

IMPROVING NATURE?: THE SCIENCE AND ETHICS OF GENETIC ENGINEERING

By Michael Reiss¹ & Roger Straughan.²
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Pp. 288. \$24.95 (hard).

Improving Nature? is guided by a simple set of premises — that the science of genetic engineering is essential to discussing its ethics and, moreover, that a coherent set of ethical principles cannot be developed solely from scientific comprehension. This stance is sensible, if not self-evident, in the examination of any new technology.³ The authors, Michael Reiss, a biologist at Cambridge University, and Roger Straughan, a moral philosopher at the University of Reading, would seem an apropos pair to tackle genetic engineering⁴ from this integrated science and ethics approach. But while each contributes heartily to introducing the science of genetic engineering and philosophical ethics as separate topics, their resulting application of this hybrid method is generally too cursory to be useful.

I. INTRODUCING THE SCIENCE AND ETHICS

The first forty pages of *Improving Nature?* present an admirable introduction to the history and science of genetic engineering, accessible to anyone passingly familiar with biology. The authors highlight the unique features and possibilities of genetic engineering in order to lay a suitable foundation for discussing its novel ethical consequences. Although many public relations-types, scientists, and government

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2. Roger Straughan is a moral philosopher and Reader in Education at the University of Reading. He has also acted as ethical advisor to the European Union.

3. For example, in analyzing how to govern the deployment of a nuclear bomb, a society would not wish to rely just on the scientists who built it. On the other hand, the ultimate decision-makers would surely go awry without a suitable technical understanding of how the device works and what exactly it does.

4. Many writers employ the term "recombinant DNA technology" when discussing issues of genetic engineering, possibly as a more "marketable" term for this type of biotechnology. However, the authors recognize that recombinant DNA technology is technically a subset of genetic engineering, which is roughly defined as "any change to the genetic make-up of an organism resulting from the direct insertion of genetic material either from another organism or constructed in the laboratory" (p. 2 n.1).

agencies have stated that genetic engineering is essentially an amplification of more traditional forms of biotechnology, such as breeding,⁵ the authors begin the introduction by noting several key differences. Genetic engineering may involve all manner of species, whereas those utilized in traditional cross-breeding are typically closely related.⁶ The time scale for observing significant effects in genetic engineering processes is several weeks compared to several or many years under traditional techniques. In addition, genetic engineering is "far more ambitious," and may be applied not only to food and drink, but also to pollution control, drug production, plants and animals that produce human compounds, such as insulin, and sewage control (p. 5).

The authors follow with a detailed introduction to genetics and the nature of the DNA helix as a code, and finally discuss the basic principles of genetic engineering (pp. 11-41). Considering that many ethical discussions of biotechnology rarely refer to the basic science involved, the lucid presentation in *Improving Nature?* sets it apart from the many works which jump into the thick of bioethics from the start, often with an obvious agenda, as well as those works that, unfortunately, fail to delve into the science at all.⁷

In the next major section, the authors present an introduction to morals, ethics, and theology that covers approximately the same number of pages as the scientific introduction but is generally less informative and less relevant (pp. 43-89). For example, discussion of the philosophical distinction between ethics and morals is not necessary for an introductory work. On the other hand, some important ethical considerations are explicated, such as the difference between intrinsic (inherent) wrongs and extrinsic (consequential) wrongs (p. 49). The discussion

5. See, e.g., *Gene Cuisine Scientists Are Working Hard On Specially Engineered Food*, ST. LOUIS DISPATCH, May 27, 1992, at 1C ("FDA Commissioner David A. Kessler said agricultural scientists have used methods of crossbreeding and genetic manipulation for centuries to produce new foods, like hybrid corn or tangelos. Genetic engineering techniques, he said, are a more precise way of doing the same thing."); Sally Lehrman, *Rifkin Enlists San Francisco Chefs in National Biotech Food Fight*, BIOTECH. NEWSWATCH, Sept. 21, 1992, available in Westlaw, TECNEWS File ("Dr. Christine Bruh, food marketing specialist at the University of California, Davis, said that genetic engineering is the same as the traditional plant breeding that has resulted in crops like hybrid corn.").

6. A controversial example of cross-species engineering involves the creation of frost-resistant properties in tomatoes by the insertion of appropriate genes found in fish. See Molly O'Neill, *Geneticists' Latest Discovery: Public Fear of 'Frankenfood'*, N.Y. TIMES, June 28, 1992, at A1.

7. For other works with useful scientific introductions to genetic engineering, see ENZO RUSSO & DAVID COVE, *GENETIC ENGINEERING: DREAMS AND NIGHTMARES* (1995); SUSAN ALDRIDGE, *THE THREAD OF LIFE: THE STORY OF GENES AND GENETIC ENGINEERING* (1996); G.J.V. NOSSAL, *RESHAPING LIFE: KEY ISSUES IN GENETIC ENGINEERING* (2d ed. 1989).

surrounding the possible intrinsic problems of genetic engineering drives to the heart of such oft-repeated debates as the natural versus non-natural, ecological holism versus materialistic reductionism, and the religious versus secular. Reiss and Straughan examine the deeper arguments behind general theological sentiments (pp. 70-89), such as genetic engineering is wrong simply because it is unnatural or against God's will, and conclude that it is ethically problematic "to maintain fundamental theological objections to . . . genetic engineering *per se*" (p. 89). In a detailed section on theology, they discuss issues such as natural law and the stewardship mentality that humans "can exploit the whole rest of the created order for their own ends" (p. 81). This section, like the general ethical introduction as a whole, fails to tie the loose ends together. The ethical discussion functions as a compendium rather than as a coherent relation of specific ethical issues to genetic engineering. Although the authors warn that their work is intended to provide questions and not answers, without a more focused engagement of the scientific and ethical components, the lay reader is unlikely to make any well-formed opinions by the end of the book.

II. MICROORGANISMS, PLANTS, ANIMALS, AND HUMANS

The second half of *Improving Nature?* attempts to apply the basic scientific and ethical material presented in the first half to the genetic engineering of microorganisms, plants, animals, and humans, each in a successive chapter. This organization is based on the theory that the ethical problems become thornier as one considers more complex organisms.⁸

Microorganisms are probably the most frequent subjects of genetic engineering due to generally lower costs. Well-known genetically engineered microorganisms, or products derived from them, include human growth hormone, human insulin, rennet (an enzyme present in most cheeses), and bovine somatotrophin ("rBST"). The authors attempt to cover the basics of each of these technologies and the ethical and scientific concerns related to them, but the coverage is generally too brief to enable the reader to make any sound conclusions. For example, the

8. This sentiment tends to be borne out in public surveys, especially in the context of cross-species transfers. For example in a national poll conducted by academics in conjunction with the USDA, 34% of respondents did not support, or found unacceptable, plant-to-plant gene transfer; 61%, animal-to-animal; 75%, animal-to-plant; 80%, virus-to-plant; and 90%, human-to-animal. See *Biotechnology Study Shows Consumers Concerned About 'Ethical Implications' of Technology*, BNA DAILY REP. FOR EXECUTIVES, Dec. 4, 1992, available in LEXIS, News Library, DREXEC File. This may, of course, merely reflect an anthropocentric approach to the issue.

section on rBST packs a host of issues into only five pages, including health risks to cows and humans, the controversy over natural and artificial food products, and economic consequences, such as the possibility of putting small family farmers out of business (pp. 106-10). In order to decide whether there are any extrinsic problems with these technologies, an enormous amount of information is necessary. Unfortunately, the authors fail to do a thorough job of presenting the often-conflicting information available on these topics.⁹ Although the footnotes and documentation are extensive, the authors should have more fully developed these vigorous debates in order to demonstrate the numerous difficulties in reaching ethical conclusions with regard to genetic engineering. Brief discussions, unsatisfying to the discriminating reader, are typical of the remainder of the book.

The section on the genetic engineering of plants covers important issues including ecological risks, economic consequences, and patenting (pp. 131-64). The discussion on patents is especially weak, exemplified by the authors' conclusion that "the logic behind moral indignation about 'owning life-forms' seems far from clear in view of the fact that we happily talk about owning cats and dogs and orchids and orchards without arousing moral outrage" (p. 160). Reiss and Straughan miss an important distinction here, namely that ownership of a patent on a "life-form" is not ownership of a single thing, but rather control over a technological innovation as applied to *all* relevant organisms.¹⁰ This raises difficult issues that the authors do not address. For instance, the Council for Responsible Genetics, a non-profit organization representing scientists, bioethicists, and religious leaders, criticizes plant patents from a variety of perspectives:

9. For example, the authors make a brief mention of a controversial study indicating some possibility of increased breast cancer in women who drink milk from "rBST-cows" due to possibly increased insulin growth factor-1 in the milk (p. 108), but fail to reconcile this assertion with contentions by the FDA "that rBST has no appreciable effect on the composition of milk produced by treated cows, and that there are no human safety or health concerns associated with food products derived from cows treated with rBST." *International Dairy Foods Ass'n v. Amestoy*, 898 F. Supp. 246, 248 (D. Vt. 1995), *rev'd* 92 F.3d 67 (2d Cir. 1996) (voiding a Vermont statute requiring that milk derived from rBST be specially labeled on the basis that the labeling caused irreparable harm to manufacturers and that strong consumer concern alone was not a substantial state interest justifying restrictions on commercial speech). Additionally, the authors provide no documentation for their claim that rBST increases milk production "by some 20%" (p. 107). In fact, recent reports indicate that Monsanto, the manufacturer of rBST, overestimated production gains. See Robert Steyer, *Backers and Critics Both Wrong on BST: Small Number of Farmers are Using the Product*, ST. LOUIS POST-DISPATCH, Aug. 11, 1996, at E1.

10. Compare GARY L. FRANCIONE, *ANIMALS, PROPERTY, AND THE LAW* (1995) (critiquing ownership of animals regardless of whether they are genetically engineered) with *Diamond v. Chakrabarty*, 447 U.S. 303 (1980) (holding in a 5-4 decision that a live, human-made microorganism may be patentable).

Patenting plant life will also intensify the inequality between the developing and industrialized nations. . . . The developing world has never received compensation or recognition for these intellectual and technological contributions. Patenting plant life will exacerbate this inequality. . . . This "biocolonialism" will continue the pattern of a few transnational corporations profiting at the expense of large numbers of indigenous farmers.¹¹

The contribution of genetic engineering to this ostensible biopiracy and its ethical implications is an interesting and difficult issue, though casually dismissed in *Improving Nature?* (p. 160).

Despite a continued lack of documentation and in-depth analysis, the final sections on the genetic engineering of animals and humans raise many interesting issues and are generally well presented. The authors insightfully contrast animal welfare and animal rights perspectives. The welfarists argue that animals deserve to be spared as much suffering as possible, but that these decisions should be balanced against the ends and interests of humans. The more radical animal rights approach posits that animals should enjoy many of the same sorts of deontological rights as humans, such as the right not to be traded, experimented upon, or killed.¹² Which perspective one holds is enormously important to how one views genetic engineering of animals, and the authors succinctly explore the possible consequences of both arguments.¹³

11. Council for Responsible Genetics, *No Patents on Life!: DNA Patents Create Corporate Monopolies on Living Organisms* (visited May 1, 1997) <<http://essential.org:80/crg/crg3.html>>.

12. See, e.g., FRANCIONE, *supra* note 10.

13. For the welfarists, hormones like rBST, which can cause increased mastitis infections in cows, translate into a more painful life for the animal. "Common sense, the scientific literature and the courts have all concluded that . . . animals suffer as a result of genetic engineering" (p. 178). Even manufacturers admit that the use of rBST results in "increased incidence of mastitis, cystic ovaries, disorders of the uterus, retained placentas and other health problems, including indigestion, bloat, diarrhea, and lesions of the knees" (p. 108). "[T]he cow . . . becomes so swollen and engorged so often that she must be milked every two hours. . . . [A]nother problem is mastitis. . . . The disease is characterized by the formation of cysts. Symptoms include pain, tenderness, swelling and there may be a cloudy liquid discharge from the nipple." Trisha Flynn, *Mother Knows Best: Leave Milk to the Cows and the Consumers, Please.*, ROCKY MOUNTAIN NEWS, Apr. 17, 1994, at 4M. Even though mastitis can often be treated with antibiotics, the amount cows can intake is regulated, since antibiotic residues appear in the milk. See *id.* The animal rights advocates, on the other hand, merely perceive genetic engineering as a further entrenchment into the autonomous realm of the individual animal, exemplifying the view that animals are merely things and entities to be manipulated like machines (pp. 183-84).

Although welfarists traditionally conclude that it is ethical to eat animals, the authors

The recent cloning of a sheep in Scotland unnervingly raises the specter of cloning humans.¹⁴ Reiss and Straughan sensibly split the ethical debate into three key subjects: the patenting of human genes (pp. 200-01); somatic gene therapy, which will not affect an offspring's genome (pp. 202-16); and germ-line therapy, which may affect an offspring's genomes (pp. 216-22).

Although germ-line therapy may at first glance seem to raise the most critical ethical questions, the authors perceptively detail difficult issues in all of these areas. For example, intense debate surrounds Myriad Genetics's patenting of BRCA1, the human gene responsible for almost one-half of inherited cases of breast cancer (p. 200). Proponents of patenting assert that it is essential to providing incentives for scientific research, while critics counter by alleging the degrading and "blasphemous" effects of patenting life (p. 201).¹⁵

Somatic-gene therapy generally covers medical procedures designed to alter the genetic make-up of cells to inhibit disease, but also includes the possible engineering of human traits such as intelligence, beauty, and even sexual preference (p. 211). The authors caution against the use of genetic engineering to enhance traits (p. 223), but one wonders if the pressures of the marketplace, especially the black market, will eventually win out.

Finally, Reiss and Straughan make an even greater exhortation against the non-medical use of germ-line therapy, which may include engineering one's reproductive cells to alter traits such as intelligence and strength in one's offspring, and call for its ban until much more research has been carried out (pp. 218-23).

note a variety of reasons why eating genetically engineered animals might warrant a different result (pp. 185-90), particularly from religious and health perspectives. A leading consumer group in this area is the Pure Food Campaign led by Jeremy Rifkin. This campaign has organized a grass-roots effort to inform consumers of what it considers to be the myriad dangers of genetically engineered foods. See James Ridgeway, *Robocow: How Tomorrow's Farming Is Poisoning Today's Milk*, THE VILLAGE VOICE, Mar. 14, 1995, at 27; The Pure Food Campaign Homepage (last modified May 1, 1997) <<http://www.geocities.com/Athens/1527>>.

14. For an in-depth overview of the story and science behind the cloning of "Dolly," see Michael Specter & Gina Kolata, *After Decades and Many Misteps, Cloning Success*, N.Y. TIMES, Mar. 3, 1997, at A1.

15. See generally Phyllida Brown & Kurt Kleiner, *Patent Row Splits Breast Cancer Researchers*, NEW SCIENTIST, Sept. 24, 1994, at 4.

III. THE NEED FOR EDUCATION

Improving Nature? does not specifically address the issue of cloning. However, the recent media hoopla surrounding that paramount issue ties nicely into the final point of the work, namely that educating the public about the science and ethics of genetic engineering from a broad, level-headed, and reasoned perspective is crucial to utilizing biotechnology in an appropriate manner (pp. 228-44). Cloning oneself, perhaps so as to be more amicable and quick-witted, will eventually become a very real issue in the public arena. A lack of scientific knowledge and ethical understanding on the part of the public will only work to unleash a Pandora's box of genetic engineering's worst nightmares. This may result in a backlash, ultimately discouraging research important to the well-being of humankind, animals, and the environment.

Even though *Improving Nature?* never quite answers the question in its title, it generally provides a sound starting point for enlightened debate and focuses attention on the many complex ethical issues that genetic engineering raises.

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