

/BOOK REVIEW

An Ecological Look at GMOs

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As the editors of *Release of Genetically Engineered & Other Micro-organisms*, Martin Day and John Fry aim to give their readers a greater understanding of the ecological basis surrounding the release of micro-organisms into the environment. The strength of this multiauthored book lies in its ecological perspective.

Early chapters describe some current uses for nongenetically modified microorganisms in agriculture and the environment, while the middle portions of the book focus on the potential for gene transfer in the environment. It concludes with an in-depth discussion of several environmental releases of genetically modified organisms (GMOs).

The chapters discussing the use of nongenetically modified organisms in agriculture and in the environment remind us that the development of a regulatory framework might fruitfully draw on experiences gained from the release of nonmodified bacteria. Gerard Catroux and Noelle Amarger, for example, describe how in many countries farmers have successfully inoculated crops for almost a century to increase nitrogen fixation.

Gene transfer is considered in great detail, with chapters on conjugation, transduction, and transformation. These in-depth reviews may at times prove difficult to understand for readers not trained in biology, but do successfully illustrate the biological complexity of gene transfer in the environment. In addition, these chapters apprise the reader of gaps in our knowledge. One theme running throughout the book is that of the need for additional studies *in situ*. This theme is reiterated by the editors, who argue that more ecological studies should be undertaken to complement molecular biological research, warning that without such research the fruits of molecular biology will not be fully realized.

Some emphasis is given to how research on the release of GMOs may help explain how environmental factors influence gene transfer. In a chapter discussing the potential uses of lethal genes for biological containment, Stephen Cuskey suggests that lethal bacterial genes may be useful markers for measuring gene transfer; David Bishop et al. describe how a genetically marked virus can be moni-

tored in the environment.

The chapter by David Bishop et al. and the one by David Drahos et al. are interesting to compare, as both sets of authors chronicle early releases of GMOs. Bishop and his coauthors draw on their involvement in field releases, beginning with the 1986-1987 release of a genetically modified virus in the U.K., while Drahos et al. detail their experiences with U.S. field trials of genetically modified bacteria, which began in 1987. Both groups describe positive and efficient interactions with regulatory authorities and other interested parties. These positive experiences contrast sharply with the delays and problems that occurred prior to the release of genetically modified *Pseudomonas* by Advanced Genetics Sciences and Steven Lindow, leaving the reader to wonder whether Bishop's and Drahos' positive experiences were actually representative of other releases in the U.S. and Europe.

The Bishop and Drahos releases illustrate the importance of a stepwise approach to the release procedure. Both research groups established successful track records before releasing organisms with commercial potential. The establishment of such a record and the ongoing collection of ecological data by these groups may have resulted in increased confidence among both regulators and the general public. Drahos et al. note, however, that the collection of ecological data is costly and time-consuming.

The chapter by Gerard Catroux and Noelle Amarger allows the work of Drahos et al. to be placed in a larger context. Catroux and Amarger survey some of the current agricultural uses of *Rhizobia* as soil inoculants, describing how the widespread establishment of many types of soil bacteria appears not to have caused any environmental problems. They conclude that, as species such as *B. Japonicum* may remain in the field for many years after introduction, there is a need to determine whether a GMO will become established. Although the chapters by Catroux and Amarger and Drahos et al. are complimentary, information on the field releases of other genetically modified soil bacteria would have been helpful. For example, it would have been interesting to be able to compare Catroux and Amarger's review of releases of naturally occurring *Rhizobia meliloti* with a discussion of Biotechnica International's releases of genetically modified *Rhizobia meliloti*.

Taken as a whole, *Release of Genetically Engineered & Other Micro-organisms* is a good resource for researchers working in this area, but the absence of a general bibliography will limit its usefulness to the general reader, and as such it is not really suitable for those who are new to the issues raised by the environmental release of GMOs. ///

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