tention as a Dahlem workshop, this book is much more speculative than is *Genome Evolution*. At the molecular level are papers by Britten on genomic alterations and by Davidson on genomic regulatory organization, both referred to above. At the cellular level there are contributions by Wessels on the description of processes of metazoan morphogenesis; Freeman on comparative development of embryos, with an additional call for "judicious use of appropriate molecular chronometers" as the "only approach" capable of resolving phylum-phylum phylogenetic relationships; Wolpert on pattern formation; Kaufman and Wakimoto on the larger significance of homeotic and segment patterning loci; and Katz on the as yet rather poorly known "ontogenetic buffer mechanisms." A recurring theme of these four papers at the cellular level (and in the Group Report) is the need in attributing meaning to a pattern (or morphology) to differentiate the specific function of some process from incidental side effects of that process, whose "real" function is quite different, and from mere historical remnants. This problem of sorting out ultimate cause from proximal effect is also raised in the two papers at the level of the life cycle. Thus Stearns discusses life histories and asks, "How much of any particular plastic response in a life history trait has evolved, and how much is inevitable?," and Bonner and Horn in their essay on size, shape, and developmental timing confront the same issue of partitioning out incidental effects. Finally, at the level of evolution, Alberch and Gould respectively focus on developmental constraints in evolutionary processes and on the role of developmental timing in macroevolution.

In comparing these two books with regard to ease of use, one notes that Dover and Flavell write in their introduction that "we have not exercised editorial control over [the] contributions." Nor has an index been provided. The papers also lack abstracts, and titles of articles are not included in the references. The Dahlem volume has an index, its references include titles, and seven of its papers have abstracts. *Evolution and Development* has the spark of disciplined originality. The subject matter of *Genome Evolution* is equally fascinating, but the topic deserves a presentation more attentive to the needs of the reader. Together, the two books would make a superb basis for a seminar on evolution.

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Plasma Physics

Plasma Physics and Nuclear Fusion Research. RICHARD D. GILL, Ed. Academic Press, New York, 1981. xx, 688 pp., illus. $66.50.

The Culham Summer School on Plasma Physics has been held annually for 17 years and is recognized as having provided an excellent introduction to the field for many. This collection, which is based on lectures delivered in the course between 1978 and 1980, should be well received. Although one of the standard textbooks would be better for an introductory course, the book should interest anyone entering or wishing to get an overview of the field. I was pleased to see that on some subjects it is already slightly dated.

The authors have achieved their goal of providing a high-level introduction to a capable student who has little or no background in plasma physics. An attempt is made to treat simple models with enough detail and rigor to impart an understanding of the problems and techniques of each field, and the authors have provided a broad understanding of the organization of each and of what is being accomplished in it. Some of the chapters contain considerable detail and could serve as useful references. The cross-referencing in the early part of the book is well done, but more effort could have been expended in other places. There are many typographical errors throughout the book. They cause no problem but are annoying.

The first three sections of the book provide an introduction and foundation and cover theoretical developments. The first paper, by B. J. Green, is an excellent overview of the field. The next two sections cover experimental devices and heating and diagnostics. Though the discussions of tokamaks, pinches, stellarators, and mirrors in the section on experimental devices are clear and accurate, they are something of a disappointment. The authors of the five papers in the section were too careful in their efforts to delineate the problems and fail to convey the sense of accomplishment and optimism that now exists. The high temperatures achieved on the Princeton Large Torus in 1978 are reported almost in passing. Similar results with higher densities have since been obtained on the Poloidal Divertor Experiment. Recent developments have also introduced new enthusiasm into the program. These include the confinement of a 350 eV plasma for 10 msec in the ZT-40 reversed-field pinch, the achievement of current-free stellarator plasmas with 700 eV temperature, 10^{14} cm^{-3} density, and 35 msec confinement time with neutral injection on Wendelstein VII-A and 200 eV temperature, 5×10^{12} cm^{-3} density, and 40 msec confinement time with electron cyclotron resonance heating on Heliotron E, and the conception of a thermal barrier for the tandem mirror.

The final section covers inertial confinement, charged-particle beams, astrophysical plasmas, and computational plasma physics. The editor has limited the amount of material on these subjects, and though he was correct in doing so it makes one hunger for more.

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Processes of Cell Division

Mitosis/Cytokinesis. ARTHUR M. ZIMMERMAN and ARTHUR FORER, Eds. Academic Press, New York, 1981. xvi, 482 pp., illus. $55. Cell Biology.

The eukaryotic cell cycle culminates in a radical reordering of cellular contents. The restructured cytoskeleton and condensed chromosomes then follow an ancient choreography that is designed to ensure the precisely equal segregation of genetic information into the forming daughter cells. Because of the importance and the scale of these events in the cell, the subject of mitotic mechanism has captured the imagination of cell biologists since the 19th century. A great deal is known about the basic processes of mitosis and cytokinesis, but some fundamental questions remain unanswered and there is controversy about the nature of the mechanism of mitosis. In this collection, one will find described a wealth of experimental approaches and a wealth of results. Firm conclusions are harder to pin down.

The pace of research in this field is quickening. Many important and, one hopes, conclusive results have recently been published. Thus, some of the arguments of authors in this volume must now be tempered by more recent evidence, particularly with respect to the involvement of actin in the mitotic spindle and to the orientation of spindle microtubules. Nevertheless, the book is timely and broadly representative of the more established research approaches. It serves a valuable purpose in bringing

together the diverse research on cell division.

The volume is divided into three sections; the first describing premitotic events; the second, events surrounding chromosome motion; and the last, the processes of cytokinesis. The general quality of the papers is high.

Of the many promising new approaches to the study of mitosis and cytokinesis the study of mutants receives the most attention (with three papers devoted to the subject). A particularly noteworthy paper by Berl R. Oakley describes some beautiful studies done by Oakley and N. R. Morris on tubulin mutants in *Aspergillus*. Oakley and Morris have thus far been able to show that, other than by their mere assembly, microtubules play an essential role in mitosis. The question this study raises (what role do microtubules play in mitosis?) is obvious and fundamental and clearly points the way to future work.

The lysed cell model of mitotic and cytokinetic motion, an important technique largely developed by W. Z. Cande, is presented with clarity by Judith A. Snyder. Microinjection technique is also covered by Snyder. Thus far the technique has helped to clarify the possible role of actin and myosin in mitosis and cytokinesis, but its as yet untested potential to jam the works with antibodies against other putative components of the motile apparatus suggests important contributions yet to come. Again, Snyder's paper should be consulted for information on the application of antibodies in attempts to disrupt motion in the lysed cell system. This important work is deserving of more attention than it receives in the volume. I might also point out that many of the contributors describe the microtubule polarity orientations of the spindle deduced from experiments in which microtubules were grown from cell centers or kinetochores in vitro, but Snyder is the only one who presents the more recent and compelling data (of S. Heidemann, U. Euteneuer, and J. R. McIntosh and of B. Telzer and L. Haimo) in which the orientation of spindle microtubules attached to kinetochores in situ is shown to be the other way around. That is, these microtubules exhibit the same polarity as nonkinetochore microtubules of the same half-spindle.

The use of monoclonal antibodies to demonstrate the distribution of unknown spindle components and to facilitate their extraction is just beginning to be described in print, and it is not mentioned in the book. The molecular genetic analysis of the kinetochore and its constituent parts has gotten under way with the elegant studies of L. Clark and J. Carbon on the nature of centromeric DNA in yeast. This work, with its obvious implications for genetic engineering as well as for furthering the basic understanding of the role of the centromere in mitosis, is mentioned only twice (in papers by Oakley and by John R. Pringle).

Long-standing techniques that have paid off are well represented in the volume. One favorite of mine is the micromanipulation of chromosomes to determine the nature of the forces acting on them when they become displaced from the spindle. Gordon W. Ellis and David A. Begg do a real service in succinctly and clearly summarizing the major findings of these efforts, largely work done by Begg and by R. B. Nicklas. Other mechanical or physical manipulations include microbeam irradiation of spindle parts (discussed by Forer) and displacement of the spindle location in the cell in order to alter cytokinesis. This latter work, as described by Gary W. Conrad and Raymond Rappaport, has a long history, but it remains a mystery how the spindle communicates essential spatial and temporal information to the cell cortex to trigger a cytokinetic furrow.

Immunofluorescence studies have yielded a number of important conclusions. The volume contains a highly readable account of this work by J. E. Aubin. Calmodulin is localized to the spindle during mitosis, as are certain protein kinases. It is fair, knowing this, to speculate on the role of these proteins in the mitotic process. Aubin evenhandedly presents the evidence for and against a specific localization of actin in the spindle. However, the reader should again consult Snyder's paper for review of the rather compelling work of Cande that suggests no role for an actomyosin system in chromosomal movement. Work demonstrating a centromere-specific antibody, and tracing the antigen it recognizes through the cell cycle, is important but apparently too recent for mention in the Aubin review, or indeed in the volume. Quite beautiful immunofluorescence results showing the dramatic changes in microtubule distribution in interphase sea urchin embryos are presented by Patricia J. Harris, along with speculation on the role of calcium in producing rapid changes in microtubule distribution in the cell.

Besides the lack of coverage of some major new findings and directions, the one major flaw I find with the volume is that it is laid out with a design unfriendly to neophytes. The book would have been well served by a general introduction and review. Instead, it thrusts the reader directly into a technical paper on the usage of cell-cycle mutants. I suggest that the reader wishing to become acquainted with the field read the papers by Snyder and by Conrad and Rappaport and then, with the benefit of an up-to-date background, tackle the remainder of the book.

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