GMOs and the Social Sciences and Humanities

It's all about life
It's all about ethics
It's all about politics
It's all about global governance

Okay, I will start off with a personal observation. This subject really freaked me out. I was freaked out because I had no idea how I was going to address this subject with a group of Arts and Science students. The subject matter is just so broad, as the implications of this technology span a wide range of natural and human systems and social science and humanities topics. Of course that was the case for climate change as well, but somehow dealing with the sun's energy, atmospheric science, and ecological and human systems is easier than dealing with the minute details of the fabric of life itself. The universe of the small has been much more of a challenge for me than the universe of the big.

When I started looking at the relationship between biotechnology and genetic engineering and the social sciences and humanities, I realized the true enormity of the subject. And everywhere I looked, I found examples of the complex relationship between the life sciences and the social sciences and humanities. And everywhere I looked, I found examples of how this subject touches on life.

A few examples of the relevant interfaces between the sciences and the arts included:

- the mapping of the human genome, and the implications for diagnoses, gene therapies, prevention of hereditary disease, and the ethical debate surrounding the "genetic manipulation" of humankind and the social consequences of this manipulation;
- the development of new pharmaceutical products, especially vaccines and drugs, and the issues of equitable access to these products;
- stem cell research and ethical issues related to cloning;
- the genetic modification of organisms to add or enhance natural traits, and the issues related to food security, agriculture, and biodiversity.

There was no way I could address all of this. So I decided to focus on one aspect of the larger biotechnology and genetic engineering subject and look almost exclusively at Genetically Modified Organisms (GMOs) and food. Why food? Because we all eat it, we all need it, and this is where most of the social, political, and global dialogue and action seems to be concentrated. I was also hungry when I made this decision.

GMOs and Human Society (It's all about life…)

As a starting point, I began with the same reminders I used to start the climate change unit. Biotechnology and genetic engineering is not just a physical and life sciences issue: it is a political, economic, and social issue.

Like climate change, the issues surrounding biotechnology and genetic engineering are a classic example of the clash between a concept grounded in science, and the economic, political, and social context in which policy decisions are made and implemented.

To understand climate change as a phenomenon, one must not only understand the physical and life sciences aspects of the issue, but the social sciences and humanities aspects as well.

1. Playing God? Spirituality and GMOs

Virtually all of the world's religions have a creation narrative of some kind. However the GMO debate has been heavily concentrated in rich, industrialized, and for the most part Christian parts of the world. As a result, the "playing god" issue (in the Christian sense) has been the most prominent expression of the faith/science dialogue when it comes to GMOs.

Prince Charles weighed in with an argument that it is wrong to play god with nature:

"Mixing genetic material from species that cannot breed naturally, takes us into areas that should be left to God. We should not be meddling with the building blocks of life in this way."

Richard Dawkins (Biologist and Athiest) has made the point that all agriculture, at some level, is unnatural:

"Wheat, be it ever so wholemeal and stoneground, is not a natural food for *Homo Sapiens*. Nor is milk, except for children. Almost every morsel of our food is genetically modified – admittedly by artificial selection not artificial mutation, but the end result is the same. A wheat grain is a modified grass seed, just as a Pekinese is a modified wolf. Playing God? We have been playing God for centuries!"

Interestingly, the Catholic Church came out in favour of GMOs in 2003 while opposing many other aspects of biotechnology. This view was based largely on the potential of GMOs (as the Vatican saw it) to address world starvation and malnutrition.

However, on March 10, 2008 the Vatican issues an update to the "seven deadly sins", which now include: (1)genetic modification; (2) human experimentations, (3) polluting the environment; (4) social injustice; (5) causing poverty; (6) financial gluttony; and (7) taking drugs.

"You offend God not only by stealing, blaspheming or coveting your neighbor's wife, but also by ruining the environment, carrying out mortally debatable scientific experiments, or allowing genetic manipulations which alter DNA or compromise embryos." (Monsignor Gianfranco Girotti)

The Muslim Council of Indonesia approved the import of GMOs in 2003. A *Fatwa*, or religious edict, could have been issued banning GMOs.

GMO foods are generally ruled as Kosher by rabbinical experts, largely on the basis of their consistency with Jewish law and the Kosher character of inputs into any given GMO.

A Pew Initiative on Food and Biotechnology poll conducted in 2001 revealed that 57 percent of Protestants (and 62 percent of Evangelicals) oppose agricultural biotechnology based on their religious or ethical views while 37 percent are in favor; Catholics followed closely behind with 52 percent opposed and 42 percent in favor. Among Muslims, 46 percent said they are opposed, with 32 percent in favor. Jews were the most favorable of the technology, with 55 percent in favor and 35 percent opposed.

The key variable does not seem to be religious belief, intensity of religious belief, or interpretation of belief, but rather the attitude toward science.

2. Ethics and GMOs (it's all about ethics…)

OK, here is where I need to provide a basic introduction to ethics.

Right off the bat, it is important to distinguish between ethics and morals. Ethics is all about the theory of right and wrong, the greater good and right action. Morals are all about the practice of ethics in decision making, action, and the observance of ethical principles. The inability to distinguish between right and wrong is indicates "amoral" qualities, while actions that violate ethical principles are taken to be "immoral."

The study of ethics examines metaethics (the study of where ethical systems come from), normative ethics (the development of moral standards of right and wrong), and applied ethics (the resolution of specific ethical problems). So, applied ethics is kind of like applied science, except without the jackets.

From these broad strands of ethical work we get different ethical systems built around different suppositions or starting points. Here are a few examples of these ethical systems and how they relate to GMOs.

Virtue theory stresses the development of good character. Drawn from Plato's cardinal virtues (wisdom, courage, temperance, and justice) this system emphasizes virtue over vice (cowardice, insensibility, justice and vanity). For critics, GMOs are often described as immoral because they are a demonstration of a will to power over the natural world, a desire to dominate nature. This is an ethical argument based on virtue theory.

Consequentialism and utilitarianism are ethical systems based on consequences, and a more specifically on a cost-benefit evaluation of those consequences. Essentially, this is about goodness versus badness. Consequentialism posits that an action is moral if the consequences of that action are more favourable (i.e. good) than unfavourable (i.e., bad). According to The Oxford Guide to Philosophy, utilitarianism is an approach that regards the morality of actions as entirely dependent on consequences or results for human (or sentient) well-being. There are many variations, but contemporary utilitarianism tends to stress that the "goodness" of any state of affairs is solely a matter of how much overall (or average) well-being people enjoy in that state of affairs. The rightness or goodness of an action is determined by the extent to which it produces a greater balance of desire satisfaction for those involved. Some utilitarian thought focuses on the need to maximize satisfaction, others on finding an optimal level of satisfaction relative to other factors (suggesting trade-offs), while still others suggest satisfactory outcomes are sufficient to be considered right or good. If you are thinking that is there is a lot of overlap here, you are correct: one form of utilitarianism is actually called direct consequentialism! In the GMO debate, anyone arguing that the dangers of GMOs outweigh the benefits (or the other way around) is making a consequentialist or utilitarian argument of some kind or another.

Then there is *duty theory*, an ethical system based on obligations. These obligations come in the form of duties to us (ourselves) and to others. These duties are not as subject to consequentalist or utilitarian deliberations, because they are considered more absolute (you have a duty to care for your children, you should not kill). In the GMO debate, duty theory can be found in the argument

that we have a responsibility to nature and to future generations not to tamper with the genetic order or that we have a responsibility to use science to improve the human condition.

The ethical debate over biotechnology began in the mid-1970s, when ethical issues associated with recombinant DNA and basic gene transfer research developed in medicine, human DNA manipulation, and biological weapons development.

Ethical controversy over specific agricultural products began in the early 1980s, when the first legal actions were taken against anti-ice bacteria that was to be used to protect crops from frost damage.

Since these early beginnings, several ethical issues have arisen. There is no way I could cover them all, so this was a bit of a selective process on my part.

It is clear that one fundamental ethical issue about GM crops is their impact on human welfare. This issue revolves around the question of whether GMOs will increase human welfare or damage human welfare, by harming consumers or the environment and wildlife. Of critical concern are human safety concerns including the possible existence of toxins in GM plants; allergenetic reactions; and the use of antibiotic marker genes in plants that could lead to human resistance to antibiotic medicines.

Another ethical issue is the concern that genetic engineering is “unnatural” or constitutes a “trespass” against nature. The problem is where do we draw the line between “natural” and “unnatural”? Today’s maize varieties are very different than their wild ancestors, so is Bt maize “unnatural”?

Consider that some GMOs that have been developed through genetic engineering might have occurred through conventional plant breeding techniques: the same techniques that gave as almost all of today’s major cash crops. So is the “unnatural” nature of GMOs all about process rather than outcome? Other GMOs might not have been achievable by conventional breeding but the end result is similar to the kinds of effects of conventional breeding have had on insect resistance or increased yield or durability.

Another ethical issue is the question of conditions: if certain conditions can be satisfied, are GMOs unethical? So if developing countries had equal access to and control over GMOs, and if GMOs were not harmful in any way to humans and the environment, would GMOs still be considered unethical?

Yet another ethical issue is the lack of public participation in the decision-making process surrounding the development, approval, and production of GMOs. The lack of a sufficient level of transparency and openness in this process (dominated by agribusiness and government agencies) has led to charges of a serious “democratic deficit” in the GMO debate and therefore a serious breach of the public trust.

Finally, ethical issues have been raised concerning the threat GMOs pose to biodiversity, seed stocks, the survival of traditional crops and agricultural practices. In effect, GMOs are taken to represent a threat to traditional agriculture in favour of biotechnology largely controlled by corporations.

Reasonable people have spent a lot of time trying to develop ethical systems for GMOs. Here is one attempt by the Nuffield Council on Bioethics. Basically, it says that to be ethical, the development and introduction of GMOs must:

- minimise any risks both to our food and to our environment that might arise from the use of GM plants in agriculture;
- maximise consumer choice, so that consumers are informed when GM material is included in food products and are able to choose whether or not to buy such foods;
- maximise the potential benefits of GM technology for people throughout the world, and particularly to encourage a fair distribution of such benefits;
- determine the ethical desirability of particular types of genetic modification and their cumulative impact on the environment and society at large;
- maximise the dissemination of clear information about GM technology from trusted sources, its potential benefits and potential risks, and what is being done to increase knowledge about these matters.

3. The Precautionary Principle and Substantial Equivalence

I decided to follow ethics with this issue because they are actually closely related (as is the next topic). Remember the precautionary principle from the unit on climate change? Well, this issue is a big one in the GMO discussion as well.

Here, the question boils down to what is safe food? Here is the definition of "safe food" according to the Organisation for Economic Cooperation and Development (OECD):

"Food is considered safe if there is reasonable certainty that no harm will result from its consumption under anticipated conditions. Historically, food prepared and used in traditional ways is considered safe on the basis of long term experience, even though it may naturally contain harmful substances. In principle, food is presumed to be safe unless a significant hazard has been identified." (OECD 1993)

Okay. But GMOs are in a different category, right? So in the case of GMOs, enter the precautionary principle, as defined by the Rio Declaration (yes, this is from the same conference that launched the UNFCCC):

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Principle 15, Rio Declaration on Environment and Development)

This issue has caused a lot of diplomatic squabbling as we shall see later. Basically, the position of the US and Canadian governments is that GMO products are "substantially equivalent" to non-GMO products. What does that mean? Well, the key concept behind "substantial equivalence" is function: how does the food function in the body? The GM product may be different physically from the conventional product, but if it looks, tastes, smells, and digests the same, then the product is functionally the same as an non-GMO product, and should be treated the same (that is, as substantially equivalent).

4. Labeling GMO Foods

Does the consumer have a right to know if a product they are consuming or buying contains GMOs? The intuitive answer is yes, but this begs a follow-on question: the right to know what? Or are we talking about the right to know the relevant (whatever that may be)?

Take the example of a vegetable oil made from GM crops: does the consumer have a right (or need) to know that this oil was made using a GMO, given that after the refining of the oil, no DNA (no genetic material) remains in it?

Suppose you have a bean modified with a tomato gene and a tomato modified with bean gene. Separately, these would need to be labeled. But would you need to label a soup made from the two (complete set of genes)? If the answer is yes, then labeling is as much about process (because the genetic modification may itself cause issues related to human safety) and the fact that the products of origin--the tomato and the bean--are both modified in and of themselves, than it is about the genetic content of the soup.

Suppose you have a product that contains no GMOs, but the process used to create the product used a GMO. Would this product have to be labeled?

5. Patent Law and GMOs

Well, I am not a lawyer but this is a really big part of the GMO story. The main issue seems to be patent law.

Patents exist to protect innovators: research and development of new ideas and products is expensive and time consuming. Without patent rights, any producer could reverse-engineer a product and sell it more cheaply on the market because they would not have to recoup the costs of research and development. Without patent law, the economic incentive to innovate would be greatly reduced.

But patents can be enforced without scruple, skew research toward high patent potential products, and cause harmful inequities between developed and developing countries.

A famous example of the issues (which predictably are largely ethical issues) surrounding GMOs and patent law was case of Percy Schmeiser versus Monsanto.

Monsanto is a famous/infamous biotechnology company that developed a resistant gene for the canola plant (remember Dave and his discussion of glyphosate introduction into corn and soya beans?) which has the effect of producing canola resistant to Monsanto's Roundup brand of herbicide. Monsanto marketed this resistant canola seed as Roundup Ready Canola. The big selling point of this seed was that farmers using it are able to control weeds using Roundup, while avoiding damage to the Roundup-resistant crops.

So how does the law come into play? Well, the users of the seed are required to enter into a formal agreement with Monsanto, which specifies that new seed must be purchased every year, at an annual cost (a licensing fee) of C$15 per acre.

Roundup Ready Canola was introduced in Canada in 1996. Two years later, Roundup Ready Canola accounted for 25% of the country's canola area.

Enter Percy. Percy Schmeiser was a canola breeder and farmer in Bruno, Saskatchewan. In 1997, Percy discovered that one of his fields contained canola that was resistant to herbicide Roundup. But Percy had never bought or used the Monsanto Roundup Ready seed. A farmhand later harvested and saved the seed, which was used to replant the field the following year. In 1998, over 95% of Percy Schmeiser's canola crop was identified as the Roundup Ready variety.

Enter Monsanto. The company sued Percy Schmeiser for patent infringement. Monsanto charged that by keeping the Roundup Ready canola seeds and failing to obtain a license to use them, Percy had violated the Monsanto patent. In his defence, Percy Schmeiser maintained that his use of the seed was accidental, and that he had a right to save and reuse seed from plants that grew on his land. This he argued overrode the Monsanto patent. The case went to federal court.

The Supreme Court ruled in favour of Monsanto, arguing that patent law rights take precedent over property rights in the Patent Act. Schmeiser won a moral victory, because the court held that he was not liable to pay damages or Monsanto's legal fees (which by this time had risen into the hundreds of thousands of dollars!).

There are some public myths about this decision that deserve mention. First, Schmeiser has contended that he lost the right to use his strain of Canola he had bred over decades of farming because he could not prove that there were no Round Up Ready genes in his seed stocks, which he then had to destroy on the advice of his lawyers. This interpretation is not consistent with the ruling of the Supreme Court, which does not require a farmer to prove the absence of any patented gene prior to growing any seed.

Second, the decision was widely interpreted as a case of accidental contamination that would put farmers everywhere at risk of lawsuits from patent holding corporations. This is not the basis for the Supreme Court's decision. The decision was based on the fact that Schmeiser had identified, saved, and then used Round Up Ready seed, and therefore this was not a case of accidental contamination but a case of intentional violation of a patent. The case of accidental contamination beyond a farmers control was not at issue in the case.

Third, the ruling did increase the legal position of biotechnology companies in Canada, because the decision found that patent protection for a single gene or cell extends to the entire plant. This is despite the general legal precedent in Canada that higher life forms cannot be patented. And so, the Monsanto versus Schmeiser case has added to the ethical and legal debate over patenting life forms. Here is an example of a view opposing such patents:

"Patents on life-forms and living processes should be banned because they threaten food security, sanction biopiracy of indigenous knowledge and genetic resources, violate basic human rights and dignity, compromise healthcare, impede medical and scientific research and are against the welfare of animals. Life-forms such as organisms, seeds, cell lines and genes are discoveries and hence not patentable." (Institute of Science in Society. 2000. Open Letter from World Scientists to All Governments Concerning Genetically Modified Organisms (GMOs).

6. Science, Society, and GMOs

The debate over GMOs, like the debate over climate change, reflects the awkward and contentious social interface between the physical and life sciences and the social sciences and humanities.

At one level, the social debate over GMOs reflects two different sets of rational thinking, economic-scientific rationality and social-humanistic rationality.

From an economic-scientific rationality perspective, technology and innovation are positives and are required for continued for economic growth and human well-being. Technological innovation is to be encouraged, and efforts to manage or control that innovation should be consistent with scientific knowledge based on tests.

On the other hand, from a social-humanistic rationality perspective, social issues take priority over technological innovation and economic growth. Technological innovation should be conducted within a set of boundaries that establish what is socially good and what is not. Efforts to manage and control innovation should be guided by the interests of consumers and social values.

At another level, the battle over GMOs is an example of the competition for public trust and discursive power that takes place on many issues involving the scientific world and the policy world. The GMO battle is not only a battle about science, ethics, safety, and law. It is also a battle between pluralist interest group politics and their fight in the media.

In the social debate over GMOs the role of science has evolved. Initially, the hope was that science would inform regulations on human and environmental risk: science would literally be an impartial arbiter of risk and safety.

This hope began with the first effort to regulate research into DNA: the Asilomar Conference (Pacific Grove, Monterey, California). This was a gathering of 140 scientists and some lawyers and physicians who came together to discuss biosafety issues surrounding recombinant DNA research, and to promote the public awareness and transparency of this science.

During the conference, the principles guiding the recommendations for how to conduct DNA experiments were established. The first principle for dealing with potential risks was that containment should be made an essential consideration in the experimental design. A second principle was that the effectiveness of the containment should match the estimated risk as closely as possible.

In addition to regulating the experiments that were conducted, the guidelines also forbade the performance of other experiments. One such experiment was the cloning of recombinant DNAs derived from highly pathogenic organisms. In addition, neither the cloning of DNA containing toxin genes, nor large scale experiments using recombinant DNAs that were able to make products that were potentially harmful to man, animals or plants were allowed under the guidelines.

On the issue of public awareness, those attending the conference wanted DNA research to be transparent to the public. The Watergate scandal of 1972 was one of the reasons that this motivated the scientists at the Asilomar Conference to bring science into the public eye to ensure that they would not be accused of a cover-up.

Bringing science into the public eye also coincided with the rapid rate at which recombinant DNA technology entered the industrial world. Debates about DNA research were largely won by scientists who argued that the risks were slight.

However, because of the practical applications of the technology, funding for research using it started coming more from the private sector and less from the public sector. In addition, many molecular biologists developed ties with private industry as equity owners, corporate executives and consultants. The modern biotechnology industry is the result, and the creation of that industry introduced commercial interest into debates about biotechnology research and ethics.

Just as importantly, the status of science has been undermined by a loss of public trust. This lack of trust has come from an erosion in the faith of public institutions, the use of science to create ambiguity over safety, and growing concern about food safety.

This "public trust deficit" has been exploited by NGOs, and the competition for the public trust and discursive power has shifted the entire agri-biotech debate from technical-scientific risk to the realm of values (about nature and life) and culture (traditions and lifestyle).

The complex scientific issues, the scientific ambiguities and uncertainties involving risk, and possible future developments in science have been replaced by value based, right versus wrong, good versus bad portrayals of technology and the interest groups involved.

And so, rather than talk science, corporations are portraying themselves as "green" and environmentally friendly, or supportive of food security in developing countries. The aim is to make themselves look less self-interested and more trustworthy, concerned with the public interest. Meanwhile NGOs portray themselves as guardians of the public trust, the wards of certification of "greenness", and fighters against evil biotech companies and captured governments.

Some NGO campaigns have demonstrated overzealous portrayals of science: monarch butterfly larvae was said to be threatened by GMO corn, and a flawed report showing high toxicity in rats that had been fed GMO potatoes.

The end result is that there is not a lot of space for informed discussion and debate about science as social debate (the competition) has grown more acrimonious and moralistic. This is dangerous because for science because public opposition is a crucial variable: once opposition sets in, it is extremely difficult to get it back on the basis of scientific rationality (witness the nuclear industry).

The GMO Debate Summarized

Even with a focus on GMOs and food, there were a number of issues that there was simply no space to address, but many of these issues can be addressed in the PBLs for this unit of the course. So I thought I would summarize the main issue areas in the GMO debate, and if we have time look at the Golden Rice example.

What are the issues?

- The sanctity of life and the conviction that tampering with nature is a violation of natural or divine law against the potential for improving the human condition;
- Ethical deliberations about the benefits and costs of GMOs and the ethical responsibilities to people and the environment;
- Human safety concerns;
- Concern for environment and biodiversity;

- Consumer rights and information access concerning final product (retail) labeling and the use of GMOs in production of food;
- Regulatory autonomy and sovereignty from business interests;
- Threat to traditional agriculture, livelihood, control of agricultural inputs (seeds).

The Golden Rice Case Study

Dave examined the science of the Golden rice issue last class. Dietary vitamin A deficiency is a serious global concern. The deficiency can lead to serious health problems, including impaired vision and diarrhea. Up to two million deaths of children under five could be avoided with sufficient vitamin A intake.

Rice is the dietary staple of half of the world's population, but the part most people eat (the endosperm) contains no vitamin A. And so, an idea was developed to take the genes that produce protovitamin A (a precursor to vitamin A) and to insert them into rice. This led to the creation of "Golden Rice" using daffodil genes (which turned the rice golden in colour).

Critics charged that:

- To obtain the necessary vitamin A, unrealistic amounts of rice would have to be consumed
- Encourage the increased planting of rice and affect traditional rice growing practices
- Affect the biodiversity of rice stocks
- Vitamin A exists in most traditional vegetables: the problem of dietary deficiency comes from poverty, lack of control over land, and modern agricultural practices that threaten the balance of traditional diets
- The only ones to benefit will be companies that produce and patent the genetically modified rice

Advocates charge that:

- Golden rice was not expected to satisfy the entire dietary requirement for vitamin A, just supplement it: some supplementation is better than none to reach daily requirements
- New varieties of Golden Rice do carry sufficient vitamin A
- Not all people can grow or have access to traditional foods: they do not know how, have no land, or live in climates that can not support them
- Critics are more interested in fame and donor money than the science and the human impact of vitamin A deficiency

<u>GMOs and Domestic Politics (It's all about politics…)</u>

Well, here we find ourselves back with domestic politics again, just as we did with climate change. The politics of GMOs are characterized by a significant divergence between the US and Europe and the "developing" world because of differences in public perception, interest group dynamics, political systems, and industrial structure.

In the US, biotech firms and large farming interests (agribusiness) have lobbied for and obtained relatively light regulatory frameworks. In Europe, NGOs advocating more stringent measures based on the precautionary principle have successfully lobbied the EU for tougher measures against GMOs.

The US

In the US, concerns about the safety of bio-engineered foodstuffs first emerged in the 1970's. Governments allowed scientists to regulate themselves, and were supportive of an economically promising new industry. In the 1980s, when laboratory experiments moved to field trials of potential products, such as Monsanto's Roundup Ready maize and Syngenta's Bt cotton, the debate began on the risks to humans and the environment.

The US responded by assuming "substantial equivalence" between GM foods and conventional crops. All GM crops were subject to central regulatory oversight by federal government agencies responsible for conventional food regulation (USDA, EPA, FDA).

The first commercially grown genetically modified whole food crop was the Flavr Savr tomato, which was made more resistant to rotting by Californian company Calgene. It was introduced into the US market in 1994. In 1995, the US began the first large scale planting of GMO crops for market use. Earliest crops included insect protected cotton and herbicide resistant soybeans (1996).

GMO crop production increased rapidly. By 2000, the US had 30.3 million hectares of GM crops planted, 68% of the world total. Between 1995 and 2005, the total surface area of land cultivated with GMOs had increased by a factor of 50, from 17,000 km_ (4.2 million acres) to 900,000 km_ (222 million acres), of which 55 percent were in the United States.

Biotechnology, the US, and Monsanto

The story of Monsanto in the US illustrates many of the themes we have addressed so far. It also illustrates the role of corporate lobbying on this issue (at least in the US).

In 1986, executives of Monsanto went to the Reagan administration and asked for the government to regulate the emerging genetically modified food industry. There were no products yet, but the company and others like it knew that the public was getting worried about the new technology and wanted government regulation so there would be confidence in the industry. Monsanto also planned to hire GM opponents as consultants. The plan was to gradually secure public confidence.

But in the early 1990s the strategy changed. A new executive team took over the company, believing in the science and the economic potential of the products. The new strategy was to sweep away regulatory obstacles, discredit GM opponents, and aggressively market the GM product line. The company shifted its efforts to remove regulations and obtain government approval for release of more products.

In 1992 the Bush administration (Bush I, that is) removed most regulatory oversight on GM foods, essentially making them subject to the same oversight as other products, so they would not, as Vice President Dan Quayle put it, "be hampered by unnecessary regulations." Biotechnology companies would no longer need government approval to sell their products. Any additional product testing of GM foods would be carried out by the companies themselves, and labeling was ruled out as potentially misleading to the consumer.

In the US Food and Drug Administration (FDA) scientists were opposed to this measure, believing there was a scientific basis to require tests of GM foods.

Even the GM food industry was surprised by Monsanto's position against labeling, as evidence by the following expressions:

> "Monsanto forgot who their client was. If they had realized their client was the final consumer, they should have embraced labeling. They should have said, 'we're for it.' … They should have said, 'I'm the consumer's friend here." (Thomas N. Urban, then Chairman and CEO of Pioneer HiBred International).

> "How could you possibly argue against labeling? The public trust has not been nurtured." (Roger Salquist, former CEO of Calgene (the company that launched the Flavr Savr Tomato engineered for slower spoilage, and the first GM fruit to hit the market).

This prompted the beginning of the anti-GM food movement, which spread rapidly around the world. Opposition grew in the US and Canada, but especially in Europe, where the Clinton Administration took a hard line trying to promote GM foods. This strategy also back fired. Jeremy Rifkin (a noted anti biotech activist), describes the early 1990's as a "turning point" in the campaign against GM foods.

Monsanto would suffer the consequences: the company's stock price fell, and it ceased to become an independent company when it was taken over by Pharmacia, a New Jersey Drug company.

This story illustrates two things:

- The GM foods industry exerted a decisive influence over government regulatory practice: "In this area, the US government agencies have done exactly what big agribusiness has asked them to do and told them to do." (Dr. Henry Miller, former head of biotechnology issues at FDA from 1979 to 1994)
- Corporate practice had a major role in galvanizing the anti-GM food movement (as one former Monsanto strategy group member said: "When you put together arrogance and incompetence, you've got an unbeatable combination. You can get blown up in any direction. And they were."

Even Robert Shapiro, the architect of the new Monsanto strategy, would later admit: "We've learned that there is often a very fine line between scientific confidence on the one hand and corporate arrogance on the other. It was natural for us to see this as a scientific issue. We didn't listen very well to people who insisted that there were relevant ethical, religious, cultural, social, and economic issues as well."

Europe

The EU authorized the use of the first GM product within EU territory in 1994. In Europe, the initial response of European states was the same as the US. But the approach changed when the EU introduced an-EU wide set of GMO regulations in 1990: the deliberate release directive. These rules required a risk assessment and safety approval for all GM products in the EU.

These regulations were based not on the "substantial equivalence" concept used in the US, but on the precautionary principle. Using this system, some GM products were approved for the EU market in 1996-1997. Later, the EU would require labeling of all GM products.

There were disputes within the EU on GMO policies: when the issue of whether or not to import Ciba-Geigy's Bt-176 maize from the US came up in 1996, the European Commission was divided. When expert opinion had ruled that safety concerns were nonexistent, the Commission approved the sale of the maize in the EU. This provoked a huge controversy, with the Pesticides Action network arguing: "This is crazy. They have started a gigantic experiment with us as the guinea pigs."

As a result of growing anti-GM sentiment in European publics, from 1998-2004 the EU placed an informal moratorium on the approval of GMO products. Several EU countries also put national bans on certain types of GM foods (a clause in the 1990 EU deliberate release directive regulations permitted this).

In 2004 the EU began authorizing GMO products again after introducing new regulations on food labeling (requiring all GMO foods to be labeled as such) and traceability (requiring GMO products to be traced and recalled if necessary). There were 10 approvals between 2004 and 2006, and overall about 30 GMO products are authorized for sale in EU today.

Why is there such a difference between EU and US/Canada views of GMOs?

- Experience of mad cow and foot in mouth disease
- less faith in regulatory and oversight bodies in Europe as a result
- national regulatory policies on GM products was seen as a barrier to efficient internal trade in the EU: better to have an EU-wide policy
- the identification of GMO issue by the EU as a way of building credibility as defender of public trust (anti-EU sentiment is quite high among Europeans)
- opposition to globalization and big business in European publics

Developing Countries

When the matter of GMOs in the developing world is addressed, a variety of issues are engaged. These include the impact of GMOs on traditional agricultural techniques, crop biodiversity, retention and practice of traditional knowledge of plants and growing techniques, loss of control over seed, and the development of a "biotech divide" between wealthy countries and poor countries

Developing countries are a GMO battleground:

- Both the US and Europe have been using incentives and disincentives to motivate developing countries to side with their position on GMOs;
- At the same time, interest groups and NGOs from all sides of the debate have been working with civil society actors in the developing world to encourage them to adopt their positions on GMOs;
- At the same time, developing countries have been grappling with the issue of what their regulatory stand on GMOs should be.

The US has been developing bilateral cooperation in agricultural technology research and development in the developing world:

- USAID Biotechnology Initiative
- Collaborative Agricultural Biotechnology Initiative
- Collaborative Research Support Programs
- African Agricultural technology Foundation

- Bean/Cowpea Collaborative Research Support Program
- African Center for Excellence in Biotechnology

At the nongovernmental level, hundreds of NGOs, business associations and individual firms have attempted to influence developing countries policies on GMOs:

- Corporate donations of technology to developing countries research institutes
- Funding for biotechnology or biosafety research
- Education and instruction of stakeholders

And on the other side:

- Funding for protest campaigns
- Support for organic and local food production
- Support for agricultural capacity building

In developing countries a debate is underway on GMOs, especially as they related to food imports, GMO production for exports, and the preservation of local agricultural practices

There is growing frustration in the developing world with what they see as interference coming from developed countries, both from governments looking for international allies on GMOs to corporate interests and anti-GMO activists. There is a growing sense in developing countries that they need to develop their own biotechnology sectors, and establish their own national approaches to GMOs based on their own needs.

Two recent examples highlighted the level of concern about GMOs in developing countries:

US food aid to Africa: 2002-2003 the WFP provided several sub-saharan African countries at risk of severe famine with food aid. The US contribution contained transgenic Bt corn. Zambia rejected the US food aid, and a fight broke out with the US accusing the EU of having pressured Zambia to reject the food aid and the EU accusing the US of trying to introduce GMOs into Africa using the WFP.

Support for US WTO legal action against EU regulations: pressure was exerted on developing world countries to support either the US or the EU position. The case of Egypt is notable. Egypt initially supported the US position, but then backtracked and withdrew its support. At the time, Egypt was the second largest recipient of US foreign aid, and was negotiating a free trade agreement with the US. But Egypt was also heavily dependent on Europe for exports and imports (over 33% for both) and received financial assistance from the EU as well. And so Egypt tried to appease both, refusing to actively support the US or EU position and withdrawing from the proceedings.

Future battlegrounds over the GMO issue will include provincial or regional governments versus federal governments: the legitimacy of international and national regulatory bodies is in question. For example, Australia on a national level is pro GMO, yet nine of its 10 states are strongly anti-GMO and have passed a moratorium on growing GMO crops.

India and China are shaping up as the two largest future GMO battlefronts. China, for example, has the second largest GMO research next to the U.S. However, because of public opposition both countries now require mandatory labeling for GMOs.

Whew. OK, next week id the global governance side of all of this!