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Biotechnology's Future Benefits: Prediction or Promise?

Jeffrey Burkhardt
Professor, Agriculture and Naural Resource Ethics and Policy, Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida

Much current research and development (R&D) in agricultural biotechnology is focused on the so-called "next generation" of biotech. There is an assumption that this work is ethically justifiable because the expected outcomes are ethically sound. However, people in the agricultural biotechnology enterprise must prove that the "promise of biotechnology" justifies their efforts.

Key words: agricultural biotechnology, ethics, future benefits, future biotech, promising.

This paper addresses the ethics of the so-called "next generation" of genetically modified organisms—bioengineered nutriceuticals, so-called "functional foods," biofuels, and biomaterials (see Pew Initiative, 2001). Most of the standard ethical concerns about food and environmental safety, and socioeconomic concerns such as corporate power over the food system, will probably apply to what we can call "future biotech." However, in this paper, the focus is on a different kind of concern associated with the ethics of these products—namely, the basic ethical legitimacy of engaging in R&D of future biotech. Is work on future biotech ethically justifiable? People should not assume that it is. Rather, people in the biotechnology establishment will have to accept the ethical responsibility to prove that it is.

Ethical Justification and Science

Ethics seeks justifications for actions—the principles or reasons why we should or should not do certain things or be a certain way. Critical ethical analysis should provide answers to questions such as: Should we genetically engineer foods to produce, for example, health- and nutrition-enhancing traits? Are we ethically justified in doing this? Most important, Why are we ethically justified in this work?

Although there is an ongoing debate among ethicists about the role of virtue, character, community location, and so on, in ethical justification, on a simple level the justification or criticism of actions and/or practices can be described as either *consequentialist or nonconsequentialist.* Nonconsequentialist principles are of two kinds: those that judge actions in terms of their consonance with a predetermined set of duties (*deontological* principles, after *deon*, Greek for "duty"), and those that judge actions in terms of their embodiment or expression of virtuous character traits (*virtue ethics*). Both kinds of nonconsequentialist justifications undertake to show that people have followed (or tried to follow) what ethics demands. When people do their duty or act virtuously, they are justified; when they stray from acting on principle or in accord with moral virtues, they are wrong. In contrast, consequentialist ethical principles assess actions or practices in terms of their outcomes. According this orientation, good outcomes justify an action, bad outcomes condemn it. How *good* and *bad* are defined is, of course, critical. Contemporary ethicists tend to define good in terms of benefits, and bad in terms of costs or risks. As such, consequentialist justifications usually take the form of *utilitarianism*, which is concerned with maximizing benefits or achieving a net benefit (benefits > costs) through actions or polices. (See LaFollette, 2000, for more detailed descriptions of deontological, virtue-based, and consequentialist/utilitarian ethical theory.)

Whether future biotech R&D is ethically justifiable depends on the basis on which it, and science in general, is to be judged. Science is now usually regarded as ethically neutral, at least by scientists. Science generates knowledge which gives rise to technology. Only after the results of scientific practice are in the public arena, and development of its applications is initiated, is information truly available for evaluation. In the West, we tend to judge science by its results or outcomes; despite claims to ethical neutrality, scientists appear to want their work to be judged by its fruits as well (Sorell, 1991). The ethical basis accepted by most practitioners and the general public for judging science is therefore a consequentialist ethical principle: science is justified when its outcomes are justifiable. Of course, many scientists—especially those in basic biological research, physics, and so on—assert that they do what they do simply out of a thirst for knowledge or "calling" to discover truth. While this may be debatable, it should be acknowledged. Moreover, it may be the case that science ought to be judged in other than consequentialist

terms. Nevertheless, science overall is still predominantly justified using utilitarian/consequentialist terms: when science confers benefits (or benefits that outweigh costs or override risks), science is engaged in justifiable practices. This is precisely the point of difficulty.

There is a general consensus among ethical analysts, echoed by many scientists and endorsed by the public, that science generally has performed ethically. Science has produced knowledge and technologies whose benefits are clear and outweigh relevant costs or risks. Certainly science has generated outcomes of a less than clearly beneficial nature, and there are ongoing debates about the ethics of particular kinds of research (e.g., embryonic stem-cell research). Overall, however, science commonly has been seen as successful in an ethical sense. This is significant socially and culturally, because it places the scientific enterprise on an ethical high ground from which scientists and research administrators can defend themselves from critics and command resources and moral support from the public. Polls have shown a general trust among the public for university scientists and medical people. This is because the public believes science to have justified itself through what it has delivered (National Science Foundation, 2001).

For the past several years, researchers engaged in biotechnology have been making a bid for the same ethical justifiability and public credibility. This attempt has met with less public success, in the form of skepticism about the neutrality of the scientists or, more commonly, simple apathy. Indeed, the question is whether the R&D on next-generation agricultural biotechnology can be ethically justified using consequentialist reasoning, given the significant uncertainty about the outcomes. The problem is that we cannot answer the question of benefits and costs, because by definition future biotech products do not yet exist in the real-world context in which we could judge them as beneficial or not. Yet, uncertainty cannot in and of itself justify inaction, for even passivity (or, in this case, the nonadoption of the technology) yields uncertain outcomes.

This points to a justification dilemma for proponents of future biotech R&D. If consequentialist ethics demands actual benefit/risk/cost calculation in order for an action to be justified, and there are not yet any of these products on the market (or in the approval process), then it appears that future biotechnology cannot be ethically justified. Yet, given the clearly positive outcomes intended for these products— "foods for health," independence from fossil fuels, a reinvigorated agricultural economy—biotechnologists, nutritionists, farmers, and many others want to claim that this work is ethically justifiable and even obligatory. One way out of this dilemma is for the case actually to be made that these products will be ethically sound, so that current R&D is also ethically justifiable.

The Future Benefits Argument

The vision and hopes associated with future biotechnology are occasionally framed in terms of slogans proclaiming "the promise of biotechnology." There is a philosophically sophisticated and potentially powerful argument that may give ethical legitimacy to the slogan, which may be called the "Future Benefits Argument" (FBA).

1. Technologies intended to provide benefits in the future are ethically justifiable if they will likely provide benefits that outweigh risks/costs.

2. Agricultural biotechnology will likely provide benefits in the future that outweigh risks/costs.

3. Therefore, current agricultural biotechnology R&D is ethically justifiable (see Burkhardt, 2001).

The agricultural biotechnology FBA, it should be noted here, is a variation on many long-standing theses in the consequentialist ethical tradition. For example, J.S. Mill (1863/1957), the paradigmatic utilitarian, wrote that expected beneficial outcomes are the sole basis for justifying present practices and policies. Henry Sidgwick (1874/1966) spent considerable effort showing the rational defensibility of this type of justification, and twentieth-century ethicists such as Richard Brandt (1979) and R.M. Hare (1981) sought to prove that this kind of argument is most consistent with facts about human moral psychology. "Expected utility" (or "expected benefits") has also played a significant role in decision theory and game-theoretic accounts of rational behavior (see, e.g., Kreps, 1990 and Brenner & Brenner, 1990).

In its current incarnation as the FBA, note that Premise 1 of the argument is the general principle that establishes conditions on ethical acceptability or justifiability, and that it is a utilitarian/consequentialist principle, concerned with the outcomes of (future) actions or (in this case) technology products. This means that ethical justifiability depends on benefits actually being conferred that outweigh risks or costs. It further means that the conclusion—that current research and product development is ethically acceptable—depends on those benefits actually being conferred. The onus is on what Premise 2 actually means. As stated, Premise 2 looks like a prediction—an answer to the "can" and "will" claims usually associated with the next generation of

biotech. Interpreted this way, the question is: What will it take for Premise 2 to come true?

The foremost condition for future biotechnology to become a reality is that scientists must succeed in their individual and collective enterprises. Crops must be transformed so that (for example) health and nutritional properties can be added or enhanced, or allergenic properties eliminated. There will have to be legal and institutional successes as well; for instance, the patent process will have to be successfully negotiated both domestically and internationally. Differences in the cultures of medical, materials, energy, and agricultural research will have to be resolved. Corporations involved in agricultural biotechnology may have to adjust to the realities of dealing with not just one or two federal government agencies, but perhaps regional, state/provincial, or even local bodies such as health departments. The products must be such that their first consumer—the farmer—can easily adopt and grow these crops. Finally, future biotech products ultimately will have to reach and be accepted by the ordinary consumer. This means these products will have to be compatible with consumers' tastes and preferences, lifestyles, and basic values. Most important, these products will have to be available and affordable, or they will fail. In short, genetically modified foods will actually have to be beneficial in order for them to be ethical. Will they be beneficial? Will they succeed at each step in the chain, from the laboratory, through regulatory assessment, through farmers' fields, to the dinner table? We do not know, and I would argue that we cannot know right now. Science, law, agriculture, and economics are all human enterprises, and predictions about human enterprises (except under a set of tightly controlled assumptions) are notoriously unreliable (see MacIntyre, 1984). The complexities involved in each step outlined above, as well as unintended outcomes of even well-intended actions, suggest that there can be no guarantees when it comes to the success—scientific, economic, ethical, and so on—of not only future biotech, but any technology, practice, or policy. The ethical problem we face, then, is that if we cannot predict that agricultural biotechnology will confer benefits in the future, then however logically sound the FBA might be, it fails as a justification for current research and product development. If we cannot know that biotechnology will confer future benefits, then evoking the FBA as a justification for present actions is at best pointless, at worst an exercise in deception or bad faith. Thompson (2000) has characterized insincere appeals to ethical justifications as "strategic discourse"—more an attempt to derail ethical communication than engage in it. Given uncertainties about future risks or benefits associated with future generations of agricultural biotechnology, the FBA may indeed be an instance of such strategic "communication."

The problem of uncertainty or lack of knowledge about future outcomes is of course not confined to the FBA as it pertains to agricultural biotechnology. Consequentialist writers have long noted an inherent problem in this kind of justification and have attempted to remedy it. The strongest remedy has been to suggest that FBA-type justifications work when expected outcomes are closer in time (Brandt, 1979), or within the range of "common sense expectations" (Hare, 1981; Sidgwick, 1874/1966), or simply "reasonably imaginable" (Nagel, 1970). The kinds and magnitudes of changes that biotechnology is touted as being able to provide, however, place it both beyond the common sense or ordinarily expectable, and no one seems to know the time frame in which beneficial outcomes are to become real. For instance, in 1983 scientists were predicting commercially available herbicide tolerant wheat "within five years" (see Busch *et al.*, 1991). Only in the past year has this become a reality ("North Dakota," 2001). Predictions about the likely availability of particular next-generation products are extremely vague and disputable (Pew Initiative, 2001).

In any event, the notion that work on future biotech products cannot be justified in consequentialist terms clearly contradicts what most scientists, science policy makers, and informed observers believe about future biotech products and about current work being done to produce them. What the above conclusion suggests, however, is that we might want to interpret the FBA's Premise 2—that agricultural biotechnology will provide benefits in the future—not as a prediction, but as a promise. There has certainly been enough rhetoric about the "promise of biotechnology." Perhaps it is time to interpret that promise not in terms a thing's potential, but as an ethical commitment. As such, "agricultural biotechnology will provide benefits in the future" perhaps should be interpreted to mean that those who engage in agricultural biotechnology agree to place themselves under an ethical obligation to guarantee, as far as it is within their power, that benefits are actually conferred sometime in the future. In this view, the ethical legitimacy of present work on future biotech would rest on scientists having (a) a genuine belief in the likelihood of a positive outcome, (b) the expertise to perform on the promise, and (c) the integrity to keep the promise even at cost to the promise maker (e.g., lost prestige, lost research funding). This does not mean that the out-

comes of science will necessarily be beneficial. However, the promise of biotechnology, so understood, can go a long way toward preventing bad consequences. And, it can generate the high moral ground the agricultural biotechnology establishment has reached for over the past several years.

Conclusion: Keeping the Promise of Biotechnology

A shift from reliance on the predictions embodied in the FBA as a justification for future biotech, to the notion that scientists oblige themselves to try to make future benefits become a reality, is both practically and ethically profound. Ethically, it signals a move away from a simple utilitarian-consequentialist approach to either a rule-utilitarian or even deontological or virtue ethics. Rule-utilitarianism was the ethical strategy Mill (1863/1957) outlined for avoiding decision paralysis. Rather than have to decide if every action would produce beneficial outcomes, we instead decide to follow certain rules that, if followed, would produce net benefits. "Keep one's promises" is an example of such a rule: on balance, if everyone generally keeps promises, the benefits will far outweigh any costs associated with keeping them (see Rawls, 1955, for the classic treatment). Promising to do everything in one's power to help realize the benefits of biotech may indeed be such a utilitarian-justified rule.

Alternatively, the shift to promise-keeping may signal a recognition that making and keeping promises of this type is a duty that any reasonable person in a similar situation would find acceptable. This would imply that a deontological justification is being invoked for R&D on future biotech, an idea that is not inconsistent with, for example, obligations that human subjects or animal care committees impose on researchers to minimize harms and respect dignity.

Still another ethical consideration is that of virtues: it may be, for example, one measure of a good scientist (administrator, regulator, and so on) that he or she commit themselves to doing the most in their power to make sure beneficial results flow from his or her work. The promise in this case is implied in the "profess" part of the learned "professions."

As profound as any of these alternative ethical-philosophical understandings of the making of promises, the practical shift from prediction to promise is even more so. One thing it practically means is that rather than addressing the ethical justification of science or biotechnology in general terms, we now must address the ethical justification of the individual actions of scientists and others involved in the processes of science as it delivers technology. In other words, ethical appraisal of science depends on the justifiability of decisions and choices made by those who are in the position to "do science" and bring technologies to reality. The idea of scientists' (and others') commitment to at least trying to achieve positive outcomes also may have the effect of introducing more self-policing at every level. It would be a small price to pay to ensure ethical justifiability to have peer review of work include assessments of likely social benefit, even if the expected benefits were only hypothetical scenarios that might play out given the nature of the research being conducted. Moreover, science administrators in both the public and private sectors have long noted that they need to be better about stewarding potentially beneficial biotechnologies from the laboratory to the marketplace (see Busch *et al.*, 1991). Furthermore, corporations involved in agricultural biotechnology appear poised to address the promise of biotechnology in more than public-relations terms. Indeed, avoiding public-relations disasters and seeking that higher ethical ground appear to be motivations for pursuing more clearly socially beneficial technologies, such as nutriceuticals and other foods for health (Mackey, 2002). The idea of an ethical commitment to try to bring forth as much benefit from agricultural biotech as is possible seems, in short, a potential paradigm shift for the biotechnology establishment and science in general (see Burkhardt, 1999).

In the end, however, promises or commitments are only as good as their being carried out. The ethical question that everyone involved in the biotechnology enterprise should ask him- or herself is this: "What should I do to guarantee that benefits result from my work in this enterprise?" This may appear to be a scientific question—e.g., "What will make this plant species exhibit this trait?" —and this is certainly relevant. But it really implies more direct actions, such as reflecting on one's ethical responsibility, communicating with other scientists and lay persons about the ethics of one's work, and supporting larger institutional measures (e.g., thorough and long-term tests for safety). Moreover, consideration of institutional or historical or economic conditions must be relevant as well, for the benefits of future biotechnology products cannot be fully realized so long as there remain unjust political-economic conditions that, for example, prevent new foods and other biotech products from being available to the people that need them most. Some may believe that asking this is outside the province of science. The response is the province of

those who are entrusted to provide solutions to these very kinds of problems.

More than forty years ago Indian Prime Minister Jawarahal Nehru (as cited in Sorell, 1991) wrote that

> It is science alone that can solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people. Who indeed could afford to ignore science today? At every turn we seek its aid.... (p. 2)

The power of science and especially genetic engineering, and their capacity to solve basic and very real human problems, establishes a *noblesse oblige* that we are not entitled to ignore or leave to others—or to impersonal market forces—to carry out. If this appears to overstep the so-called ethical neutrality of science (i.e., the presumed ethical neutrality of those in the scientific establishment), so be it. If science—and now specifically genetic engineering—wants to be judged positively by the fruits of its labors, science cannot simply cast the fruit on the market, or to the public, and expect that it will necessarily confer positive results. Rather, scientists and others in the science/biotechnology establishment must tend the fruit, watch it, and carefully guide it so that we can, in the future, say that this work was indeed ethically justified. It is presently justifiable only if we try to do our duty.

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