obtain lower labor costs in another location. There is little evidence to show that environmental regulation has significantly increased the cost of production. Indeed, there is evidence that technological innovation induced by environmental regulation has, by encouraging modernization of facilities, led to increased productivity and lower production costs.

6) On the whole, unions have supported environmental regulation despite contrary pressures. The United Auto Workers and the United Steelworkers were among the earliest institutional supporters of environmental regulation in the United States. As economic conditions declined in the steel and auto industries these unions came under increasing pressure to modify their pro-environmental stances, but they have only superficially reduced their support. While construction unions have opposed environmental regulation as inimical to large construction projects, unions such as the sheet metal workers, aware of the employment growth potential of renewable-energy technologies, have become strong environmentalists.

The most serious defect of the volume at hand is its limited discussion of the future of environmental policy. Apart from a plea for more comprehensive data sets, consideration of the future is largely relegated to a "how many angels can stand on the head of a pin" discussion of the number of future generations that should be divided into resources to come up with an equitable figure of allotments to each. Since this volume was prepared in the middle of the Reagan era, its focus on answering the distributional questions raised by the attack on environmental regulation was perhaps inevitable. However, as the post-Reagan era looms closer it can be expected that the environmental movement will shift from protecting past gains to undertake new initiatives. It is predictable that, just as the Reagan era focused attention on the negative distributional impacts of environmental policy, new movement initiatives will bring a corresponding shift in the attention of social science. Perhaps, in the course of this realignment, the contest between proponents of the market/growth and resource-constraint/regulatory approaches could also be transcended.

An analogy can be drawn to agricultural genetics, where agronomists came to regard the improvement of corn by selection as a temporary measure to be replaced by the more fundamental method of breeding disease-resistant corn. Likewise, the regulatory approach, with its orientation to modifying existing production processes, may eventually come to be seen as a temporary measure. It sensitized people to the environment until a more fundamental solution, environmentally benign production processes, could be implemented. Moreover, the development of renewable energy resources and a solar-hydrogen economy would make superfluous much of the assumption of finite resources from which many distribution issues arise. Then we could face the harder issues of socially based inequalities, freed from at least some resource constraints.

Designing environmental, worker, and consumer safety factors into production processes before they come on line would reduce regulatory costs and the need to mitigate ill effects later. Of course, governmental regulation is essential to determining the safety and environmental consequences of new production processes. Indeed, it is likely that regulation will become respectable again as deregulatory excesses that have lowered safety standards in such areas as vehicular and air transportation are remedied. But to inaugurate the next era of environmental policy, a shift from modifying existing production processes to creating alternative processes of production is called for.

At present, there are many legal and administrative penalties to deal with the consequences of harmful technologies but relatively few incentives to develop safe technologies other than the prospect of future torts and high jury awards. To reverse this direction, it would be helpful if industrial and R&D policy were more closely coordinated with environmental and resource policy. Thus, proposals for federally funded R&D to create new generic technologies to improve productivity and U.S. competitiveness in world markets should be combined with R&D initiatives to reduce costs of renewable energy production and to create environmentally benign industrial processes. For example, a specific area of confluence is materials research relevant to both semiconductor chips and photovoltaics. A conference of participants from high-tech firms, environmental groups, and university research centers from both environmental science and engineering could no doubt come up with a longer list of R&D initiatives that meet both criteria.

Concrete steps to resolve the contradiction between economic growth and environmentalism would also open up new political possibilities. If the interests supporting economic growth (for example, unions, most state and municipal governments, small business in general and high-tech firms in particular) could be aggregated together with the environmental and consumer movements, it would make a formidable coalition. The political clout of such a coalition would go far beyond the veto power that each grouping exercises separately. Such a coalition could set the environmental and industrial policy agenda in the post-Reagan era, regardless of the political party that captures the White House or Congress.

HENRY ETZKOWITZ
Sociology Board of Study,
State University of New York,
Purchase, NY 10577

Life of an Astrophysicist

My Daughter Beatrice. A Personal Memoir of Dr. Beatrice Tinsley, Astronomer. EDWARD HILL. American Physical Society, New York, 1986. xx, 118 pp., illus. Paper, $11.

The pioneering work of Beatrice Tinsley on galaxy evolution, her acute insights, and her enormously generous scientific interactions with a large number of colleagues and friends had a tremendous impact on astronomy. Her death in 1981 at the age of 40 left a gap that has not been filled, and she is keenly missed alike by those fortunate enough to have known her and by those who know her only through her work. This book is a biography of Tinsley written by her father, describing her childhood, education, and career, the last largely through passages from the copious flow of letters from Beatrice to her family. In addition, there is her obituary, written by her Yale colleagues Richard Larson and Linda Stryker, which describes many of Beatrice's scientific contributions, and an introduction by Sandra Faber, a close colleague and friend.

This book is fascinating and invaluable on many levels, the first purely as history. Hill's description of Beatrice's birth in the depths of World War II in industrial England, her early childhood, and her school and university days in New Zealand powerfully evokes a world now largely vanished and is at the same time a beautifully written and vividly remembered description of childhood and a portrait of an unusual and gifted family. Many years after she had left New Zealand for the United States, and when she was many years into her great series of cosmological investigations, Beatrice was still keeping up a steady stream of letters to her family, none of them scientists, describing her struggles and triumphs with abstruse scientific problems, her work with colleagues, her travels to meetings, and such day-to-day activities as dealing with university administrators and difficult graduate students. Hill is thus able, from a distance of many thousands of miles, to reconstruct Beatrice's activities in detail from the time she arrived in the United States to the time

of her death. His book ends with a description of Beatrice's coming to terms with her approaching death and with two poems, one by Beatrice herself and one by her sister Rowena, which, in their spare and beautiful language, encapsulate the whole book.

The history written by Larson and Stryker, Faber's account (by turns touching and amusing) of what it was like to have Beatrice in the same field, and Hill's description of Beatrice's internal and external struggles to gain expression for her scientific work form a powerful picture of how brightly one so gifted as Beatrice burns—how such a person at once seems so alive and makes life feel more worth living to others. Finally, of course, this is a portrait of a superb scientist at work. Beatrice's intelligence, honesty, enthusiasm, and high standards and the grasp and sweep of her work come across strongly in the several sections of this book, which complement each other beautifully. The book should be read by anyone interested in how science works and how scientists at their best carry out this most human of endeavors.

GILLIAN R. KNAPP
Department of Astrophysical Sciences, Princeton University, Princeton, NJ 08544

Genetic Abnormalities

The Consequences of Chromosome Imbalance. Principles, Mechanisms, and Models. CHARLES J. EPSTEIN. Cambridge University Press, New York, 1986. xxii, 486 pp., illus. $59. Developmental and Cell Biology Series, 18.

This book addresses not the causes of chromosome imbalance but how it leads to an abnormal phenotype and the possible mechanisms involved. Epstein is particularly interested in the human aneuploid states, but he also discusses what is known in other organisms, particularly mammals. Following a brief introduction, he covers "clinical observations" of chromosome imbalances in humans. Part 3 focuses on "the theoretical mechanisms and issues: the primary and secondary effects of aneuploidy" and includes chapters on gene dosage effects, metabolic pathways, transport systems, receptors, regulatory systems, assembly of macromolecules, cellular interactions, pattern formation, type-countertype, and nonspecific effects of aneuploidy. Part 4 covers "experimental systems for the study of mammalian and human aneuploidy," with a particular focus on Epstein's own work in the mouse; these model systems are especially important in the study of early development, which is difficult if not impossible to study directly in humans. Part 5 addresses three major clinical problems of human aneuploidy: trisomy 21 (Down syndrome), monosomy X (Turner syndrome, gonadal dysgenesis), and cancer.

It is evident throughout the discussion that Epstein has, as he indicates in the preface, a bias toward the importance of gene dosage in aneuploidy. This admitted bias notwithstanding, he has provided a fair but critical treatment of the subject. Indeed, one of the strengths of the book is the critiques it provides of work considered. Moreover, it constitutes a comprehensive review of the field (there are almost 88 pages of references) as of 1 September 1984, when Epstein ended his systematic review of the literature.

Epstein has accomplished with distinction his goals of presenting a way of thinking about aneuploidy and of bringing "a sense of coherence to a large mass of clinical and experimental data along with many theoretical considerations." Because of the date for cutoff of references, there are some topics on which the most recent information is not taken into account. For example, I would be interested in knowing Epstein's views on homeoboxes in relation to aneuploidy. And in relation to the acquired chromosome changes, a discussion of the current molecular understanding of chromosome rearrangements in chronic myelogenous leukemia and other related conditions would be of interest.

ROBERT S. SPARKES
Center for the Health Sciences, University of California, Los Angeles, CA 90024

Japanese Prehistory

Prehistoric Hunter-Gatherers in Japan. New Research Methods. TAKERU AKAZAWA and C. MELVIN AIKENS, Eds. University of Tokyo Press, Tokyo, 1986 (U.S. distributor, Columbia University Press, New York). xiv, 221 pp., illus., + plates. $62.50. From a symposium, Vancouver, British Columbia, Sept. 1983.

The editors identify three objectives behind the presentation of this collection of essays: "to advance the use of scientific, quantitative methods in the study of prehistoric problems"; to make available (in English) the results of research in one of the most intensively investigated areas in the world; and to help clarify the "origins and affiliations of the Japanese population."

The four chapters in the first section, Archaeology: Jomon Hunter-Gatherer Subsistence and Settlement, taken together successfully attain these goals. The chapters by Koike on hunting pressure and paleobiomass around prehistoric Tokyo Bay and by Suzuki on volumetry and nutritional analysis of a shell midden are numbing in their reconstructive detail, but their value is clearly demonstrated as a background for integrative chapters by Aikens, Ames, and Sanger and by Akazawa.

In their contribution Aikens *et al.* compare preagricultural adaptations in four areas of the world: Japan, the northwest and northeast coasts of America, and the Baltic. These four cultures were characterized by continual underproduction and an economy of use, with any intensification of production deriving from sociopolitical action rather than from technological change directly. The similarities among them can be attributed to their common occurrence in biotically rich north temperate coastal-woodland ecozones and to their long-term, increasingly sedentary, developmental trajectories. The Japanese and European societies attained greater cultural complexity earlier than the North American examples as a result of more intense environmental circumscription and the eventual adoption of agriculture. In general, the relative rates of cultural elaboration are a function of duration and density of settlement.

Akazawa seeks to explain the regional diversity in the adoption of rice cultivation by Jomon populations. There was a high receptivity to agriculture and a subsequent widespread cultural uniformity in the west, whereas in the east cultivation was initially resisted and there was a continuation of more traditional lifeways based on local Jomon adaptations. The eastern populations, relying on sea fauna in the spring and terrestrial plants in the fall, enjoyed a highly productive subsistence regime from March through November. In the west, annual productivity was limited by the terrestrial resources peaking in the fall, and the promise of increased stability and higher yield coupled with subsistence practices already keyed to fall plant collection facilitated the shift to rice crops. The transition in the east involved a more radical alteration of practices, with a conflict between the labor-intensive period of planting in the spring and the fishing schedule, in an already highly productive environment. The slow, clinal adoption of rice cultivation can be explained by socioeconomic processes in differing ecosystems rather than by migration models.

Part 2 of the book, Physical Anthropology: The People of Japan Past and Present, is disappointing by comparison. The content is indicative of much of archeologically applied physical anthropology, and in that sense does not reflect on the individual authors. Until recently, the contributions of