

ical and social decisions because "it turns on the goals of the society and what trade-offs are deemed acceptable."

The third compilation, *Assessing Ecological Risks of Biotechnology*, focuses on ecological issues in its 17 chapters. Introductory chapters deal with the effects of biological introductions on communities and planned introductions in the biological control of arthropod and weed pests. I would have preferred the use of microorganisms as examples in these chapters, because the remaining chapters focus on microorganisms. There are five chapters on the ecology and genetics of microbial populations, providing overviews of surface transport of microorganisms by water, soil and groundwater transport of microorganisms, aerial dispersal of bacteria, transfer of genetic information among soil microorganisms, and genetic stability in bacterial populations. There are also chapters on modeling the dynamics of transposable elements, quantifying fitness and gene stability, quantifying risks of invasion of genetically engineered microorganisms, and quantifying the spread of recombinant genes and organisms. Finally, there are four chapters dealing with regulation (by the Environmental Protection Agency, the Department of Agriculture, and in the European Community) and a chapter on risk analysis associated with biotechnology of waste treatment.

The final chapter is a provocative essay "On making nature safe for biotechnology" by Mark Sagoff. In a wide-ranging discussion of ecological restoration, agricultural economics, and history of agriculture, Sagoff presents scenarios for agriculture, forestry, and aquaculture that are revolutionized by biotechnology. He points out that some fear biotechnology not because some genetic monster will be set loose but because "the nation will drown in a sea of surplus agriculture commodities." He is concerned that "the unparalleled speed and magnitude of the expected productivity gains" will overwhelm saturated world markets and suggests that the issues have nothing to do with the *unpredictable* risks of biotechnology but concern the profitable, predictable, intentional, and successful effects of biotechnology. Sagoff argues that the major effects of biotechnology will be twofold. First, many ecosystems may be converted to species and processes suitable to large-scale, highly controlled production. Second, as agricultural surpluses begin to be seen as infinite, and as the factory replaces the field as the location where food and fiber are fabricated, many farms will go out of production, which will allow large tracts of land to be restored to their "natural" state. Sagoff argues that esthetic, moral, cultural,

and historical arguments for preserving nature are being lost in the intricacies of arcane arguments over speculative risks and that the policy issue is whether increased efficiency of production can be compatible with maintaining the integrity of the global environment.

The introduction into the environment of genetically modified microorganisms and plants is considered by some to be a risky business. In one sense, it is ironic that risk issues have played such a dominant role in agricultural biotechnology despite its history of self-regulation since the Asilomar conference in 1975. By the end of 1989, more than 52 engineered plants and 56 engineered microbes had been released into the environment with no detectable harm.

The debate on the role of biotechnology in agriculture has expanded. Whether the revolution in agriculture that could result from the use of genetically engineered microorganisms and plants can be managed so that cultural, historical, moral, and esthetic values are upheld is the core of the problem.

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Reprints of Books Previously Reviewed

Dinosaur Tracks and Traces. David D. Gillette and Martin G. Lockley, Eds. Cambridge University Press, New York, 1991. Paper, \$29.95. *Reviewed* 247, 732 (1990).

Embryos, Genes, and Evolution. The Developmental-Genetic Basis of Evolutionary Change. Rudolf A. Raff and Thomas G. Kaufman. New introduction added. Indiana University Press, Bloomington, 1991. \$49.95; paper, \$24.95. *Reviewed* 221, 257 (1983).

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AIDS. Anti-HIV Agents, Therapies, and Vaccines. Vassil St. Georgiev and John J. McGowan, Eds. New York Academy of Sciences, New York, 1990. xvi, 634 pp., illus. \$163. *Annals of the New York Academy of Sciences*, vol. 616. From a conference, Arlington, VA, Nov. 1989.

Alternative Energy Sourcebook 1991. John Schaeffer, Ed. Real Goods Trading, Ukiah, CA, 1991. 398 pp., illus. Paper, \$14.

Atom. Journey Across the Subatomic Cosmos. Isaac Asimov. Dutton (Penguin), New York, 1991. xii, 319 pp., illus. \$21.95. Truman Talley Books.

Biocatalysts for Industry. Jonathan S. Dordick, Ed. Plenum, New York, 1991. xvi, 330 pp., illus. \$75. *Topics in Applied Chemistry*.

Biochemical Markers in the Population Genetics of Forest Trees. S. Fineschi *et al.*, Eds. SPB Academic Publishing, the Hague, The Netherlands, 1991. vi, 251 pp., illus. Paper, \$47. From a meeting, Porano, Italy, Oct. 1988.

Calculus. James Stewart. 2nd ed. Brooks/Cole, Pacific Grove, CA, 1991. xviii, 1086 pp., illus. \$65.

Cell Communication in Health and Disease. Readings from *Scientific American Magazine*. Howard Rasmussen, Ed. Freeman, New York, 1991. xiv, 185 pp., illus. Paper, \$13.95.

Cellular and Molecular Immunology. Abul K. Abbas, Andrew H. Lichtman, and Jordan S. Pober. Saunders, Philadelphia, PA, 1991. xii, 417 pp., illus. Paper, \$26.95.

The Development and Neural Bases of Higher Cognitive Functions. Adele Diamond, Ed. New York Academy of Sciences, New York, 1990. lvi, 749 pp., illus. Cloth or paper, \$180. *Annals of the New York Academy of Sciences*, vol. 608. From a conference, Philadelphia, PA, May 1989.

A Dictionary of Genetics. Robert C. King and William D. Stansfield. 4th ed. Oxford University Press, New York, 1990. viii, 406 pp., illus. \$39.95; paper, \$19.95.

The Effectiveness of Methadone Maintenance Treatment. Patients, Programs, Services, and Outcome. John C. Ball and Alan Ross. Springer-Verlag, New York, 1991. xiv, 283 pp., illus. \$59.

Electronic Conduction in Oxides. N. Tsuda *et al.* Springer-Verlag, New York, 1991. x, 323 pp., illus. \$79. Springer Series in Solid-State Sciences, 94. Translated from the Japanese edition (Tokyo, 1983) with revisions.

Exploring the Sun. Solar Science since Galileo. Karl Hufbauer. Johns Hopkins University Press, Baltimore, MD, 1991. xviii, 370 pp., illus. \$39.95. New Series in NASA History.

Fibrinogen, Thrombosis, Coagulation, and Fibrinolysis. Chung Yuan Liu and Shu Chien, Eds. Plenum, New York, 1991. x, 450 pp., illus. \$95. Advances in Experimental Medicine and Biology, vol. 281. From a symposium, Taipei, R.O.C., Aug. 1989.

Fractals, Chaos, Power Laws. Minutes from an Infinite Paradise. Manfred Schroeder. Freeman, New York, 1991. xviii, 429 pp., illus., + plates. \$32.95.

Fundamental Astronomy. H. Karttunen *et al.*, Eds. Springer-Verlag, New York, 1991. xiv, 478 pp., illus. Paper, \$34.95. Springer Study Edition. Reprint, 1987 ed.

Hybrid Control Systems in Manufacturing. Agostino Villa. Gordon and Breach, New York, 1991. xvi, 231 pp., illus., + index. \$80.

Immunology. A Short Course. Eli Benjamini and Sidney Leskowitz. 2nd ed. Liss (Wiley), New York, 1991. xxvi, 459 pp., illus. Paper, \$29.95.

Knowing Children. Experiments in Conversation and Cognition. Michael Siegal. Erlbaum, Hillsdale, NJ, 1991. x, 154 pp., illus. \$32.50.

Lipid Biochemistry. An Introduction. M. I. Gurr and J. L. Harwood. 4th ed. Chapman and Hall, New York, 1991. viii, 406 pp., illus. \$89.95; paper, \$42.

Luminescence and the Solid State. R. C. Ropp. Elsevier, New York, 1991. xvi, 453 pp., illus. \$185.50. *Studies in Inorganic Chemistry*, 12.

The Magic of Numbers and Motion. The Scientific Career of René Descartes. William R. Shea. Science History Publications (Watson), Canton, MA, 1991. xii, 371 pp., illus. \$54.95.

Nomads in Archaeology. Roger Cribb. Cambridge University Press, New York, 1991. xiv, 253 pp., illus. \$54.50. *New Studies in Archaeology*.

Organic Spectroscopy. William Kemp. 3rd ed. Freeman, New York, 1991. xxii, 393 pp., illus. \$34.95; paper, \$24.95.

Particles and Waves. Historical Essays in the Philosophy of Science. Peter Achinstein. Oxford University Press, New York, 1991. viii, 337 pp., illus. \$49.95; paper, \$24.95.

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The Structure of the Proton. Deep Inelastic Scattering. R. G. Roberts. Cambridge University Press, New York, 1991. x, 182 pp., illus. \$49.50. *Cambridge Monographs on Mathematical Physics*.

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Taking Society's Measure. A Personal History of Survey Research. Herbert H. Hyman. Hubert J. O'Gorman, Ed. Russell Sage Foundation, New York, 1991. xxiv, 257 pp. \$34.95.

The Unified Field Theory's Principles of Dimensional Relativity. Shawn Jade. Carlton, New York, 1991. 261 pp., illus. \$18.95. A Hearstone Book.

Visualization. The Second Computer Revolution. Richard Mark Friedhoff and William Benzon. Freeman, New York, 1991. 215 pp., illus. Paper, \$25.95. Reprint, 1989 ed.