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Biotechnology and Food Security

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Introduction

Mennonite Central Committee grapples with food security issues in many of its international programs. MCC was in fact founded in 1920 to respond to a famine in South Russia affecting many Mennonites.

Several of MCC's programs are bumping against an enormously significant new technology—biotechnology. While advocates tout the promise of biotechnology as a possible answer to food shortages, others see disadvantages and dangers.

The MCC Food, Disaster, and Material Resources Office and the MCC Peace Office jointly sponsored a consultation October 13–14, 2000 in Winnipeg, Manitoba, to look at issues of food security and biotechnology. This issue consists of abbreviated presentations to that consultation as well as the recommendations resulting from it.

We are grateful to the presenters for allowing us to excerpt and publish their words.

—Editor

How Genetically Engineered Foods Came to Be: A Tale of Hopes and Fears

by Daniel Charles

In the early 1980s, several groups of scientists in the United States and Europe managed to insert new genes (taken from bacteria) into tobacco and petunia cells in a laboratory dish, and nurture those few cells into whole, genetically altered plants.

Why, one might ask, did they even try? In large part, one can praise, or blame, the human urge to explore the natural world, and tinker with it. But there was also the temptation of riches and fame. A wave of new start-up companies came into being during the early 1980s, founded on the promise of better crops through genetic engineering. They were joined in this quest by older companies such as Monsanto and Du Pont.

Newspapers and magazines of this era were filled with enthusiasm about genetic engineering. Biotechnology's proponents foresaw plants that would produce larger harvests while requiring less fertilizer, less water, and fewer chemical pesticides. Such predictions often were based less on scientific data than on faith, a modern faith in technical progress.

Yet just as quickly, fears and worries emerged. Some were troubled by attempts to exert such control over the natural world, transferring genes willy-nilly from one species to another. It seemed, in words used many years later by England's Prince Charles, "to take mankind into realms that belong to God, and God alone." And where would it end? Many predicted that biotechnology would lead, ultimately, to the genetic manipulation of human beings.

To receive a copy of the summary and recommendations of the Conference on Biotechnology and Food Security, write the Peace Office at the address on the back page or contact Esther O'Hara at geo@mcc.org.

Newspapers and magazines of this era were filled with enthusiasm about genetic engineering.

In addition, critics of biotechnology harbored an abiding distrust of large corporations, especially those chemical companies that were pushing genetic engineering forward with the greatest vigor. Many of the opponents, including environmentalist groups and some churches, had campaigned in the past against the use of pesticides in agriculture, and against laws that allowed companies to claim ownership over parts of the natural world, such as genes or new plant varieties. Genetic engineering tumbled into the midst of these long-running battles.

Opponents of biotechnology demanded regulation of genetically engineered plants, and during the late 1980s and early 1990s, many countries, including the United States, Canada, and the European Union, responded. These governments set up rules intended to ensure that genetically engineered crops would cause no harm either to the environment or to human health.

The first genetically engineered food on the market was the "Flavr Savr" tomato, created by a California-based company named Calgene. It went on the market in 1994, and flopped embarrassingly. Calgene's new gene—it was supposed to prevent tomatoes from going soft as quickly—turned out not to make much of a difference, at least compared to low-tech aspects of the business such as tomato breeding, growing, and handling.

The next wave of genetically engineered crops, however, which hit the market in 1996 and 1997, proved wildly popular. They employed two different genes. One, isolated from a type of bacteria called *Bacillus thuringiensis* (often called simply Bt), made plants poisonous to insects such as the European corn borer (which feeds on corn) or the tobacco budworm (which feeds on cotton). Cotton farmers, in particular, reduced their use of other insecticides drastically by planting Bt cotton. A third of all cotton planted in the U.S. contains the Bt gene, even though Bt seed costs about three times as much as conventional seed.

The other successful gene allowed soybeans (and later, corn, canola, and cotton) to tolerate sprays of Monsanto's most popular herbicide, Roundup, which normally kills practically all vegetation. Farmers who planted these "Roundup Ready" crops were able to spray Roundup on their fields, killing weeds without harming the crop. About half of all soybeans in North American contain the commercial Roundup Ready gene.

Backlash

When these crops arrived on European shores, they encountered a wave of powerful opposition. Europe's regulators did approve both Bt and Roundup Ready crops, finding no evidence that either would harm the environment or human health. Yet in the United Kingdom, this official seal of approval enjoyed little credibility. Those same government authorities had insisted for years, mistakenly, that mad cow disease posed no threat to humans. And the original objection to genetic engineering—that it represented a perilous intrusion into the natural world by untrustworthy, profit-mad companies—remained very much alive among European environmentalists.

Monsanto, the most enthusiastic proponent of genetically engineered crops, added to the furor. The company, preaching an impending revolution in agriculture, bought a series of seed companies, becoming overnight the world's second largest seller of seeds. In addition, Monsanto introduced new rules into the seed business, prohibiting farmers from using part of their harvest as seed for the following year if that harvest contained Monsanto's patented genes. For some activists, the company became the incarnation of everything that was objectionable about genetic engineering.

The campaign against genetically engineered food became a popular revolt during 1998 and 1999, first in the United Kingdom, then in the rest of Europe. Consumers demanded that supermarkets eliminate genetically engineered ingredients (mostly soy products, which find their way into many processed foods) from their shelves, and eventually, most European retailers complied. Large quantities of genetically engineered soybeans and corn continue to flow into Europe for animal feed, but these exports also are under attack. And European governments have stopped approving any new genetically engineered crops, even though the scientific committees responsible for evaluating the risks of such crops continued to recommend approval.

Opposition to genetic engineering has revived in North America, but remains much less powerful than the movement in Europe. At the moment, the conflict appears to have reached an impasse. Farmers in North America and much of South America, if given the choice, would prefer to grow genetically engineered crops. Consumers in Europe show no signs of relenting in their opposition. The fate of the genetically engineered crops currently on the market lies in the hands of international grain traders, responding to these conflicting signals of supply and demand.

Meanwhile, in a repeat of the enthusiasm of the early 1980s, scientists promise a wave of new and fabulous products that may emerge from their laboratories. These include foods that would be genetically altered to provide benefits to consumers, instead of to farmers. There might be soybeans containing cholesterol-reducing forms of oil, for instance, or foods naturally enriched with essential nutrients.

These could solve many problems at once. Because such products would be more valuable, farmers and processors would keep them separate from conventional commodities. Products containing them would be labeled, as a selling point, and consumers would be free to choose them or not. Any potential risk they might harbor would be balanced by a promised benefit. Currently, however, such products remain promises, not reality.

Bane or Boon for the South?

Both proponents and opponents of genetically engineered crops claim to represent the interests of small landholders in the world's poorest nations. The technology's defenders point to various projects as examples of genetic engineering's potential. Researchers in Mexico are distributing genetically engineered, virus-resistant potatoes to small farmers. Virus-resistant sweet potatoes and Bt corn may soon be tested in Kenya. And there is the prospect of "golden rice," enriched with the crucial nutrient beta-carotene. In all of these projects, the seed would be distributed to farmers for free.

Opponents of genetic engineering, for their part, deride such experiments as public relations, Trojan Horses wheeled into Third World countries, opening the door for an industry that has just one objective: to enter Third World markets with patented, privately controlled seed, and extract profits.

People directly involved in Third World agriculture, in my experience, tend not to subscribe to either view. Most are not opposed to genetic engineering in principle (although many believe that it's a distraction from more important things). Most of them wouldn't mind if multinational biotech companies actually did try to sell better seeds to subsistence farmers in developing countries.

But they don't expect that to happen. Companies can't make money selling things to people who don't have money. If genetic engineering offers any benefits at all for such farmers, those benefits will have to emerge from nonprofit institutions, or from the relatively ill-equipped facilities of publicly funded laboratories in developing countries.

Open Questions

1. *How safe is (acceptably) safe?* Genetically engineered crops are subjected to closer scrutiny than crops produced by conventional breeding. But according to critics, that scrutiny does not go far enough, and does not prove that such crops are harmless. The defenders of genetically engineered crops say that such demands are unreasonable, and are merely a tactic to prevent approval of genetically engineered products.
2. *Are other issues more important?* It is absurd, some observers say, to obsess about hypothetical health risks that could be posed by genetically engineered crops, when millions of Americans continue to ruin their health by eating demonstrably unhealthy food. And it is illogical, they say, to focus on the "unnatural" nature of genetically engineered crops, when agriculture itself has meant the complete elimination of natural forests, grasslands, and even deserts.
3. *Where do we draw the line in genetic manipulation?* Few people object to the breeding of hybrid corn. Most of us probably would feel queasy about genetically manipulating a human cell in a test tube in order to produce a taller baby. Somewhere, in the vast area in between, lies the boundary between acceptable and unacceptable.
4. *What can be owned?* Genetic engineering would exist even without patents on genes and plant varieties, but some of the commercial incentive to pursue it, for better or worse, would disappear. The genes that have been inserted into Bt corn and Roundup Ready soybeans do not, strictly speaking, exist in nature. They are made from building blocks that were found in nature, painstakingly rearranged, at great expense, by human hands. Do those humans have a right to claim them, at least temporarily, for their own use?

Daniel Charles, a freelance writer, covered technology for National Public Radio until 1999. His book on the history of genetically engineered food, Lords of the Harvest, *will be published by Perseus Books in September. He is a member of Community House Church in Washington, D.C.*

Theological issues related to biotechnology

1. How do we weight being creatures and cocreators?
2. Are we in this middle ground where we need to decide what we should do technologically and what we should not do?
3. Are there things that are just wrong, even if we can do them?
4. Should we treat animals and plants with the same level of respect as humans?
5. Who ought to be evaluating this type of technology?
6. To whom should the benefits and costs of the application of this technology go, and how should this decision be made?
7. Is MCC's participation in this discussion diminishing voices from the South?

—Ted Koontz, Peace Committee member

Biotechnology and Food Security in Africa: Some Policy and Institutional Considerations

by Patricia Kameri-Mbote

Agricultural biotechnology is most crucial for African countries and especially for resource-poor farmers whose sole livelihood depends on agriculture.

Introduction

The issues of food security and poverty in the developing world and especially in sub-Saharan Africa have dominated public debate and are an issue of global concern. Exacerbating these issues is the complex subject of population growth. It is estimated that world population will hit the 8 billion mark in the year 2025; most of the increase is expected in the developing world.

Population growth has direct implications for available land (and this in the light of decreases in arable land worldwide). For Africa, where the rural population is close to 70 percent in most countries and where consequently the main economic and social activity is farming, these facts are an issue of grave concern.

The challenge for developing countries is to ensure that their citizenry enjoys food security. In Africa, there are other equally pressing issues that compete with the search for food security, namely political instability and diseases such as malaria and HIV AIDS.

What Is Biotechnology?

Biotechnology is a science that deals with the use of microorganisms, plant cells, animal cells, or parts of cells such as enzymes to produce commercial quantities of useful substances. It also deals with the construction of microorganisms, cells, plants, or animals with useful traits by recombinant DNA techniques, tissue culture, embryo transfer, and other methods besides traditional genetic breeding techniques.

Biotechnology applies across a number of fields. Agricultural biotechnology is most crucial for African countries and especially for resource-poor farmers whose sole livelihood depends on agriculture. Indeed, worldwide there has been a shift towards greater emphasis on agricultural biotechnology than on pharmaceutical, which dominated the terrain before.

Biotechnology and Food Security

The role of biotechnology in the economic transformation of Africa is the subject of academic and public discourse in the region. The discourse has placed emphasis on whether the technology has potential to improve Africa's food security status. While a wide range of policies is required to address some of the structural rigidities that undermine prospects of achieving the necessary food security status, biotechnology can enhance agricultural production in the region.

The cluster of techniques that comprise biotechnology can, if effectively harnessed and applied, radically transform farming systems by reducing post-harvest loss and increasing crop resistance to drought. For instance, the application of tissue culture in the production of bananas has increased yields for small-scale farmers in parts of Kenya. Pathogen-free banana planting material can reduce crop loss due to pests.

The biotechnology and food security in Africa debate raises several key issues:

1. How do you transfer biotechnology to African countries and strengthen their technological competence to acquire, assimilate, further develop, and effectively apply the technology for enhanced agricultural production?
2. What policy and institutional arrangements should be put in place to make the technology and its products accessible to rural farmers in the region?

These are complex issues especially considered against the background of the empirically empty rhetoric on biotechnology that is conducted at two extremes. On the one hand there are the pessimists who perceive biotechnology as eroding opportunities to address food insecurity and generating more environmental harm. In this category are environmental lobbies. On the other hand are the optimists who see biotechnology as the panacea for all problems including food insecurity. In this category are biotechnology scientists.

The debate on whether biotechnology can solve Africa's food insecurity problem is moot in my view. Similarly, I eschew the debate on whether African countries should embrace biotechnology as intellectually dry because:

1. No technology by and of itself has internal momentum to create food security for any society or region. It is how the technology is applied and molded by society that determines its usefulness. Indeed, if biotechnology were the panacea for food insecurity problems, we would not be talking about hunger and starvation today in light of the net increases in food production recorded in the world in the last two decades.

   There are obviously other problems, such as access to the food (Is it affordable? Can it be moved across regions effectively?), equity (at the international and national levels), and distribution of the food globally and nationally, which impact on food security. Such issues impinge on food security but are not strictly speaking biotechnology problems.

2. There is not inherent goodness/badness in any one technology. Most technologies have advantages and disadvantages. For instance, the introduction of the motor vehicle and airplane must have been opposed on grounds of the dangers these technologies exposed people to. The same argument may have been used for computers and cell phones.

   The concern should be on how to maximize the benefits of the technology while minimizing its risks. Indeed, there is a relationship between ignorance and lack of information on any given technology and the level of acceptance of that technology by the ignorant or uninformed person.

3. The biotechnology revolution is with us and is witnessed by the increase in the acreage of genetically modified crops and the proliferation of genetically modified products and processes. Biotechnology has transformed agricultural and economic systems of countries such as the United States, Canada, and some countries in Latin America and Asia.

4. To deal with biotechnology processes and products requires some level of biotechnology competence. Only those countries that understand genetically modified organisms can effectively monitor and regulate their application. In this regard, African countries such as Egypt and South Africa are poised to leapfrog to higher levels of technological competence and performance as they have invested in sound institutional structures for managing biotechnology.

The Status of Agricultural Biotechnology in Africa

It is noteworthy that most African countries have not taken deliberate efforts to understand biotechnology, tap its potential, and use it to address some of their basic agricultural problems. This is so despite evidence that the last two decades have witnessed increased investment in biotechnology research and development (R&D) by a number of African countries. Indeed, national agricultural research institutes, public universities, international institutions, and private companies have engaged in some form of agricultural biotechnology.

There are generally three categories of countries in terms of biotechnology R&D capacity and potential in Africa:

1. Countries that are generating and commercializing biotechnology products and processes using third-generation techniques of genetic engineering (Egypt, South Africa, and Zimbabwe)
2. Countries engaged in third-generation biotechnology R&D, but which have no products or processes yet (Ghana, Kenya, and Uganda)
3. Those engaged in second-generation biotechnology—mainly tissue culture (Tanzania and Uganda)

The actors in agricultural biotechnology R&D in African countries can be distinguished from those in the developed countries where private corporations such as Monsanto are emerging as the main drivers of biotechnology R&D, and consequently own and control biotechnology information.

The globalization of the world economy and the emergence of the giant transnational corporations (with economic potential greater than that of a group of developing countries put together) are shaping the development of countries in Africa and elsewhere in the developing world.

The concentration of agricultural biotechnology R&D in a handful of companies has implications for access to the technology and products thereof, given the trend toward tighter control of intellectual property promoted by the World Trade Organization's agreement on trade-related aspects of intellectual property rights (TRIPS). This concentration and the provisions of TRIPS have resulted in the progressive privatization of biotechnology innovations that have resulted

African Centre for Technology Studies

ACTS is a policy research institution committed to ensuring that science and technology contribute to sustainable development. Its mission is to enlarge policy choices for Africa's sustainable development through technological change and environmental management. The Centre's objectives are:

- **to undertake policy research on issues of critical importance to Africa's development;**
- **to strengthen national capacities of African countries to act on global environmental agreements;**
- **to enhance Africa's voice in global fora such as World Trade Organization, Convention on Biological Diversity, and various United Nations meetings;**
- **to monitor global trends in science and technology and their relevance to African development;**
- **to foster exchanges between researchers and government officials at local, national, regional, and international levels; and**
- **to provide affiliation to researchers and others working on issues of science, technology, and the environment, especially as it pertains to Africa.**

The Centre's two projects of direct relevance to the biotechnology and food security debate are:

1. **The Project on Agricultural Biotechnology Assessment in Sub-Saharan Africa seeks to identify the needs, strengths, and weaknesses (human, financial, infrastructure, and laws) in the management of biotechnology in agriculture in Ethiopia, Kenya, Uganda, Tanzania, South Africa, and Zimbabwe; and**
2. **The Biotechnology and Public Policy Capacity-Building Initiative under the East Africa Research Network on Biotechnology (BIO-EARN) contributes to capacity building through regional workshops, short training courses for mid-level policy makers, and internships for policy makers.**

The Centre is currently developing a guide to the Biosafety Protocol in collaboration with the World Resources Institute and will be carrying out training courses on biosafety in 2001–2003.

—Patricia Kameri-Mbote

from material provided freely by communities of farmers around the world; this is an issue of great concern today.

The main constraints to the capacity of biotechnology to engender food security in Africa are limited capacity—human, financial, and infrastructural; ill-defined or non-defined institutional arrangements for biotechnology R&D; and ambivalence to or indecision on biotechnology.

Biotechnology is with us and is poised to influence agricultural systems in the world tremendously.

Policy Challenges for Africa

1. To establish clear priorities in investment in biotechnology. Countries should identify specific areas or technology trajectories in which to invest to meet specific goals and to utilize the available skills and resources optimally.
2. To ensure availability of finances for biotechnology R&D. Current investment in this area is not sufficient. This could be done by forging strategic alliances with the private sector, ensuring that the public good of availing food to all is not compromised by profit motivation.
3. To consider the role of intellectual property rights and their impact on the acquisition, development, and diffusion of biotechnology.

Concluding Remarks

Biotechnology is with us and is poised to influence agricultural systems in the world tremendously. It has, like all other technologies, advantages and disadvantages.

We should not throw out the baby with the bathwater, but we should ensure that we have the requisite capacities (human, infrastructure, legal, policy, and institutional) to tap the benefits of biotechnology, minimize the risks to the environment and human health, and check the trend toward concentration of ownership in a handful of multinationals through monopoly intellectual property rights.

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What Biotech Research Firms Do

by Greg Penner

I want to go through how we do genetic engineering and how the products of genetic engineering are regulated.

Biotechnology is the use of technology to alter biology. That has been going on for an awfully long time and it's a very generic activity.

Breeding is the use of artificially imposed selection on plants, and that started at least 3000 years ago with the Egyptians.

Genetic engineering is the direct insertion of a gene or genes into a plant. You can even take the gene from the same plant and place it back into that plant; as long as you have done that from a genetic engineering approach, it is genetic engineering.

A *genetically enhanced organism* is an organism that contains the product of genetic engineering.

As a backdrop, I will just walk through a bit of how wheat breeding is done now. In public labs and private labs all over the world, wheat breeding is done by crossing wheat plants, and crossing the progeny of these crosses with corn. What happens is that the corn chromosomes are eliminated after one or two cell divisions in the embryo, leaving only the wheat chromosomes. The wheat chromosomes present are only those that were donated from the pollen; thus each chromosome is missing its pair. The wheat chromosomes are then doubled, each chromosome replicated so that its pair is also present, through the use of a chemical that interferes with cell division. Genetic segregation for traits is eliminated in a single generation. Each wheat plant that is derived in this way will breed completely true (that is, each individual plant will only produce identical copies of itself).

The point of this discussion was to demonstrate that what is termed conventional plant breeding, which is not regulated in any way, can involve a substantial amount of technological intervention. Wheat varieties are being grown in Canada that have been derived using the approach described above.

There are two primary approaches that are used in genetic engineering of plants: biolistics and agrobacteria.

Biolistics basically involves shooting the genes in with a gun. What they originally did was to take the gene of interest and allow it to attach itself to gold particles, which have a very high surface area. The initial experiments used a .22 caliber pistol to shoot the genes in. Now we use an apparatus that consists of helium gas under pressure and a diaphragm that will break at a precise amount of pressure, resulting in the release of gold particles at a defined velocity. This approach allows for more precise control of velocity but we are still basically blasting those gold particles into the tissue.

The other system that is used is *Agrobacteria tumefaciens*. Agrobacteria are bacteria that live in the soil, naturally infect the plants, and cause a crown bulb tumor around the base of the plant. A circular piece of DNA from the bacteria that contains genes that stimulate uncontrolled plant cell growth actually inserts itself into the plant DNA. It does this naturally in nature. So what some scientist did was to use the agrobacteria to place new genetic material into the host plant. They took out the genes that promote plant growth and substituted a gene that they wanted to deliver into the plant.

Commercializing Biotechnology

Biotechnology companies have basically only commercialized two types of genes: herbicide resistance and insect resistance in a limited number of crops. Monsanto, for instance, has commercialized Roundup Ready and Bt transgenic crops.

Roundup is an herbicide that affects tryptophan biosynthesis. Tryptophan is one of the amino acids that plants make and that we need to get from plants because we don't make it. Mammals do not have this biochemical process. What the herbicide does is to affect the performance of an enzyme in the plant. In order to breed varieties of plants that will not be harmed by Roundup, we've achieved Roundup resistance in two ways. One is by modifying the enzymes so that they are expressed at higher levels . So the herbicide comes in and binds to the enzyme, but because there is more of the enzyme present there is still enough left for the plant to be able to produce tryptophan; thus the plant is not affected by the herbicide. The other process involves taking a gene from bacteria in the soil that detoxifies Roundup, and we have introduced that into plants as well. In canola we use both genes. In a lot of the other crops we just use the enzyme that is resistant to Roundup.

For insect resistance, we talked a little about Bt *(Bacillus thuringiensis)* this morning. Bt has been around since the 1940s. It's a crystalline protein with 120 to 150 different forms. One of the ways we find new forms of Bt is to look at insect cadavers, examine the bacteria that are growing in them, and then isolate the Bt from those and see if there is a new form of Bt.

Bt had been applied in aerial spraying of crops since the 1940s, but what we have done is to take the gene from the Bt bacterium and put it into the plants.

The effect of Bt on the monarch butterfly has been a fairly significant issue. One of the things that get lost in media reports is that there are 30 percent more monarch butterflies in the U.S. now than there were five years ago. There is much less pesticide applied in the U.S. than there was two years ago. A lot of non-targeted insects were killed by the aerial application of Bt, and by expressing Bt in the crop, the fatality rate of a lot of insects that live in the soil is reduced. They are not as pretty as monarch butterflies, but they still represent genetic diversity.

We understand how these genes work, we understand what they do and how they are expressed in the plant. But this is not enough for the regulatory agencies.

Regulatory analysis is based on substantial equivalence. Substantial equivalence is a necessary concept because crop varieties vary in terms of their composition. There is no single definition of the composition of a canola seed. Substantial equivalence means that it must fit within the range of variability exhibited by the varieties in the marketplace. We have to show that the genetically enhanced organism is substantially the same as the product without the genetic enhancement. We need to look at the composition of the grain and tissue. In additon, the digestive fate of the protein produced by the genetically enhanced organism also needs to be clearly understood in a range of digestive systems.

Another thing we need to do is the environmental impact of the genetically enhanced crop—what it's going to do in the field. Is it going to increase the weediness? If the pollen transfers into a wild species, what is it going to do in that wild species?

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Theological ethical principles for discerning issues related to biotechnology

1. God created this world and us in it, and God pronounced it good.
2. We are creatures first, and all our creativity is secondary under God.
3. We are fallen and sinful creatures. We live with limits.
4. We are creative and desire to create.
5. Life is a gift.
6. We do not know everything.
7. We are not good enough to be controlling creative people in some areas.
8. We are invited to participate in God's creative tasks in some areas and not invited to participate in God's creative tasks in other areas.

—Harry Huebner, Peace Committee member

As a scientist I am very comfortable standing up and saying that what we have commercialized is safe, and we can demonstrate that it is safe.

As a scientist I am very comfortable standing up and saying that what we have commercialized is safe, and we can demonstrate that it is safe. All the data we have collected on these crops are in public databases. The Canadian Food Inspection Agency has a Web site (www.cfia-acia.agr.ca) where anybody can go look at our data. It's sound science backing up what has been done to date.

Looking into the Future

What's next? Biotechnology companies are investing heavily in broad based research programs termed genomics. Monsanto has sequenced arabidopsis, which is a model dicot (broad-leafed) plant that has just a little DNA. They have sequenced a large proportion of the genomic DNA in rice, which is a model monocot (a narrow-leafed plant with parallel veins in the leaves). Companies are doing this so that they can understand how all the genes work and how all of these genes work together as a system. It's really exciting science. How does the plant work? How does it respond to disease? What turns it on and what turns it off?

Monsanto has developed a canola that has a 60-fold higher level of vitamin A in its oil. They are negotiating with various parties in the developing world to release this germplasm so that it could be used to help prevent night blindness. This is not seen as a cure for night blindness, nor as a complete solution for vitamin A deficiency in people's diets, but it should help.

Dr. Greg Penner is a research manager for a biotech research firm in Winnipeg, Manitoba.

The Dangers of Biotechnology

by Brewster Kneen

We have to look at the notion of . . . biotechnology as an expression of culture and ask ourselves, "Do we really like this expression of our culture? Do we really want to treat life that way?"

Some of you may have read about the recent incident with Taco Bell's taco shells (and subsequently many other products made from corn) being found to contain a genetically engineered protein that had been approved for use in animal feed but not for human food use. The corn containing the illegal insecticidal (Bt) protein was discovered not by the regulatory agencies responsible—the U.S. Food and Drug Administration and the U.S. Department of Agriculture—but by a citizens' coalition.

Obviously the regulatory system is not working, but more significant, really, is the reason it was not approved for human food use: the regulators said they could not tell whether this novel protein was allergenic or not because they had nothing to compare it to.

A major agbiotech company has been running ads in the farm papers. The language in these ads is quite intriguing. The punch line is "When the weeds are out of your field, nothing is out of your reach" or "The power, the promise, and you." This is very emotive language for science. It has very little to do with biotechnology and much to do with power.

There is a long, long history of people feeding themselves, of living in their environment. Otherwise we wouldn't be here. If vitamin A deficiency had always been a problem, I guess most of us would be blind. How did we get here? We got here by feeding ourselves in a myriad of ways for many, many centuries. That is the broader context. And then we shrink that down to the industrial agriculture of the last fifty years and we act as if we know what we are doing in industrial agriculture. Fifty years is nothing, absolutely nothing. And look at the problems that we have created! Do we really know what we are doing?

I'm not trying to pin this on anybody. It's a cultural problem. I'm really appalled about some of the things I did when I started farming—what we took for granted about pesticides and so on before we knew better.

It is interesting in our culture that when you get into genetic engineering, we identify our history as progress. Technology is one of the tools of progress, and we can't be against progress; therefore we can't be against technology. And this is the context of genetic engineering. We are very careful not to say anything outright against technology, which

I find very strange. I think there are some kinds of technologies that are demonic. For example, there is not a lot of agreement that nuclear weapons are a very good thing, but we certainly don't want to suggest that genetic engineering is equally negative. But maybe we should. Or . . . why don't we? That's the more interesting question.

If you were to listen to the biotech industry in particular, or look at our tradition of industrial agriculture, it's very much oriented to monoculture and the assumption that *we* have the answers. "How do *we* transfer our technology to the rest of the world to solve their problems?" Or, as it is often put, "Only with biotechnology will *we* be able to feed the world." I find that offensive with its assumption that other people don't know how to feed themselves. Why they are unable to is another issue.

There is a vast range of diversity in terms of how people live in God's creation. What we offer as a solution—our monoculture and our technology—is a very small fraction of that whole spectrum. And it is very arrogant of us to think that our answer is the only answer as to how we might live in this world.

What we have done with industrial agriculture and increasingly now with genetic engineering is to create a food system dependent on external life-support systems. We have literally created dependency. You take your corn crop or your canola crop out there and put it out in the wild—would it survive? Does it fit ecologically? Probably not—because it has been created, designed, and engineered to be dependent on artificial life-support systems.

Herbicides, insecticides, fertilizers, and irrigation were all essential to the Green Revolution. When they were no longer provided by the aid programs, there was trouble. I think we still don't acknowledge how much damage was done by that.

I don't think that any technology, including biotechnology, drops out of the sky. Technology is a social construct, and biotechnology is certainly a social construct. To engage in this project you have to have a very particular world outlook, a certain attitude.

How many people, if you really let your imagination go, could comprehend the notion of patenting life forms? Yet we talk about it as if it wasn't an issue. I suspect that for a vast majority of the world's people, the notion of patenting life is absurd. It's not comprehensible, much less defensible. When we look at genetic engineering, I think it's really important to look at the culture that has generated this technology.

Already we are in the debate about gene therapy and embryo manipulation in human beings. And if it's okay for cows, then why isn't it okay for women? The technology is the same. The companies are the same.

I think it is morally irresponsible, utterly irresponsible, to think that we can treat food and human life as somehow not intimately related. We have to look at the notion of technology and biotechnology as an expression of culture and ask ourselves, "Do we really like this expression of our culture? Do we really want to treat life that way?"

The assumption that I find troubling is that nature is hostile and stingy and we have wrestle a living out of nature. It's that hostility that I find troublesome, because most people have survived by learning how to live in their environment, and with it.

How many of the problems that we wring our hands over are the result of our civilization demanding exploitation over the rest of the world, colonizing and destroying cultures, and then wondering in despair over the problems that we are now facing? And if you say, "Wait a minute, this is not biotech"—yes it is, because it is exactly the same mentality of colonization, only now we are colonizing the genes. When it comes to mechanisms of control, we've become much more sophisticated. We don't need to recruit armies anymore. We are going to structure those into the genes that are patented. It's a control issue.

To my mind, nature is not our enemy, it is not stingy, there is plenty for everybody if we took a different approach of sharing and respecting, and respecting different approaches to how people deal with living on this earth.

What it comes down to is acknowledging how little we know. For example, I was raising a question with a nutritionist/biochemist, the head of the allergy clinic at Vancouver General Hospital, about the growing prevalence of allergies and asthma. I was really struck by her response: we don't know anything about the biochemical pathways in the human body. We know virtually nothing about the metabolic processes. To claim that this is safe or not safe is just absurd, because we don't even know what normal is.

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Terminator technology and traitor technology have been developed largely with public funds. The U.S. Department of Agriculture invested a great deal in *terminator technology* that is designed to make seeds infertile in the second generation, so that no farmer can save seed and use it again next year. It is even better protection than a patent for the company to make sure that the farmers come back into the commercial seed market, year after year. It's a biological control that forces farmers to purchase seed instead of saving it.

***Traitor technology* is an even more advanced technology that goes beyond this. The traitor is a combination of characteristics of a single plant that can be turned on or off using various chemicals that, of course, the farmers have to buy. The chemicals can make the same plant more drought resistant or less drought resistant or grow taller or grow shorter depending on the agro-ecology where that plant is being grown. If you buy and apply the chemicals, you have a great deal of control over how this particular plant responds to a given climatic situation.**

—Kristin Dawkins

It took me aback, because I didn't realize, I had assumed that they did understand some of this stuff. But I find increasingly that real scientists are saying, "We don't know."

I think that is a really healthy antidote to the hubris, the profound hubris, that seems to be the primary motivation of genetic engineering—the contempt for human life and the willingness to demolish it, take it apart, and put it back together as if somehow we know even more than God, thinking all the while: we can do this—we are so wise that we can do this with impunity. And if we create a problem, we will come up with a technological fix. That is arrogance to an extreme and I am not happy with it.

Brewster Kneen is the author of Farmageddon: Food and the Culture of Biotechnology *(New Society Publishers, 1999). He lives in Sorrento, British Columbia.*

Biotechnology Issues We Need to Address

by Kristin Dawkins

Whatever any of you are thinking about the pros or cons of biotechnology, I think that any policy analysis has to focus on the public interest as well as the private interest. It has been put another way: "Follow the money." When you spend money in that way you cannot spend it in other ways.

What we are watching in genetic engineering is a tremendous shift of money and other resources from the public sector to the private sector, worldwide. The vitamin A rice ("golden rice") that is put out in the public as the panacea to blindness caused by vitamin A deficiency in much of Asia and Africa—just the other day (in October 2000) it was transferred from public sector researchers to private corporations.

1. The first issue we need to address is the Biosafety Protocol that was finalized in January 2000. Right now exports of grains need to say that they may contain genetically modified organisms (GMOs), whether they do or not. It is the right of a country then to refuse that import as long as they do some kind of a risk assessment. Ethiopia led 100 other Third World countries that fought for the Biosafety Protocol to be at its most stringent. And it was the grain exporting countries, the United States, Canada, Argentina, Chile, and Uruguay, that opposed there being any protocol at all. What does that tell you about what the South needs to feed itself?
2. The World Trade Organization agreement on trade-related aspects of intellectual property rights (TRIPS). A group of African nations are calling for "no patents on life" as a provision of the TRIPS agreement. We should be supporting them. They are also calling for "no patents on essential drugs."
3. In the policy arena is the World Intellectual Property Organization (WIPO). They are presently researching the whole concept of indigenous knowledge. What kinds of protections ought to be in place to enable indigenous people and farming communities to retain the rights to their knowledge and resources without their being biopirated? The Organization for African Unity has drafted a model law that would create a priori rights, like human rights—recognized prelaw, prewriting as being the rights of indigenous peoples.
4. The Food and Agriculture Organization (FAO) is presently negotiating something called the International Undertaking on Plant Genetic Resources for Food and Agriculture. The concept of farmers' rights is being written into a legally binding text that would preserve the rights of farmers to use, exchange, and market farm-saved seed.
5. The Convention on Biological Diversity (CBD). Every year there is a meeting of the parties to that Convention to try to move it from being a framework convention, setting out principles, to actually having practicable law that can be enforced.
6. The FAO is also negotiating a code of conduct on biotechnology. What should that code say?

We are also seeing *biopiracy,* where corporations send anthropologists and other scientists to the biodiverse parts of the world to collect samples of organisms, microorganisms, and fungi that might have value in creating new pharmaceuticals or as something to be mixed with another variety and bred over time into some other profitable product. They take these samples and once they have them in the laboratory, manipulate them ever so slightly to be able to claim that they have done something innovative with them, then go to the patent office with the goal of controlling those biological resources for the twenty-year length of the patent.

—Kristin Dawkins

7. The Codex Alimentarius Commission, a body of the United Nations under both the FAO and the World Health Organization, has set up an ad hoc, intergovernmental task force on foods derived from biotechnology. What is this task force going to be debating?
8. The World Health Organization has a biennial assembly, and the last two times they have tried to pass a resolution saying that essential drugs should not be patented. Each time it was vetoed by the United States.
9. The World Health Organization has recently started investigating the question of human genetic engineering through cloning human beings, and also human germ line engineering, which has the potential to cause the altered DNA to become part of the human species.
10. The Biological and Toxic Weapons Convention is hardly ever talked about, but there is research going on to use human genetic engineering knowledge as well as agricultural engineering knowledge to create weapons of mass destruction.

You can draw some moral and ethical conclusions from what I've said, but I would like to go further and say that it is really a question of values, a question of our vision for the future. It is about how we see our society organizing itself into the future and how we see our relationship as human beings to other species on the planet, and to the community of humanity as a whole.

Kristin Dawkins is vice president for international programs of the Institute for Agriculture and Trade Policy in Minneapolis.

Genetic engineering is different from any other kind of potential pollution that we know. That is spoken about quite eloquently in article that was in the April 2000 edition of *Wired* magazine. Phil Joy, the CEO of Sun Microsystems, talked about how genetic engineering, robotics, and nanotechnology—these three technologies—are even more frightening in some ways than nuclear technologies precisely because they set loose organisms into the ecosystem around them that cannot be recalled. They are self replicating: once they are out there they are going to do their thing and there is nothing that we humans can do about it from that point on.

—Kristin Dawkins

Recommendations Resulting from the Consultation on Biotechnology and Food Security

1. Mennonite Central Comittee should recognize that among its North American constituency and international partners, there is a diversity of opinion on the moral and safety questions raised by biotechnology. For some this represents a significant threat to a God-given definition of life. For others it holds great potential to enhance life and health. At the same time, however, there is agreement that introducing this technology into a world of inadequate legal and trade controls leads to exploitation and abuse. This represents a growing injustice and merits a response from organizations like MCC. MCC should speak to the issue in ways that recognize this diversity of positions, while also clearly standing against injustice.
2. MCC should listen to and engage diverse participants in this discussion. MCC's role should be to listen to all involved, to continue the conversation, and to raise ethical questions. MCC should aim to broaden this discussion:
   - We need to hear the voices from the South, from MCC partners. FDMR's current listening project begins to do this. Country programs could also take part.
   - We should think about ways to engage the farmers in our constituency in this discussion. How do they face genetic engineering? How do they think about it? There may be a role for regional and provincial offices here.
   - We should keep the scientific community, such as scientists from our colleges, centrally involved in this discussion.

   If the issues are not only biological but also issues of international law and economic and trade systems, we need to also include economists and perhaps international law specialists in our conversation. We have people in MCC's constituency who could speak from these areas.

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3. MCC should allocate resources for further consultation, research, and advocacy on biotechnology. It is an issue that can touch many relationships: national (U.S. and Canada), and international. MCC may need additional research and advocacy capacity to address this adequately.
4. MCC should explore specifically ways we might be involved with issues of trade, patenting, and property rights. These are issues of ownership and justice.
   - We should engage government bodies looking at policy development, in North America and in other places where MCC has opportunity to do this. In different places and with diverse partners, we should be ready to pursue discussion and program on patent law and legal procedures that address power imbalances.
   - MCC in its international work should look for ways we can strengthen local groups working on the trade/intellectual property agenda, especially in places where regulation and control systems are not strong. The experience of African Centre for Technology Studies (ACTS) in Nairobi is a good example.
   - MCC should find ways to connect with the World Trade Organization discussions, possibly through the Quaker United Nations Office Geneva office's work.

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