BOOK REVIEWS

Ecological Accountancy

Nature's Services. Societal Dependence on Natural Ecosystems. GRETCHEN C. DAILY, Ed. Island Press, Washington, DC, 1997. xx, 392 pp., illus. $49.95, ISBN 1-55963-475-8; paper, $24.95, ISBN 1-55963-476-6.

Just how valuable is nature? One of the misfortunes of modern environmentalism is that the serious, respectable scientists have not spent much time trying to answer this question. Indeed, to many the question itself is vulgar and redundant, because serious scientists ought not to be troubled with stating the obvious. Where the respectable fear to tread, the ill-informed fill their shoes, which is why we have uninformed environmental campaigns. Scientific indifference to the question accounts, in part at least, for the fact that nature is disappearing, fast. And unless someone tells us why nature is valuable and, just as important, how we are to capture those values so that they show up in the everyday calculus of economic, social, and political decision-making, then there will be less and less nature for the future.

This volume of essays sets out to provide answers to the question of value. Gretchen Daily begins sensibly by running up a menu of ecosystem services: the cleansing of air and water, regulation of watersheds, waste treatment, renewal of soil fertility, pollination, pest control, seed dispersal, maintenance of biological diversity, climate and ultraviolet radiation regulation, provision of human culture, aesthetic beauty and intellectual stimulation. To these she might have added the provision of food, shelter, fodder, medicines—all the "free" wealth of the wild. Harold Mooney and Paul Ehrlich offer a brief history of concern about ecosystem services, concluding that we seem to have learned little since George Perkins Marsh expressed his concern about the depletion of natural capital over a hundred years ago. Diffusing these concerns throughout the millions of decision-makers who daily convert this natural capital to something else is the subject of an unfortunate debate, unfortunate because it diverts energy into unproductive disputes. At one extreme are those who argue for a "moral revolution," a blossoming of concern for nature, perhaps through education and campaigns of moral suasion. At the other are those who argue that nature disappears because it has no "price," no economic value. If a hectare of land is worth $2000 as agricultural land and nothing as wilderness, its fate is inevitable. But if wilderness were saleable, what then? Several of the essays deal directly with or touch upon this issue. Lawrence Goulder and Donald Kennedy elegantly set out the basics of placing monetary values of human preferences for environmental assets, and this easy-to-read introduction to complex methodology is to be highly recommended. Robert Costanza and Carl Folke traverse some dubious ground in questioning the role to be played by human preferences in valuing ecosystem services. Noting that preferences can and do change over time, and indeed may change during the process of decision-making, they opt for a process whereby preferences are (openly) manipulated in a democratic process. This sounds politically correct, but real-world democratic processes are, of course, the instruments of the powerful, and it is precisely because we know they are not reflective of individuals' wishes that economists opt for the consumer sovereignty paradigm, warts and all.

Susan Alexander, Stephen Schneider, and Kalen Lagerquist focus on climate and its economic value. They look at the economic costs of extreme weather events in the American Midwest and then at the economic value of carbon as the source of warming damage. This part of their essay is unfortunately very dated, having been superseded by the work of the Intergovernmental Panel on Climate Change, but it is good to see scientists affording the economists' work some credibility, even if they find it "highly unsatisfying." In what is probably the best essay in the book, David Tilman looks at biodiversity and provides a valuable summary of the 40-year debate on the contribution that diversity makes to stability of ecosystems. He concludes from empirical work that biodiversity has an "insurance value" in that it minimizes the damages from unpredictable events but that diversity has little to do with variability in individual component populations. Gretchen Daily, Pamela Matson, and Peter Vitousek consider the ecosystem services supplied by soil: regulation of the hydrological cycle, the physical and nutrient basis of plant life, and the context for the decomposition of organic waste, for example. But do we need all these ecosystems? The authors hypothesize what the cost of nitrogen fertilizer to replace existing natural nitrogen capture in soils would be and come to a figure of $320 billion a year. Unfortunately, these calculations commit the basic error of confusing marginal and total values, an error that Goulder and Kennedy warn against in their essay. Imagine what the price of artificial fertilizer would be if it suddenly was required to replace all natural nitrogen use!

Other essays deal with pollination and the little-publicized crisis of the decline in honeybees; natural pest control, with a range of economic values from $54 billion to $1 trillion; marine and freshwater ecosystems, and the world's forests and grasslands. The book ends with some brief case studies. Overall, this is a fine volume that makes a first cut at accounting for the value of ecosystems. The idea of listing and, where possible, measuring ecosystem values is not new, but having so much information on this activity brought together in one book is novel and rewarding.

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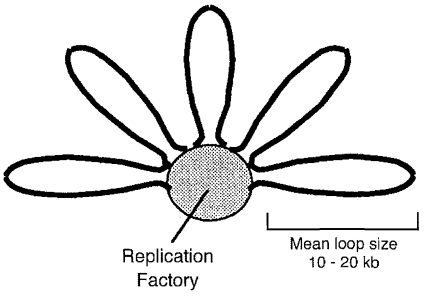
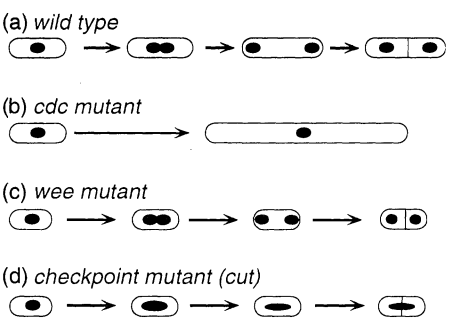
Cells and Replicons

Eukaryotic DNA Replication. J. JULIAN BLOW, Ed. IRL (Oxford University Press), New York, 1996. xx, 232 pp., illus. $105 or £65, ISBN 0-19-963586-2; paper, $55 or £29.95, ISBN 0-19-963585-4. Frontiers in Molecular Biology, 15.

The elucidation of the mechanisms of DNA replication has been a key focus of biological research since it was discovered in 1953 that implicit within the structure of DNA was a simple solution to its faithful propagation. The basic enzymology of the process was



"Cartoon to show a possible role for chromosome looping in generating a relatively constant replicon size in the *Xenopus* system." [From Blow's chapter in *Eukaryotic DNA Replication*]



"A schematic describing the cell cycle phenotypes of wild-type and mutant fission yeast cells. (a) Wild-type cells grow in length and divide by medial fission. (b) Cell division cycle, or cdc mutant cells can continue growth and macromolecular synthesis, but are defective for division. The cells become highly elongated. (c) Wee mutants are accelerated through the cell cycle and divide at a smaller size than wild type, although they are viable. (d) Checkpoint deficient cells fail to restrain mitosis even though S phase is not complete. They often 'cut' or pull apart the nucleus." [From Forsburg's chapter in *Eukaryotic DNA Replication*]

worked out largely through studies of *Escherichia coli* and its bacteriophages, with the study of eukaryotic DNA replication in the position of a poor relation. Over the last decade, the momentum in the field has shifted to eukaryotes as a result of the development of an in vitro SV40 DNA replication system and enormous advances in our understanding of the regulation of the eukaryotic cell cycle. It is fair to say that our current knowledge of the regulation of DNA replication in eukaryotes exceeds that of prokaryotes.

This volume is largely successful in capturing the key issues of the eukaryotic DNA replication field, including the enzymology of the replication fork, the structure of replication origins, and the regulation of DNA replication, and in summarizing recent progress. An attractive feature of the volume is the juxtaposition of chapters that highlight contributions from the genetically tractable budding and fission yeasts with chapters that highlight contributions of the more biochemical and cell biological approaches necessary in *Xenopus* and mammalian cells. This juxtaposition demonstrates the high degree of evolutionary conservation of the proteins that function at replication forks and the mechanisms that regulate DNA replication and its coordination with progression through the cell cycle. It also reveals the value of examining multiple systems, which is nowhere more apparent than in cell cycle regulation. Studies of budding and brewing yeasts and the *Xenopus* in vitro system have provided complementary pieces of our current understanding of cell cycle regulation of DNA replication that would have been impossible to obtain from studies of any single organism alone.

No volume of this size could possibly detail the intricacies of the structure and interactions of known DNA replication proteins. What is missing from this treatise is any consideration of viral replication systems with the exception of SV40 and details of the structures and biochemistry of replication proteins. However, what it does well is to provide eight thoughtful reviews with clear figures and diagrams written by experts in the field. Together, these reviews provide a framework for thinking about cellular DNA replication in which students, teachers, and researchers should be able to integrate developments in this fast-moving field.

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Browsings

Adviser, Teacher, Role Model, Friend. On Being a Mentor to Students in Science and Engineering. National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. National Academy Press, Washington, DC, 1997. xii, 84 pp., illus. Paper, $7.95. ISBN 0-309-06363-9.

A self-help guide for those who would like to help others, with graphic aids offering "tips" on such matters as building respect and building trust and exemplary tales of mentoring styles and career development.

Discovering Dinosaurs in the Old West. The Field Journals of Arthur Lakes. Michael F. Kohl and John S. McIntosh, Eds. Smithsonian Institution Press, Washington, DC, 1997. xviii, 198 pp., illus. $24.95. ISBN 1-56098-700-6.

Explorations of the 1870s in Colorado and Wyoming as recounted in manuscripts recently rediscovered in the archives of the Smithsonian Institution.

Embryology. Constructing the Organism. Scott F. Gilbert and Anne M. Raunio, Eds. Sinauer, Sunderland, MA, 1997. xii, 537 pp., illus. $69.95. ISBN 0-87893-237-2.

In 22 chapters aimed at college sophomores, a set of authors who have observed that students in upper-level courses in developmental biology "come to class knowing about transcription and translation but knowing nothing about teloblasts of neural crest cells" describe the development of primitive multicellular organisms (Horvath, Fell), radiate animal phyla (Martin, Martindale and Henry), acoelomates and pseudocoelomates (Ellis and Fausto-Sterling, Schierenberg), protostome coelomates (Henry and Martindale, Pilger, Collier, Shankland and Savage, Gilbert, Schwalm, Zimmer), deuterostome coelomates (Wray, Jerrery and Swalla, Whittaker, Langeland and Kimmel, Elinson, Schoenwolf, Cruz), and angiosperms (Singer).

Essential Cell Biology. An Introduction to the Molecular Biology of the Cell. Bruce Alberts, Dennis Bray, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Garland, New York, 1997. xxiv, 630 pp., illus., + supplementary material. $59.95. ISBN 0-8153-2045-0.

A textbook written for students—"first- or second-year undergraduates with little background in biology"—who find the authors' *Molecular Biology of the Cell* "too specialized and too heavy for their needs."

Eyewitness to Science. John Carey, Ed. Harvard University Press, Cambridge, MA, 1997. xxviii, 528 pp. Paper, $16.95. ISBN 0-674-28755-x. Reprint of *The Faber Book of Science* (1995).

Excerpts, with brief historical introductions, from the writings of over 100 "eyewitnesses," ranging from Vesalius, Galileo, Faraday, Darwin, Becquerel, and Born to Mark Twain, Alfred Noyes, John Updike, and Italo Calvino.

A Half-Century of the Journal of Polymer Science. David A. Tirrell, Eli M. Pearce, Mitsuo Sawamoto, and Eric J. Amis, Eds. Wiley-Interscience, New York, 1997. xviii, 695 pp., illus. $39. ISBN 0-471-17824-1.

Reprintings of "a representative set" of 34 "significant papers," arranged chronologically under the headings Polymer Chemistry and Polymer Physics, with perspective and commentary by the original authors and other experts in the various areas.

Landmarks in Gene Regulation. D. S. Latchman, Ed. Portland, London, 1997 (U.S. distributor, Ashgate, Brookfield, VT). xii, 302 pp., illus. Paper, $34 or £20. ISBN 1-85578-109-3.

Twenty-six papers from various journals, 1976–1990, brought together with commentary by the editor with the aim of providing "a useful overview of the manner in which the highly complex field of eukaryotic gene regulation has gradually been elucidated."

Ligand-Receptor Energetics. A Guide for the Perplexed. Irving M. Klotz. Wiley-Interscience, New York, 1997. xiv, 170 pp., illus. Paper, $44.95. ISBN 0-471-17626-5.

A presentation of "the core principles that provide the foundation for quantitative perspectives" on the interactions involved in the formation of macromolecular complexes.

Ronald Ross: Malariologist and Polymath. A Biography. Edwin R. Nye and Mary E. Gibson. St. Martin's, New York, and Macmillan, London, 1997. xii, 316 pp. + plates. $59.95. ISBN 0-312-16296-0 or 0-333-62551-x.

The life and work of the British Nobelist (1857-1932) who demonstrated that malaria is transmitted by mosquitoes.