strained by the others' work? The most important insight to emerge from this part of the book is that there is unlikely to be a unitary, exclusive explanation for preference evolution. The possibility of a variety of forces acting sequentially or in concert promises to make this rather difficult problem even more intractable.

In reviewing all these issues Andersson has accomplished an amazing, almost herculean, task. There is no question that this book will take its place among the classics in its field.

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Vignettes: Pleasures of Chemistry

Vigorous evolution of gas, quick coloration to brown, and the formation of precipitates; there, hidden, was the treasure of possibility in the bubbles of foam on the surface, which were observed in the reaction vessel in a corner of our small laboratory! For organic chemists, facing such an unpredictable phenomenon is not uncommon. In flasks, that which can never be predicted by thought or discussion with co-workers often happens.

—*Teruaki Mukaiyama*, in *Challenges in Synthetic Organic Chemistry* (Clarendon Press)

No other profession is endowed with such a rich landscape, draws inspiration from so many fields of science, exercises the hand and mind in so many different ways, offers such opportunities to employ creative instincts, and mixes ideas, theory, and experiment on a daily basis. Hurrah for the science of organic chemistry, and for the joy it brings those who play the research game.

—*Donald J. Cram*, in the preface to *Container Molecules and Their Guests*, coauthored with Jane M. Cram (Royal Society of Chemistry and CRC Press)

Condensed Matter

Die Kunst of Phonons. TADEUSZ PASZKIEWICZ and KRZYSZTOF RAPCEWICZ, Eds. Plenum, New York, 1994. xii, 432 pp., illus. $110. From a school, Kudowa Zdrój, Poland, Feb. 1993.

Phonon physics, the science of the properties of solids and liquids arising from collective atomic vibrations, is perhaps the oldest branch of condensed matter physics. In 1893, four years before the discovery of the electron by J. J. Thomson, F. Richarz, in an effort to establish a theoretical basis for the observed constancy of the specific heat of a crystal at elevated temperatures (the law of Dulong and Petit), was led to characterize a crystal as an assembly of atoms each of which executes a simple harmonic motion about its mean position. The same model of a crystalline solid was subsequently used by Einstein in attempting to explain the optical properties of diamond, and in this way he was led to his well-known theory of lattice specific heats. One hundred years later, in a testimonial to the vigor the field continues to display, the Winter School of Theoretical Physics held annually in Poland was dedicated to the physics of phonons. The book under review contains the proceedings of this school.

The 36 presentations at the school were divided into seven fairly broad categories—Phonons: General; Phonon Focusing; Nonequilibrium Phonons; Interaction of Bulk Phonons with Low Dimensional Gases of Carriers; Phonon Mediated Detectors of Elementary Particles; Molecular Crystals; and Electron Systems. These were selected with the desire to provide a review of the progress made in phonon physics since a winter school on the same topic was held in 1987. In this reviewer's opinion this goal was well met. However, the book as a whole displays the strengths and weaknesses of most such proceedings. Among the strengths is the breadth of the subject matter and an up-to-date quality reflecting the fact that the authors are all working actively in the fields of their contributions. Among the weaknesses is a certain loss of completeness and coherency. In addition, though the origin of the presentation suggests that they should possess some didactic qualities, not many of them in fact do: a large number instead read like brief research articles. One notable exception to this is A. G. Every's discussion of thermal phonon imaging, the study of the highly anisotropic ballistic, or near-ballistic, phonon flux patterns in crystals that are due primarily to phonon focusing, that is, to the concentration of the energy flux of phonons in special directions in anisotropic crystals. It summarizes in a clear and readable fashion the history of the subject, its theoretical underpinnings, including the contribution of catastrophe theory to the interpretation of the images predicted and observed, experimental methods for studying phonon imaging and their results, and applications of phonon imaging. The figures displaying theoretical and experimental results for phonon images in this and several other contributions on the subject are sufficiently attractive that they go a long way toward justifying the fractured German of the book's title. Another notable survey is that of A. Thellung on momentum and quasimomentum in the physics of condensed matter. The definitions of momentum and quasimomentum, the conservation law each satisfies, for an isolated system or for one interacting with an external electromagnetic field, and new physical effects in which the conservation of quasimomentum plays the central role are expounded in a thoroughly didactic paper that is a pleasure to read. The same qualities are found in the two lengthy papers, by H. Kraus and by R. Gaitskell, in which the possibilities of applying phonon physics to the construction of cryogenic detectors of elementary particles are described.

Someone interested in learning about this new field, which is still in an early stage of development, could hardly do better than read the papers mentioned above. However, even the shorter contributions give snapshots of various activities that confirm the breadth and continuing liveliness of the field of phonon physics. I would rate the volume as a better than average example of its genre, which will reward workers in the field with new insights and new results.

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Other Books of Interest

Historical Perspectives in Plant Science. KENNETH J. FREY, Ed. Iowa State University Press, Ames, 1995. x, 205 pp., illus. $44.95.

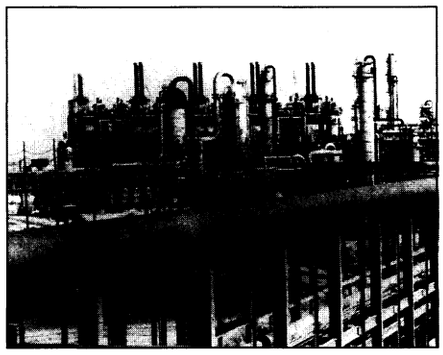
In a series of lectures presented at Iowa State University in 1991 eight scholars identified as "makers of plant science history" expounded their views of the course of

the field. In this volume the lectures are brought together in the hope of reaching a wider audience. The opening lecture is by the population biologist G. Ledyard Stebbins, who traces four revolutions affecting biology generally, the Mendelian, macromolecular, and transfer-of-energy revolutions and a second molecular revolution involving nucleic acids and the genetic code. Understanding of nitrogen fixation is the subject of the second lecture, by Robert H. Burris, who concludes an account beginning with the work of Boussingault and Liebig 150 years ago with the observation that selection of rhizobia to improve the process remains essentially empirical, as distinct from rational. Bruce Griffing then reviews the contributions of quantitative genetics to plant breeding, outlining basic concepts and methodologies and noting the work of Ronald Fisher (1918) and its later generalization by Cockerham and Kempthorne as special milestones. Turning to plant pathology, Arthur Kelman argues the case that that area of study has contributed importantly to other fields of biology, citing as examples the recognition of a fungus as the cause of smut in wheat and the fact that viruses were first identified as plant pathogens and also considering abiotic disorders such as frost damage. Ralph Riley in a lecture on crop cytogenetics reviews efforts at chromosome manipulation in such plants as rice, wheat, watermelon, and sugar beet, *Triticale* being a notable example of success. Charles S. Levings III and two coauthors discuss implications of recent biotechnology, including the development of *Agrobacterium* as a vector for gene introduction, the utility of *Arabidopsis* as a model system, and resistance to viruses and insects. In the last two lectures John W. Dudley and Neil F. Jensen both discuss plant breeding, the former considering issues of quality, crop yield, and production efficiency and the latter finding continuities from pre-scientific agriculture to the present, giving attention to such advances as the practice of artificial hybridization and the recognition of "hybrid vigor." Each lecture is preceded by a brief biography of the author. A list of literature cited follows each, and there is an index to the volume as a whole.

Katherine Livingston

American Chemical Enterprise. A Perspective on 100 Years of Innovation. MARY ELLEN BOWDEN and JOHN KENLY SMITH. Chemical Heritage Foundation, Philadelphia, 1994. 96 pp., illus. Paper, $15. Chemical Heritage Foundation Publication no. 14.

The Society of Chemical Industry was founded in London in 1881 "to advance applied chemistry in all its branches," and



"A plant for making linear olefins for biodegradable detergents, Chocolate Bayou, Texas." [From *American Chemical Enterprise*; courtesy Monsanto Company]

"James Franklin Hyde demonstrating a silicone-based poduct. Hyde began to develop silicones—products which became the foundation of Dow Corning Comporation—in 1935 at Corning Glass Company." [From *American Chemical Enterprise*; Chemical Heritage Foundation]

the effort was extended overseas with the establishment of an American Section in 1894. This publication celebrates the centennial of the latter event with a series of copiously illustrated historical sketches of aspects of industrial chemistry in the United States. The introductory essay is devoted to the early days of the American Section, which distinguished itself from the then more theoretically and academically oriented American Chemical Society and "found its niche in conviviality and communication, not lobbying or education." Other essays take up enterprises concerned with "mineral wealth" and industrial gases, from alloy steels to helium; the development of electrochemicals and related processes, including the economical production of aluminum, once considered a precious metal; and efforts prior to World War II to convert natural products into more valuable substances, results including dyestuffs, Celanese, celluloid, Bakelite, and smokeless powder or gun cotton. A chapter then recounts the development of chemical engineering as an academic discipline, the Manhattan Project being discussed as one of its "payoffs." Petroleum and petrochemicals, synthetic materials such as nylon and plastics, pharmaceuticals, and semiconductors and environmental technologies, the last two categorized together on the basis of their relevance to the "global village," are the subjects of the final chapters. The treatment is centered on the work of American Section award-winners, who include many famous chemists, and the emphasis throughout is on the contributions of the chemical industry to the general welfare; Howard Sorgenti comments in his foreword that "If today the 'romance' has gone out of industry, that is probably the greatest compliment we pay to the innovators of the past." The work ends with listing of officers and award-winners of the American Section and a page of suggestions for further reading.

Katherine Livingston

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Books Received

Accounting as Social and Institutional Practice. Anthony G. Hopwood and Peter Miller, Eds. Cambridge University Press, New York, 1994. xii, 324 pp., illus. $59.95; paper $19.95. Cambridge Studies in Management, 24.

Active Assessment for Active Science. A Guide for Elementary School Teachers. George E. Hein and Sabra Price. Heinemann, Portsmouth, NH, 1994. xiv, 155 pp., illus. Paper, $18.

Advances in Bioprocess Engineering. Enrique Galindo and Octavio T. Ramírez, Eds. Kluwer, Norwell, MA, 1994. xvi, 541 pp., illus. $260 or £172.50 or Dfl. 420. From a symposium, Cuernavaca, Mexico, June 1994.

Advances in Integrated Optics. S. Martellucci, A. N. Chester, and M. Bertolotti, Eds. Plenum, New York, 1994. viii, 343 pp., illus. $95. From a conference, Erice, Sicily, June 1993.

Bearing the Dead. The British Culture of Mourning from the Enlightenment to Victoria. Esther Schor. Princeton University Press, Princeton, NJ, 1995. x, 290 pp., $35 or £27.95. Literature in History.

Behavior and Evolution. P. J. B. Slater and T. R. Halliday, Eds. Cambridge University Press, New York, 1994. x, 348 pp., illus. $59.95; paper, $24.95.

Behavioral Mechanisms in Evolutionary Ecology. Leslie A. Real, Ed. University of Chicago Press, Chicago, 1995. x, 469 pp., illus. $80 or £63.95; paper, $29.95 or £23.95.

Between Copernicus and Galileo. Christoph Clavius and the Collapse of Ptolemaic Cosmology. James M. Lattis. University of Chicago Press, Chicago, 1995. xx, 293 pp., illus. $54 or £43.25; paper, $22.50 or £17.95.

The Cambridge Atlas of Astronomy. Jean Audouse and Guy Israël, Eds. 3rd ed. Cambridge University Press, New York, 1994. 471 pp., illus. $75. Translated from the French edition (1994) by Andrew King.

Cancer Prevention and Control. Peter Greenwald, Barnett S. Kramer, and Douglas L. Weed, Eds. Dekker, New York, 1994. xiv, 801 pp., illus. $195. Basic and Clinical Oncology, 6.

Cell Adhesion. Fundamentals and Biotechnological Applications. Martin A. Hjortso and Joseph W. Roos, Eds. Dekker, New York, 1994. xii, 273 pp., illus. $135. Bioprocess Technology Series, vol. 20.

Cellular Bioenergetics. Role of Coupled Creatine Kinases. V. A. Saks and Reneé Ventura-Clapier, Eds. Kluwer, Norwell, MA, 1994. vi, 346 pp., illus. $195 or £138.50 or Dfl. 375. Developments in Molecular and Cellular Biochemistry, 13. Reprinted from *Developments in Molecular and Cellular Biochemistry*, 133/134 (1994).

Curves and Fractal Dimension. Claude Tricot. Springer-Verlag, New York, 1994. xiv, 323 pp., illus. $42.

Death and Deliverance. "Euthanasia" in Germany