

THE CONCEPT OF NATURAL: IMPLICATIONS FOR BIOTECHNOLOGY REGULATION

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The General Synod Board for Social Responsibility of the Church of England (1999) issued a report entitled Genetically Modified Organisms: A Briefing Paper. In this report, that is cautiously favorable towards biotechnology,¹ the Synod Board states that enormous concern exists at the prospect of genetically modifying organisms arising from a sense that genetically modified foods are radically unnatural.² In this paper, I will explore this concern that the genetic modification of organisms is unnatural as a reflection of competing concepts about the natural world. As I undertake this exploration, I acknowledge that the concept of the natural is immensely complex and that my comments barely grapple with the complexities. Despite these limitations, the concept of the natural discerning the boundary between the natural and the unnatural appears to be central to the debate about biotechnology.³

Competing Concepts About The Natural World

The Mother Nature or Gaia World View

From the reading, listening, and talking about biotechnology that I have done over the past five years, a recurring theme among many who oppose biotechnology is that the natural world is a stable, orderly, peaceful world best described as Mother Nature or Gaia. Mother Nature is described as a loving mother who cares for her land forms, water bodies, bacteria, plants, and animals. Mother Nature nurtures these offspring as best she can to protect them from extinction and pollution. Mother Nature intends no harm and ordinarily does no harm to her offspring. Gaia is a self-regulating living organism (the planet Earth) that provides each ecosystem according to its physical needs. Gaia breathes in and breathes out in an intricate, inter-twined harmony that supports life to the fullest potential diversity. Gaia allows for the flowering and development of life always in harmony and mutual reciprocity.

In this view of the natural, human beings should strive first, foremost, and maybe only to live in balance with, in harmony with, and in rhythm with nature. Any human activity that is not in balance with, in harmony with, in rhythm with nature is unnatural. By their numbers, intelligence, and

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science, human beings too frequently exceed the natural balance, harmony, and rhythm of the natural world. Rather than co-existing with nature, human beings too often strive to create an artificial world made in their own image rather than reflecting the image of nature.

More specifically regarding biotechnology, many who believe in Mother Nature or Gaia also believe that human arrogance is at the root of biotechnology and that biotechnology is the final attempt to manipulate the natural world into a human-created world. As expressed by many who oppose biotechnology, biotechnology is playing God B the ultimate idolatry and the first sin (Nuffield Council on Bioethics, 1999, Append. 4, Pts. 3 & 5).

Less philosophically and more professionally, many environmentalists who support the Mother Nature or Gaia view of the natural world consider themselves deep ecologists seeking the balance, harmony, and rhythm of habitats, watersheds, ecosystems, organisms, and other natural systems. For them as believers in Mother Nature or Gaia, deep ecology is the paradigmatic science of the future whether expressed in biology, medicine, meteorology, immunology, or any other scientific endeavor.⁴

The Naturalist World View

Over these same past five years, it appears that a recurring theme among many who favor biotechnology is that the natural world is a world of constant change that has no stable balance, harmony, or rhythm. To many who favor biotechnology, the natural world is not described metaphorically as Mother Nature or Gaia. The natural world is an amoral -- please note that I did not say immoral -- world that does not exhibit care or concern for any existing thing whether inanimate or animate, living or dead. For naturalists, nature does not know; nature does not feel; nature does not have consciousness. While for naturalists, nature gives rise to wonder and awe and is beautiful and bountiful, the natural world also produces natural occurrences and natural disasters, such as famine and disease. The natural world is not a pristine world that must be left untouched. Rather, the natural world is a place of exploration in order to learn more fully the laws of nature -- cycles, causes, effects. Nature simply is nature.

In this second view of the natural world, human beings using their intelligence and their skills are part of nature. Human activities may cause harm to nature but human activities might also prevent and alleviate natural disasters. Human beings affect the natural world simply by existing but, with proper stewardship and proper ethics, human beings can improve welfare, achieve rights, and do good. As a consequence, quoting the Nuffield Council on Bioethics (1999, Pt. 1.40), The "natural/unnatural" distinction is one of which few practicing scientists can make much sense. Whatever occurs, whether in a field or a test tube, occurs as the result of natural processes, and can, in principle, be explained in terms of natural science.

More specifically regarding biotechnology, those who adopt this naturalist view of nature believe that biotechnology is an extension of scientific principles that are well established and long-used in pharmacy, medicine, chemistry, biology, environmental science, and agriculture. Moreover, the scientific principles of biotechnology are different in technique, but not different in kind, from genetic techniques that human beings have used for thousands of years to create the bacteria, crops, and animals that produce the foods, fibers, medicines, and household or commercial products used in every culture in the world. In response to those who fear that biotechnology is playing God, the naturalists might respond that biotechnology does nothing more than use the Creator's gift of intelligence to humankind -- as the Creator intended (Nuffield Council on Bioethics, 1999, Pts.1.37 & 1.38).⁵

Less philosophically and more professionally, many who believe in the naturalist view think that the twenty-first century will be the century of biology. For them, the future paradigmatic sciences will be

molecular biology and genetics whether expressed in pharmacy, medicine, environmental science, industrial production, agriculture, or any other scientific endeavor.

Policy Implications

While the competition between the two worldviews that I have described has implications for the public acceptance or rejection of biotechnology, these two views also have practical implications for governmental policies. Laws and regulations that reflect the Mother Nature or Gaia world view would be significantly different from laws and regulations that reflect the naturalist view of nature. I will discuss briefly an area in which such significant differences may be obvious.

Bacillus thuringiensis (Bt) is a widely-occurring bacterium in the soil. *Bacillus thuringiensis* has pesticidal properties against many insects. As a consequence of these pesticidal properties, the Environmental Protection Agency (EPA) regulates the manufacture and sale of Bt as a pesticide in microbial natural products (Bt sprays) and in genetically modified plants (e.g., Bt corn) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA) (EPA, 1986).

As a pesticide, Bt -- like almost all other pesticides -- will give rise to insect resistance (Tabashnik *et al.*, 1990; Tang *et al.*, 1997). As a pesticide is used, insects that have a resistance to the pesticide survive at greater rates than insects of the same species that do not possess resistance. Over time, the resistant genotypes of insects becomes the dominant population in numbers. Thus, at some number of generations, the insect population has become resistant to the pesticide. The pesticide becomes ineffective.

With respect to genetically modified crops, the EPA has specifically considered the issue of insect resistance as an issue for regulatory review as the EPA decides whether to grant a registration of the plant for sale as a plant-pesticide (EPA/USDA, 1999). More recently, to manage pest resistance, the EPA on January 14, 2000 announced a refuge policy that requires growers of Bt corn to grow 20% or more corn acres as non-Bt corn. By having refuges of non-Bt corn, the strategy is for any insects that survive the dosage in the Bt corn to mate with non-affected insects in the non-Bt corn to prevent the resistance from spreading in the insect population. Moreover, the EPA will also require that the sale of Bt corn be halted at the first sign of insect resistance (BNA, 2000; Weiss, 2000).

With respect to Bt sprays, however, the EPA has never considered pest resistance to be an issue for regulatory review at the time of FIFRA registration of the Bt spray as a pesticide (Anderson & Milewski, 1999).⁶ On searching regulatory announcements and regulations, no call for making pest resistance a regulatory issue for FIFRA registration of microbial Bt sprays could be found. This acceptance of Bt sprays -- created most often through fermentation rather than genetic engineering⁷-- without concern for pest resistance occurs even though the scientific articles cited establish that Bt sprays do create and already have created pest resistance (Tabashnik *et al.*, 1990; Tang *et al.*, 1997).

Furthermore, despite the established fact that pests have become resistant to Bt sprays, there has been no public statement by the EPA (or anybody else for that matter) that Bt sprays must be withdrawn from the market at the first sign of the emergence of pest resistance. Despite ten years of field insect resistance to Bt sprays, Bt sprays continue on the market. Moreover, the EPA demand that Bt corn seed sales cease at the first sign of pest resistance, with no similar demand for Bt sprays, occurs even though a scientific study exists that Bt plants may often provide a pesticide delivery system that better manages pest resistance than pesticide delivered through Bt sprays (Roush, 1994).

What accounts for the regulatory policy of the EPA that treats pest resistance to Bt in crops as a significant issue but does not consider pest resistance to Bt sprays to be an issue at all? While assuredly many influences affect this EPA stance, I suggest that an important factor is the two differing views of the concept of natural. These differing views have impact through two different influences.

One possible influence is the worldview of the EPA regulators themselves. If the EPA regulators share the view of nature as Mother Nature or Gaia, they may consider pest resistance from Bt crops to be unnatural but that pest resistance from Bt sprays is normal in the natural world.

A second possible influence is the worldview of those who pressure EPA. If environmental groups view nature as Mother Nature or Gaia, these environmental groups likely will consider pest resistance from Bt crops as unnatural while remaining relatively unconcerned about the pest resistance caused by Bt sprays. If the EPA feels more akin emotionally to environmental groups or feels more politically influenced by environmental groups, the EPA may endorse the Mother Nature or Gaia view of nature with concomitant consequences for regulatory policy.

Conclusion

The philosophical debate that I have tried to sketch in this commentary is not the only factor affecting the regulation of biopesticides. Differences between Bt-crops and Bt-sprays exist -- among others persistence in the soil, longevity of effective action, and modes of action (living versus killed pesticide) -- and are important considerations for appropriate regulation.

Yet, this underlying philosophical debate about the concept of natural seems to me to be crucial to understanding the debate about biotechnology. Furthermore, the policy implications that I discussed with respect to Bt have similar echos with respect to issues relating to the safety of foods from conventional farming as compared to the safety of foods from organic farming; and with respect to the safety of pharmaceutical products as compared to the safety of dietary supplement products. In each instance, how the product is viewed (as natural or unnatural) significantly affects the regulatory policy applied to the product. Concurrently, how the product is labeled as natural or unnatural depends on the worldview of the concept of natural of the person who is applying the label.

Acknowledgment

This commentary is a revision of a paper presented to the Conservation Technology Information Center (CTIC), Forum on Biotechnology, February 2, 2000, in Colorado Springs, Colorado. The CTIC has its offices in West Lafayette, Indiana. The author thanks those who asked questions at the Forum and who read this paper in manuscript.

Endnotes

¹ For example, the report states, "Wisdom is unlikely to lie either in an unrestricted exploitation or in a total prohibition, but in careful consideration of individual proposals. In this respect, genetic engineering does not seem very different from other forms of scientific advance, Church of England (1999, Point 5. Theological Issues).

² Rene Dubos, a microbiologist, environmentalist, and co-author of the United Nations report Only One Earth, wrote an editorial for the New York Times in 1977 that explained how his hostility to genetic modification as unnatural changed to support because the potential benefits are large and the dangers purely hypothetical. (as cited in Piel & Segerborg, 1990, p. 244).

³ For an excellent discussion of biotechnology generally, read Nuffield Council on Bioethics (1999). Chapter 1 of this book has two subsections that are particularly relevant to this paper, The Natural/Unnatural Boundary and Taboos and Moral Conservatism.

⁴ Deep ecology is my wording but I use this term with the meaning found in the Nuffield Council on Bioethics (1999, Pt. 1.8) report, "'the environment' [is] an object of ethical concern, regardless of how the environment affects the interests of human and other animals. See also Pts. 1.7 & 1.44.

⁵ Purposefully, I do not explore a view of nature that is devoid of ethics and stewardship. Human beings can view nature as nothing more than the domination and degradation of creation and creatures by the powerful and the cunning. I posit that those who believe in Mother Nature or Gaia and those who believe in the naturalistic view of nature are equally people of good will and virtue. However, if my optimism about good will and virtue is unwarranted, for those who desire to view nature as nothing more than the setting within which to dominate and degrade, I see no reason why they would not mask their designs equally well and as often in either view of nature I have described. For those who desire purposefully to seek evil, worldviews are adopted and propagandized simply as means to attain immoral ends (see Shattuck, 1996, chap. VI & chap. VII).

⁶ Dr. Andersen, Director, Biopesticides and Pollution Prevention Division, OPP, EPA stated in a presentation, "Resistance management requirements have only been placed on Bt plant-pesticides (Andersen & Milewski, 1999).

⁷ Bt sprays can be produced by a combined process of fermentation and genetic modification. The first genetically engineered biopesticide to gain EPA/FIFRA registration was a Bt spray. (Gelernter & Schwab, 1993). It is my understanding that organic farmers use this Bt spray. Indeed, it is my understanding that until the advent of biotechnology that Bt sprays were not as effectively nor as widely used in the United States as the present (Chambers, 1999).

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