produced over the last ten years as a result of meetings. Reasonably enough, it cannot fulfill the promise of its compendious title with only 11 papers, but it should definitely be on the reading lists of those working on the cell cycle and cell proliferation.

Some of the papers are novel either in siting or in ideas. It is a pleasure to find Harris developing a theory about the control of mitosis by calcium, for this process is very much the culmination of the cell cycle but is normally ignored by the cyclists. Gerson's chapter raises the intriguing problem of intracellular pH. Even if the relations of pH to cancer can be taken with a grain of salt (or Ca⁺⁺), I was surprised to learn of the marked changes in pH during the cycle of *Physarum*.

Many of the other articles are in the current mainstream of cycle research. Three of them (McCarty and McCarty, Gurley and seven colleagues, Krause) are concerned with chromatin and histones. There are technical arguments here, but also some major biological questions that can only partially be answered. For example, are histone modifications such as phosphorylation and acetylation the cause or the effect of the changes during mitosis or the S period? Do these modifications have effects on transcription and are the effects general or specific? Two other papers are relevant to another important question—are

proteins synthesized periodically through the cycle? In studies of proteins separated on gels and of enzyme activity, Sauer finds no evidence of periodicity in *Physarum*. Howell and Baumgartel, on the other hand, do find periodicity in *Chlamydomonas* (at any rate in the rates of synthesis) and suggest that only some of this periodicity might be due to their system of light-dark synchrony. Finally, Rao and Sunkara show from fusion experiments that there is an S-phase inducer present in the G₁ cytoplasm of mammalian cells. A concentration-dependent inducer either of DNA synthesis or mitosis is a familiar concept in various cell types. What is surprising here is that the inducer is not concentration-dependent. Two cells in the same stage of mid- or late-G₁ are accelerated into S after fusion, and, even more surprising, they are not accelerated if they are in early-G₁. This paradoxical result should stimulate further work on S-phase control.

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Celestial Mechanics

Dynamics of Planets and Satellites and Theories of Their Motion. Proceedings of a colloquium, Cambridge, England, Aug. 1976. VICTOR SZEBEHELY, Ed. Reidel, Boston, 1978. xii, 380 pp., illus. \$39. Astrophysics and Space Science Library, vol. 72.

This proceedings volume contains the papers presented at the 41st Colloquium of the International Astronomical Union. The volume covers planetary theory and analytical methods, numerical and other techniques, satellites of Jupiter and Saturn and artificial satellites, and gravitational problems of three or more bodies. In total 28 papers and 15 abstracts are included.

The first two parts of the book deal with planetary and lunar motion. Some interesting, highly theoretical papers are presented, mostly by European scientists and mathematicians, particularly from the Soviet Union and from France. These papers are of high quality and indicate a much-needed resurgence of analytical methods to complement the current emphasis on numerical methods.

Most of the contributions in the third part of the book discuss extensions and refinements of useful and currently popular numerical methods. One contribution, by Petrovskaya of the Leningrad Institute, introduces modifications of the geopotential expansion designed to im-

prove its convergence and usefulness at the surface of the earth.

Part 4 concerns satellites, with a number of papers giving emphasis to improving the existing analytical series solutions of the natural satellites of Jupiter and Saturn. Some of these papers are status reports of continuing research projects in the area. Several new results or new extensions of previous results are given, especially the extension of deSitter's work by Aksnes and the second-order theory of the Galilean satellites by Ferraz-Mello.

Part 5 considers periodic orbits and orbital stability. A paper by Hadjimetriou and Michalodimitrakis presents recent major results concerning periodic orbits in the general three-body problem. Other papers report on several interesting analytical and numerical results concerning the theory of orbits. Robinson discusses the effect of a large space station at the location of the Lagrangian points. Markellos presents a new kind of periodic orbit: the asymmetric, three-dimensional periodic orbit. Message and Taylor consider asymmetric planar periodic orbits.

The overall quality of the papers is high, and there are contributions from nearly every research center in celestial mechanics throughout the world. Workers in the field will refer to this volume for many years to come.

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