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Book Review: GENETICALLY ENGINEERED ORGANISMS: BENEFITS AND RISKS

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GENETICALLY ENGINEERED ORGANISMS: BENEFITS AND RISKS.

By J. R. S. Fincham and J. R. Ravetz. Published in cooperation with the Council for Science and Society by University of Toronto Press, Toronto and Buffalo (New York). $50.00 (hardcover); $15.95 (paper). xiii + 158 p.; ill.; index. ISBN: 0-8020-5918-X (hc); 0-8020-6863-4 (pb). 1990.

In the continuing debate on the introduction into the environment of genetically modified organisms, particularly those modified by recombinant DNA, there are few books suitably written for poli-

cymakers, the lay public and scientists in other fields. This book describes the current state of the science and art of genetic engineering, potential uses (particularly outside the laboratory), and the benefits that can be expected. It is particularly pertinent for examining potential risk and management of risk from the perspective of the United Kingdom.

The strength of the book is in its discussion of scientific aspects of genetic manipulation. The science is presented with excellent and appropriate background material. Generally appropriate analogies are used to show that much of what is being done and is expected to be done is an extension of scientific and commercial practices with which we are familiar. In the scientific chapters (Chapters 2–8), the authors are circumspect in pointing out that potential hazards remain hypothetical and speculative. In otherwise accurate representations, there are two notable errors. One is in Figure 2.3, which shows RNA polymerase tracking along double-stranded RNA, instead of DNA. A more serious error is the incorrect description (in Chapter 5) of the most promising plant virus for use as a vector as having RNA as its infective particles and as a retrovirus. Cauliflower mosaic virus has DNA in its infective particles and its genome is replicated by way of an RNA intermediate. It is an example of a pararetrovirus, in which RNA copies of the viral genomic DNA are copied back into infectious DNA by a virally encoded reverse transcriptase. There are minor typographical errors elsewhere.

In discussing science policy, risk assessment, and managing the uncertainties of risk assessment (Chapters 1, 9 and 10), there is, surprisingly, some unwarranted absolutist statements and inappropriate analogies, some of which are contradicted in different chapters. Discussion of categories of risk, by and large, is missing from the policy chapters. That is, all genetically engineered manipulations are considered to be of equal concern. Of the "five problems of deliberate release" (Chapter 1), it is not pointed out that none of these are unique to biotechnology. Yet the authors (Chapter 2) point out that not only have there been no documented examples of harm through gene cloning, but that what matters are the demonstrable consequences or performance of the cloned material, not the method by which it was derived.

There is a general concern, almost to the point of microphobia, about the use of microorganisms in the environment. For example, the authors recommend designing organisms to not only do their job, but also to limit their survival. They do not acknowledge the desirability or need, on occasion, to have relatively persistent useful microorganisms, e.g., for biological control of pathogens or pests. Microphobia is further indicated by a statement that "a microorganism is effectively out of sight and out of control from the moment it is inoculated into an agricultural field" (p. 43). Such a statement would surprise applied scientists such as plant breeders and pathologists. The book is particularly weak in acknowledging the success, not simply the failures, of applied sciences in the environment. Further, while excellent discussion is given of the means of genetic transfer in multiple organisms, there is not a single statement that alludes to the inherent stability of genetic material, including that of microorganisms.

In the chapter on risk assessment (p. 121), the authors assert that our experience in coping with genetically manipulated robust organisms on a large scale is limited. Is over a century of worldwide experimental and scientific breeding and commercial production of genetically modified microorganisms, plants and animals "limited"? Further, it is categorically stated that only laboratory experiments can be precise, controlled or subject to hypothesis testing (p. 130). This would be challenged by those scientists who work in the environment. These statements illustrate the continuing difficulty of scientists from different disciplines communicating and understanding one another's approaches and results. Precautions with genetically modified and nonmodified organisms are appropriate in assessing unknown and/or unpredictable consequences. The authors acknowledge that the "discussion of the risks of genetic engineering has been too much dominated by an over-dramatic view, verging at times on the apocalyptic" (pp. 125–126).

It is disappointing that there are no illustrative standards of practice given for the normal introductions of plants and animals. For example, the experimental origin of the bread on the breakfast table would be surprising to many, including quite a few in the scientific community.

Regulation is presented in both a generic and a legal sense. The authors point to the successful use in research and industry of a body of rules and procedures, some of which have been codified. Potential levels of oversight, appropriate to categorization of risk, are not mentioned. In the United States, for example, categorization of risk is acknowledged in laboratory experiments by decentralization of oversight for low-risk experiments that were decided upon by both scientists and the public; comparable decentralization for experiments in the environment have not been forthcoming to date.

In the last chapter, on managing the uncertainties of risk assessment, a need for balance is recognized, "in which scientific uncertainties are managed by prudence and tact, and in which the

differing perceptions of the different parties," including the public, "are recognized and respected" (p. 131). The statement, however, that "there can be none of the certainties" with introduction into the environment "that have traditionally been associated with scientific knowledge as it has been taught and popularized" (p. 132) is contradicted by examples and discussion of recognition of the differing levels of potential risks in other chapters.

The book has a very useful glossary of terms that is clear and precise. There is also a helpful index, and references are given at the end of all chapters, save one. Since the book is useful for showing the spectrum of thinking within the scientific establishment of the United Kingdom, it deserves the attention of scientists, the public and policymakers.

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