# BOOK REVIEWS

## Engines of Biodiversity

**Plants in Changing Environments.** Linking Physiological, Population, and Community Ecology. F. A. BAZZAZ. Cambridge University Press, New York, 1996. x, 320 pp., illus. $75 or £55, ISBN 0-521-39190-3; paper, $29.95 or £19.95, ISBN 0-521-39843-6.

*Ambrosia* versus *Abutilon*. *Erigeron* versus *Solidago*. *Polygonum* versus *Setaria*. Which plants will win in competition, and how will plant communities express the victories and losses? When Kasparov faces Deep Blue, each brings to the chessboard a vast archive of strategies, deceptions, and techniques for dealing with novel situations. But are the stratagems of the grand master more intricate or multidimensional than the interactions between the plants of abandoned agricultural fields? In *Plants in Changing Environments* Fakhri A. Bazzaz explores the nature of plant-plant interactions, documenting a richness that could be the envy of a grand master.

Succession, the sequence of changes in an ecosystem following disturbance, is one of the oldest and most discussed topics in plant ecology. From early debates, which often focused on the relative importance of individual species versus emergent properties of whole ecosystems, to recent models on the requirements for species coexistence, succession has integrated many of the big questions in plant ecology. Now, increases in disturbances generated by humans place a new priority on understanding the consequences and mechanisms of succession. Whether disturbance is generated by a natural process, like a fire or a hurricane, or by an anthropogenic process, like deforestation, nutrient deposition, or climate change, succession following disturbance is characterized by a number of common themes, including features of the plants that are most successful at different stages.

*Plants in Changing Environments* explores common themes, as well as irregularities, in plant succession, drawing especially on results of multidisciplinary studies by Bazzaz and his colleagues over the past 20 years. By focusing on a few well-studied examples, Bazzaz is able to link observations across fields and evaluate the relative roles of dramatically different processes, such as seed germination requirements, biomass allocation, and photosynthetic responses, in controlling ecological success. The examples from studies by the Bazzaz group on abandoned fields in Illinois, mixed deciduous forest in Massachusetts, and tropical rainforest in Mexico and Southeast Asia span a broad range of ecosystems and patterns of succession. They also represent a very substantial fraction of the multidisciplinary studies on plant succession. Bazzaz and his students were early advocates of the idea of linking studies on physiological controls on ecological responses, genetic variation within populations, and consequences of these for the composition of the plant community. Their dedication to this multidisciplinary approach and their persistence in applying it to a small number of ecological settings have resulted in a truly unique body of information.

The book is organized around understanding the process of plant succession, but succession is the framework for an even more important discussion. At its core, *Plants in Changing Environments* is about the natural mechanisms that regulate biodiversity. Bazzaz details a fantastic diversity of ecological responses that allow different species to compete effectively for the resources they need to grow and reproduce. In most successions, any of a number of species can be dominants at some stage, and the regulators of success are often very different among species. In some cases, the date of disturbance, because it implies temperature during the season of seed germination, is the critical controller on relative dominance. In others, it is the level of drought, or high light, or time of the day at which plants are exposed to sunflecks. Some species recruit individuals for specialized habitats from populations with a large diversity of genotypes, while others achieve comparable flexibility with fewer, more variable genotypes.

*Plants in Changing Environments* does not develop a comprehensive model for predicting the trajectory of plant succession, though it makes a number of generalizations, including some that are quite strong. The book's central message, cemented with a plethora of examples, is that the mechanisms that control ecological success are diverse, complex, and multidimensional. Interactions among individuals and interactions between individuals and the environment have the richness and power to be engines maintaining biodiversity, if human actions allow the persistence of the species and genotypes that are the key players. *Plants in Changing Environments* is a window into the way those engines work.

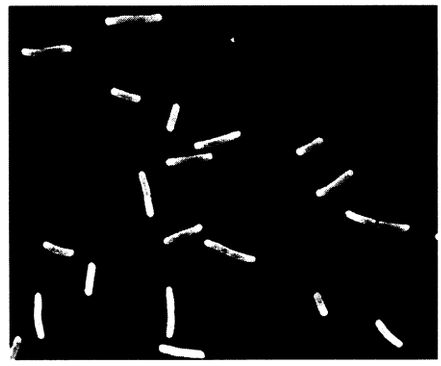
***Christopher Field***
*Carnegie Institution of Washington, Stanford, CA 94305, USA*

■

## Microbial Invention

**Regulation of Gene Expression in *Escherichia coli*.** E. C. C. LIN and A. SIMON LYNCH, Eds. Chapman and Hall, New York, and Landes, Austin, TX, 1996. xvi, 592 pp., illus. $99.95 or £59. ISBN 0-412-10291-9.

Did *Escherichia coli* invent gene regulation? The casual browser might come to that conclusion from the prevalence of *E. coli* gene regulation in the biological literature of the past 50 years. The hyperbole in the question should not obscure the fact that an affirmative answer is closer to the mark than if the question were to be asked about any plant or animal, for *E. coli* is closer to the pre-prokaryotes in which gene regulatory mechanisms first developed in rich abundance. There are more proximate reasons, however, for the preoccupation of bacteriologists with gene regulation. The bacterial growth strategy involves rapid adjustments in the rate of expression of individual genes in response to second-by-second sensing of the environment. Other means of controlling cellular functions are used and are important, but it is the short half-life of their messenger RNA molecules and the physical linking of translation and transcription that enable modulation of gene function to be such a prominent fea-



*Escherichia coli*. [Courtesy of James T. Park]