"Four nestlings banded in Greenland. The male in the foreground was sighted at sea in October of the same year perched on a Russian ship. Seven years later, he was trapped as a breeding adult in Greenland." [C. Anderson; from *Peregrine Falcon Populations*]

that the captive propagation and release techniques are an important contribution, this section could have profitably incorporated objective parley about the successes and limitations of this management tool. Richard Fyfe's recommendation that follow-up study is essential before the success of captive-breeding programs can be evaluated should be heeded.

I found the papers on dynamics and ecology the most informative and stimulating part of the book. Debate between Hunt and Newton concerning the role of density-dependent population regulation in peregrines provides worthwhile reading. Jean-Marc Thiollay contributes some intriguing information on prey availability and foraging by peregrines in Tunisia. Although the data are limited, R. Wayne Nelson explores the possibility that large broods may be maladaptive in terms of parental survival. This question has important ramifications for management programs that strive to provide falcons with large or "optimum" broods. Newton concludes this section with some penetrating conjecture, including a suggestion that large cliffs preferred by peregrines may be more important for facilitating hunting and territory defense than for preventing the predation of nestlings as traditionally presumed.

The contributors to the short section on geographic variation in peregrine populations point out several potential applications of modern genetic analyses to both basic research and management programs. With the exception of Derek Ratcliffe's essay, I found that the series of papers dealing with humanity and the peregrine added little.

Overall, the volume represents a monumental effort in amassing knowledge of the peregrine falcon. Except for a few minor lapses, it is well edited. Its most distracting shortcoming is the certitude with which many of the principal contributors view the release of captive-bred falcons as successful without critical evaluation. Most important, the book provides an informational foundation for fostering advancement in several areas of conservation biology. A framework for future inquiry is elegantly embodied in the four "irreverent questions" posed by Nisbet: What caused the population crashes? What is known about the population dynamics of peregrines? What is being learned about the biology of the peregrine from captive breeding programs? and Where have all the captive-reared birds gone?

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An Environmental Problem

The Acid Rain Controversy. JAMES L. REGENS and ROBERT W. RYCROFT. University of Pittsburgh Press, Pittsburgh, PA, 1988. xviii, 228 pp., illus. $24.95; paper, $12.95. Pitt Series in Policy and Institutional Studies.

This is a useful update on the acid rain debate during the Reagan years. The book draws heavily on studies by the Environmental Protection Agency (Regens was an EPA staff member in the early 1980s). It also presents interesting information about state initiatives designed to monitor and curb emissions. The book begins with a historical overview of air pollution controls in the United States. Chapter 2 deals with scientific evidence regarding acid rain and with relevant federal research support. This chapter leaves out new findings on acid rain in the American West and is weak on forest damage. Chapter 3 summarizes a wealth of technical information on acid rain control technologies, and chapter 4 does the same with respect to the cost of and financing options for control. The last two chapters review the many variations on the Reagan theme of "research yes, action no" and the unsuccessful attempts of the Congress to enact new legislation for reducing SO_2 emissions. The regional divisions between "polluters" (the Midwest and high-sulfur coal states) and "victims" (primarily the Northeast and Canada) are clearly articulated.

The authors do not take positions on the policy issues. They, like others, seem to be torn between two considerations. On the one hand, the complexities of the scientific and economic sides of the issue are increasing. Therefore, the Reagan approach may have had a point. On the other hand, waiting for a strong political consensus in support of control just does not seem enough. This is where the book falls short of what we now need in the growing literature on acid rain. I would have liked the authors to link their report to some broader questions: Have recent scientific findings changed the nature of the debate? Why is the search for new controls so much focused on reducing SO_2, with relatively little attention to the role of NO_x? What does it take to achieve a national consensus in favor of action? After all, acid rain has been on the policy agenda for two decades. Why are controls in this case more elusive than for conventional forms of air and water pollution, or pesticides, toxic substances, and industrial wastes? In those instances we may still be far from satisfactory solutions, but at least we have decided to act. We have not done so in the case of acid rain, at least not in the United States. Actions on the part of Europe and Canada are noted with approval. Though these countries have agreed on reductions in SO_2 emissions (but not NO_x), it remains unclear whether their actions will move them ahead of the United States, whose regulations were previously imposed under the Clean Air Act. The agreed-upon reductions, after all, are from current levels, giving a country with a lenient baseline a longer way to go before it will match standards that were imposed elsewhere during the 1970s.

Let me suggest three possible scenarios that might provide a strong enough incentive for the enactment of legislation: (i) evidence of direct health threats from acid deposition, such as toxic substances in drinking water; (ii) widespread economic damage, such as loss of crops, forests, or historic buildings; and (iii) linkage between acid rain and other problems of pollution, such as global warming. The first two justifications for controlling acid rain are considered by Regens and Rycroft, the third is not. Arguments 1 and 2 have received more attention in Europe than in North America. Effects of acid rain on health remain unclear. The damage to crops is limited, and the decline of forests is now seen as the result of many factors, including SO_2, NO_x, ozone, pests, climate, and management practices. Damage to historic buildings is well documented and massive. The argument that sustainable development will be

impossible without reducing the use of and pollution from fossil fuels is slowly gaining ground. A growing awareness of the connections among environmental problems led to the 1987 limited international agreement to reduce the production of ozone-depleting chlorinated fluorocarbons. A more comprehensive approach may provide a framework for taking a new look at the economic, social, and political linkages between energy, transportation, pollution, and development. Rather than searching for specific controls to reduce acid deposition, our goal may have to shift to reducing harmful emissions into the air because of their combined harmful effects on local, regional, and global environments. This will not make it any cheaper to control pollution, but it may obviate the fruitless confrontations between the Midwest and the Northeast, or Canada and the United States. And it may contribute to the general goal of sustainable development.

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A Well-Studied Worm

The Nematode *Caenorhabditis elegans*. WILLIAM B. WOOD *et al.*, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 1988. xvi, 667 pp., illus. $94. Cold Spring Harbor Monograph Series, vol. 17.

There is probably no organism that is growing in popularity among biologists at a faster rate than the free-living soil nematode *Caenorhabditis elegans*. Through the work of a relatively small number of pioneers, beginning largely with the efforts of Sydney Brenner and colleagues in the late '60s and early '70s, many elements of the organism's biology have been described completely. For example, a heroic effort has led to the complete description of its cell lineages. The entire neuroanatomy of the organism has been described through meticulous reconstruction of 20,000 electron micrographs of thin sections. The genetic map currently has about 700 identified genes, and an ordered collection of recombinant clones of the entire genome is just around the corner. This information provides an unparalleled resource for studying cell growth and differentiation at the single-cell level. Considering the opportunities this information provides, the appearance of this monograph could not be more timely.

The worm book, as it is called, serves many purposes. It is a comprehensive reference book, an introduction to the genetics and biology of *C. elegans*, and a source of many reviews of active research areas. As a reference for those in the field, and for helping outsiders to translate some of the *C. elegans* literature, the book is invaluable. The appendixes contain cell lineage charts, diagrams showing the positions of identified cells at various times during development, and a series of illustrations showing the positions of each neuron in the animal. For genetic topics, the book contains a wonderfully thorough appendix describing the phenotypes and map positions of most of the known genes and their alleles. A map of cloned genes is also included, but because of the progress in this area this section is rapidly becoming outdated.

The book provides for the first time an in-depth description of the basic biology of *C. elegans*. Chapters by White, Sulston, Kimble and Ward, Wood, and Riddle describe the anatomy and development of *C. elegans* in great detail, and a chapter by Emmons describes the structure and organization of the *C. elegans* genome. The newcomer may find the chapter "Cell lineage" (by Sulston) particularly interesting, as it includes a highly readable account of insights gleaned from the lineage. Much of "The nervous system" (by Chalfie and White) will also be of general interest, especially to those considering using *C. elegans* to study problems of neuronal cell specification, axon guidance, synaptic specificity, and behavior.

The opportunity for genetic analysis of complex biological processes is a major virtue of *C. elegans*, and this point is brought home repeatedly in the book. "Genetics" (by Herman) provides a description of how the basic tools of genetics are applied in *C. elegans*. In addition, many of the chapters describe the application of genetic analysis to problems in development, neurobiology, and cell biology. For example, "Genetics of cell lineage" (by Horvitz) demonstrates the power of using *C. elegans* genetics and laser microsurgery to define control circuits for pattern formation, developmental timing, and cell migration at the single-cell level. The chapter "Sexual dimorphism and sex determination" (by Hodgkin) describes elegant and detailed genetic experiments that define a complex pathway for sex determination. Additional chapters discuss genetic studies of muscle (Waterston) and the hardy alternative developmental form, the dauer larva (Riddle).

No volume can fulfill all readers' expectations, and this one has a few limitations. For example, a more detailed index would have made it much more useful to newcomers. Also, much valuable information about *C. elegans* transposable elements, DNA transformation, and gene structure has emerged since publication of the book and so is missing from it. However, the value of any monograph in a growing field can best be measured by whether it is still used regularly a few years after publication. By this criterion, the worm book will be a huge success. Every laboratory and most individuals working on *C. elegans* will want a copy. In addition, every library should have a copy, both to provide a rich source of information about *C. elegans* and to catalyze access to an increasingly important primary literature.

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Freshwater Plants

Vegetation of Inland Waters. J. J. SYMOENS, Ed. Kluwer, Norwell, MA, 1988. xiv, 385 pp., illus. $140. Handbook of Vegetation Science, vol. 15/1.

As a compendium of recent and useful information on the macrophytic vegetation of lakes and rivers, this book partially fills a vacuum in the literature.

The book opens with two chapters primarily on the physical and chemical environment written from a limnological perspective by R. G. Wetzel and by H. L. Golterman *et al.* These are followed by an excellent review on photosynthesis as related to ecology in macrophytes, with bits of information on macrophyte and phytoplankton production, by M. Søndergaard. There are three descriptive chapters on macrophyte structure and phytosociology by C. Den Hartog and G. van der Velde, by E. P. H. Best, and by G. Wiegleb, and two chapters written from an ecosystem perspective, one by C. M. Breen *et al.* on the vegetation of swamp and flood plains and the other on the vegetation of running waters by F. H. Dawson.

The remaining three chapters seem out of place. One, a comprehensive case study of fenns in Holland by J. T. A. Verhoeven *et al.*, consisting largely of previously unpublished data that should have first appeared in the primary literature, is the only chapter that is not a review. The other two are largely or totally on algae but are not sufficient to give the microphytes their due in the book. The first, by J. M. Melack on aquatic plants in extreme environments, is well written and does touch on macrophytes in saline lakes. The other, by J. J. Symoens *et al.* on algal communities, focuses on the