

## **Should the United States require labeling of genetically engineered food products?: Voices of competing American interests**

Sarah Pope

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### **Abstract:**

In this case, students will explore a variety of perspectives on the risks and benefits of agricultural biotechnology. The setting is a forum to debate whether or not the United States should require, as countries in Europe already have, labeling of food products containing genetically modified organisms. Presenting their arguments against labeling are representatives from Calgene, a major biotech corporation; papaya growers from Hawaii; and a small group of scientists who are using biotechnology for humanitarian aid. Debating in favor of labeling are members of Citizens for Health; a contingent from the Union of Concerned Scientists; and a coalition of organic farmers. Although the forum has been convened to talk about labeling, all interests present feel that agricultural biotechnology itself is really on trial.

Students must consider the merits of positions on both sides of the debate and recognize that labeling, if adopted, might well prove to be a first step towards more serious regulation of bioengineered food products. Are the potential benefits of biotechnology worth the risks? If so, how should the process and products be regulated? Is there a way to ensure that the needs and concerns of all interest groups are addressed?

As we enter the 21<sup>st</sup> century, these are questions we must address. Biotechnology, risky though it may be, will not simply go away; we must decide how we can best to use it in positive ways while guarding against damage to the environment, our culture and human health. The present generation of students will have important choices to make about the directions agricultural biotechnology takes, whether as policy-makers or scientists or simply as consumers of food. This exercise is designed to induce students to think carefully about the pros and cons of genetic engineering, in order that they might make better-informed choices in their daily lives.

### **Background:**

Gregor Mendel laid the cornerstone of agricultural biotechnology in his quest to understand how plants pass on traits to subsequent generations. In the mid-1900s, scientists began to gain an understanding of DNA and by the 1960s they were experimenting with genetic code. In the 1970s, they discovered enzymes that act as genetic scissors and glue, cutting and pasting specific gene sequences. Scientists could thus transfer genes to micro-organisms, but the genetic engineering of plants was more difficult, as they contain many more genes than simple microbes and have rigid cells walls that are hard to penetrate. However, scientists in the 1980s found a solution in a bacterium called *Agrobacterium tumefaciens*, which infects the genetic system of broad-leaf plants. By removing the bacterium's genes and replacing them with agronomically useful ones, scientists can "infect" plants with new genetic material.<sup>1</sup> Another technique was necessary for most cereal crops, however. Dr. John Sanford of Cornell University invented the gene gun that can "shoot"

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<sup>1</sup> Henk Hobbelink. 1991. "Biotechnology and the Future of World Agriculture: The Fourth Resource." London: Zed Books Ltd.

genetic information into the cells of an organism.<sup>2</sup> Today, it is theoretically possible to combine DNA from any organisms on Earth. Ostensibly, there are few bounds to the improvements we can make on plants, animals, and perhaps even ourselves. For example, genes from flounders have been used to increase the ability of tomatoes to withstand freezing temperatures.<sup>3</sup>

However, there are some practical restrictions. Genetic engineering has turned out to be much more difficult and more expensive than anyone predicted. The most desirable traits for agriculture are governed by complex interactions of many genes, but our best technology allows the transfer of only a few genes.<sup>4</sup> We still do not understand the nuances of complicated gene interactions.

The biggest players in the agricultural biotechnology industry are chemical corporations, followed by universities and the US Department of Agriculture; seed companies, biotech companies, and food companies.<sup>5</sup> Some examples of plant traits these organizations are developing are herbicide tolerance, virus, insect and disease resistance, quality traits, and nutrient fortification.<sup>6</sup>

While proponents of agricultural biotechnology assert that it has the potential to feed the world, prevent disease and promote health, improve the quality of fruits and vegetables, reduce pesticide use, and increase reliability and purity of food crops,<sup>7</sup> they face widespread opposition. Many people harbor concerns that by genetically engineering food crops, we are releasing poorly understood organisms that may threaten the environment and human health, reduce biodiversity, endanger the livelihoods of organic farmers, and increase the dependence of small scale and Third World farmers on powerful international corporations, who will gain most of the benefits from the new technology and will control most agricultural distribution.<sup>8,9</sup> Grassroots campaigning in many western European countries has already achieved the goals of locally enforcing mandatory labeling of GMOs and has prompted those governments to restrict or reject imports of genetically engineered food. Americans, however, have yet to decide exactly how they will receive agricultural biotechnology.

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<sup>2</sup> Dennis Gonsalves et al. 1998. "Transgenic virus resistant papaya: New hope for controlling papaya ringspot virus in Hawaii." From APSnet Features, The American Phytopathological Society, St. Paul, MN. Online at [www.apsnet.org/education/feature/papaya/Top.html](http://www.apsnet.org/education/feature/papaya/Top.html)

<sup>3</sup> Jane Rissler and Margaret Mellon. 1996. "The Ecological Risks of Engineered Crops." Cambridge, MA: The MIT Press.

<sup>4</sup> Paul Raeburn. 1995. "The Last Harvest: the Genetic Gamble that Threatens to Destroy American Agriculture." New York: Simon and Schuster.

<sup>5</sup> Hobbelink 1991.

<sup>6</sup> Rissler and Mellon. 1996.

<sup>7</sup> UC Davis Center for Consumer Research. "Benefits of Biotechnology." Online at [ccr.ucdavis.edu/biot/html/benefit.html](http://ccr.ucdavis.edu/biot/html/benefit.html)

<sup>8</sup> Citizens For Health, online at [www.citizens.org/Food\\_water\\_safety/GeneticEngineering/GMO/Natural/GMONaturalorganic.htm](http://www.citizens.org/Food_water_safety/GeneticEngineering/GMO/Natural/GMONaturalorganic.htm)

<sup>9</sup> Union of Concerned Scientists. "Risks of Genetic Engineering." Online at [www.ucsusa.org/food/gen.risks.html](http://www.ucsusa.org/food/gen.risks.html)

**Scenario:**

May 2001

It is a hot, dry day in Los Angeles, California. Smog dinges the mountains, which are barely visible in the distance out the floor-to-ceiling windows of the conference room on the 60<sup>th</sup> floor of the GenTech Tower. Although the room is perfectly air-conditioned and outfitted with every comfort modern technology can afford, temperatures are rising inside.

Nineteen people are seated around the long oval table that stretches the length of the room. They are a moderator and representatives of six different organizations, convened today to debate the merits and drawbacks of agricultural biotechnology, and more specifically, the need for mandatory labeling on foods containing genetically-modified ingredients.

Presenting their arguments against labeling are representatives from Calgene, the first company to commercially offer genetically engineered tomatoes; papaya growers from Hawaii's Puna district, whose livelihood was saved by the introduction of transgenic papayas after a virus decimated regular plants; and a small group of scientists who are using biotechnology to add vital nutrients lacking in many Third World diets to food crops. Debating in favor of labeling are members of Citizens for Health, a consumer advocacy group that worries about health risks involved with genetically engineered foods, a contingent from the Union of Concerned Scientists who are alarmed by the potential ecological damage genetically modified (GM) crops may cause, and a coalition of organic farmers who fear agricultural biotechnology will severely endanger their ability to protect their crops against pests using natural measures and destroy biodiversity. They also oppose genetic enhancement of crops on philosophical grounds. One member from each team will briefly outline his or her organization's position on agricultural biotechnology.

After a welcome and an overview of the guidelines for the debate from the moderator, the groups making a case for mandatory labeling in the United States open the forum.

**Arguments against biotechnology and in favor of mandatory labeling:**

*Cindy Sano, a prominent member of Citizens for Health, a consumer advocacy group, presents her organization's stance on labeling of GMOs (genetically modified organisms). She is a 35-year-old mother of three and although she received no formal higher education, she has been active in consumers' and farmworkers' rights movements since her twenties and is very knowledgeable about agricultural biotechnology.*

I would like to open this forum by reading to you from the testimony of the Organic Trade Association, submitted to the United States Food and Drug Administration on November 30, 1999:

The FDA should label foods containing genetically-engineered organisms or their products because Americans want to know what we eat, and we have a right to that knowledge. There are a variety of concerns about our food – some people want food that is grown in an ecologically healthy way, others, food that is prepared according to religious principles, and still others, food that does not contain animal products. Until recently, consumers could buy organic, or kosher, or vegetarian, and be assured that they were getting nothing more and nothing less than what was

advertised. Now, though, due to the new and truly dramatic development of genetic engineering, we are getting more than we know.<sup>10</sup>

Our governmental agencies and multimillion-dollar corporations are not telling us the whole truth about agricultural biotechnology. There are sound reasons to believe that GMOs can hurt us. One concern is allergens: what genetic engineering does is to transfer proteins between organisms. Virtually all known allergens are proteins. If we do not know what is in the food we buy, we cannot protect our families and ourselves. Many people are fatally allergic to nuts. They take great precautions to avoid any products that might contain traces of nuts. They would not know, however, to avoid unlabeled soybeans that have been modified to contain genetic material from Brazil nuts. A study at the University of Nebraska showed that such soybeans were indeed capable of causing allergic reactions in susceptible people.<sup>11</sup> This is cause for alarm! The soybeans were withdrawn from the market, but what other harms are lurking, unidentified, in our food? GMOs may not be safe for anyone, even people who have no allergies. Another study found that rats fed on GM potatoes had stunted brain growth and immune system breakdowns.<sup>12</sup> As a responsible mother, I have to be absolutely certain that I am not endangering my children's health by trying to provide them with good nourishment. Along with many other Americans, I demand the right to know what is in the food that I buy!

*Eddie Verde, a second-generation organic farmer from Texas, presents the concerns of the organic farming coalition, whose representatives were drawn from several state organizations for this conference. He has a degree in agriculture from Texas A&M and another in international relations (with a concentration in power and inequality) from Harvard. He is in his early forties and now devotes his time to running his small farm and organizing in the organic agriculture movement.*

Agricultural biotechnology poses a grave threat to organic farmers all over the world. Because we do not use chemical pesticides on our crops, we rely on natural soil bacteria, *Bacillus thuringiensis* (Bt), to deter harmful insects. Now corn and other crops are genetically engineered to contain Bt, expressing a constant high dose that kills pests like the European corn borer. The idea is that this will reduce the amount of chemical pesticides needed to protect the crop. However, it is only a matter of time until insects develop a resistance to Bt. Most farmers will return to chemical inputs, but organic farmers cannot. Bt is our only line of defense: we will suffer heavily if its effectiveness is compromised.<sup>13</sup>

We strongly oppose the way agriculture is being practiced in this country, and biotechnology is only making things worse. We are losing valuable biodiversity as locally adapted crop strains are replaced with monocultures. The new genetically modified crops stretch across thousands of acres, and each plant is identical to the next. Farmers know this is a risky situation – any disease or pest that can attack one plant can attack them all with epidemic force, leaving our business in ruins. Most have responded to this threat by increasing chemical inputs, which is dangerous to the health of humans and the environment. We feel organic is the only responsible way to farm.

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<sup>10</sup> Organic Trade Association. November 30, 1999. Quoted in Citizens For Health

<sup>11</sup> Citizens for Health

<sup>12</sup> Ibid.

Dr. Arpad Pusztai, a scientist with the Rowett Research Institute in Aberdeen, Scotland, conducted this controversial study, which was never peer-reviewed. He was fired after releasing the results.

<sup>13</sup> Robin Mather. 1995. "The Garden of Unearthly Delights: Bioengineering and the Future of Food." New York: Dutton.

We also oppose monocultures from a philosophical standpoint. As Vandana Shiva has said,

Monocultures of the mind generate models of production which destroy diversity and legitimise that destruction as progress, growth and improvement. . . . from the perspective of diversity . . . they are impoverished systems, both qualitatively and quantitatively. They are also highly unstable and non-sustainable systems.

Monocultures spread not because they produce more, but because they control more. The expansion of monocultures has more to do with politics and power than with enriching and enhancing systems of biological production.<sup>14</sup>

Monocultures are one more way to increase our dependence, and the dependence of our Third World counterparts, on giant corporations and an international hierarchy of economic power that leads to increased impoverishment of the small farmers at the bottom. We demand the protection of biodiversity, sustainable agriculture, and the human cultures that depend on it.

Labeling is absolutely necessary to distinguish our painstakingly tended, environmentally friendly, healthful, sustainable products. Consumers know that when they buy organic, they are benefiting themselves, the Earth, and our country's family farming culture. They must have the choice to uphold these values by avoiding GMO products. Also, high-yield GMO crops sustain overproduction and keep farm prices very low, which is bad for everyone in agriculture.<sup>15</sup> We suspect that non-GMO food items will soon be able to command higher prices in health food stores. Labeling would encourage more farmers to take advantage of this and commit to growing their crops without the use of biotechnology.

*Sofia Aspettare, a 29-year-old molecular biologist who recently earned her Ph.D. from UC Berkeley, has come to represent the Union of Concerned Scientists. She has intimate knowledge of agricultural biotechnology, having done her doctoral work on the molecular effects of genetic engineering in plant cells. She also studied ecology as an undergraduate. She joined the UCS because she feels agricultural biotechnology is too poorly understood to justify commercial applications at this point in time.*

As scientists, we cannot help feeling great excitement about the possibilities offered by biotechnology. However, we feel there are many reasons to proceed with great caution, especially in agriculture. Most of our concerns are ecological. Introducing a new genetically engineered plant, particularly one that has been given superior survival traits like pest resistance or herbicide resistance, invites a host of dangers. The plant may become a pesky weed. It may pass its genes to wild relatives, which may then become weeds. GM plants expressing toxins like Bt may harm non-target organisms, including beneficial insects and soil microbes.<sup>16</sup> We have seen time and again that changing one factor can create a ripple effect throughout an entire ecosystem: we have no idea how GM crops will interact with their environment at a systems level.<sup>17</sup> We also consider them a threat to biodiversity: farmers eager to reap the benefits of high-yield, pest- or herbicide-resistant crops are abandoning locally adapted landraces (native varieties), most of which are quickly becoming extinct.<sup>18</sup>

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<sup>14</sup> Vandana Shiva. 1993. "Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology." London: Zed Books Ltd. p.7

<sup>15</sup> Raeburn 1995.

<sup>16</sup> D. Saxena et al. 1999. "Insecticidal toxin in root exudates from Bt corn." *Nature* 402: 480.

<sup>17</sup> Rissler and Mellon 1996.

<sup>18</sup> Raeburn 1995.

Agricultural biotechnology relies on wild relatives and diverse landraces as sources of germplasm to improve crops, but as it distributes those crops in monocultures across wide areas, those local varieties are destroyed or abandoned to become extinct. In Greece, 95% of the native wheat varieties have gone extinct since the 1950s. In America, 72% of potatoes are four varieties. 96% of the pears are two varieties. 69% of the sweet potatoes are one type. Any biologist knows this is a very dangerous situation, as epidemic diseases could easily obliterate the crops. Although seed companies say they have hybrid varieties numbering in the hundreds, all are probably very closely related. A recent report revealed that all US corn crops are dependent on only four inbred lines.<sup>19</sup> “The products of biotechnology are displacing the source upon which the technology is based,” said Garrison Wilkes. It is like “taking stones from the foundation to repair the roof.”<sup>20</sup>

We also feel biotechnology is being employed to the wrong ends. The technical processes of genetic engineering have turned out to be much more difficult than anyone thought: we can transfer only two to five genes, but the most desirable qualities, like yield, drought-resistance, and nitrogen fixation, are governed by the complex interactions of many genes.<sup>21</sup> Instead of working to improve the technology to attain these benefits, researchers have fallen back on the easy fixes – herbicide resistance and pest resistance. We strongly feel that the genetic engineering we are seeing in these areas has great potential to harm the environment.

Labeling is crucial at this point in the development of biotechnology, and should be the first step towards much stricter regulations. Independent risk assessments should be done for each new GMO before it can be field-tested and offered commercially. We must be conservative until we better understand the interactions of GMO crops with their ecosystems. We must not blindly believe the assurances of the EPA and other government organizations that wish to promote the use of agricultural biotechnology, which we have investigated and found to be faulty.<sup>22</sup> While the EPA claimed that insecticide use decreased on Bt corn crops, our own assessment found that chemical applications had increased, despite a very low pest population. Furthermore, the benefits of Bt corn are probably already in decline, due to the inevitable development of resistance in pests and the damage to non-target beneficial insects.<sup>23</sup> We insist upon stricter regulation immediately! Protection of the environment must be our top priority.

### **Arguments in favor of biotechnology and against mandatory labeling:**

*Joe Progress is head of Calgene’s Research Department. He has worked for the company for twenty years and played an important role in the development of genetically modified tomatoes for commercial marketing. He is proud of the work his teams of scientists have done and feels personally that the possibilities of biotechnology are endless and that genetic engineering, if used responsibly, can solve many problems with agriculture and food distribution.*

What we are doing with agricultural biotechnology is not really different from traditional plant breeding. For millennia, farmers have been crossing different strains to produce plants with the most desirable qualities, like higher productivity and disease

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<sup>19</sup> Ibid.

<sup>20</sup> Garrison Wilkes, quoted in Raeburn 1995, p. 104

<sup>21</sup> Raeburn 1995.

<sup>22</sup> Benbrook, Dr. Charles M. October 17, 2000. “An Appraisal of EPA’s Assessment of the Benefits of Bt Crops.” Prepared for the Union of Concerned Scientists by Benbrook Consulting Services.

<sup>23</sup> Ibid.

resistance. Now, with genetic engineering, the process is much faster and a lot more accurate. We can select the most desirable traits without also including undesirable qualities, and we can transfer useful genes between species.

Calgene is proud to have been the first company to commercially offer transgenic vegetables – our 1994 MacGregor tomatoes. We develop crops that are cheaper and more efficient to process, encourage sound environmental practices like the reduction of chemical pesticide application, and are more appealing to consumers.<sup>24</sup> We are aware of the risks posed by monocultures and fully support the EPA’s specifications for interspersing “refuges” of non-GM plants throughout large plantations of modified crops.<sup>25</sup> We maintain, however, that agricultural biotechnology poses no threat to biodiversity. Our company relies on diverse wild species as sources of genetic material: we would never want to compromise that resource. The vast majority of our modified crops grow nowhere near their wild relatives, so there is no question of competitive exclusion in the first place.<sup>26</sup>

We are pleased to have the opportunity to promote ongoing improvements and innovations in the field of biotechnology by financing independent researchers who are working to create nutritionally enhanced crops that will alleviate world hunger and help to prevent disease. This is something large companies like Calgene, which have the necessary stores of germplasm, the access to technology and the financial resources, are best-suited to do.<sup>27</sup> We have always been committed to safety and would never market a crop that was potentially dangerous to human health. We are careful to avoid known allergens and can use the tools of biotechnology to identify and change protein structures that seem likely to cause problems.<sup>28</sup> We assert that there is no risk to health from GMOs.

We oppose mandatory labeling because it would significantly increase the costs of processing foods. Crops would have to be segregated at all steps from the field to the shelf, at great expense to the growers, packers, transporters and sellers. Also, there is no way to include an appropriate amount of information on a small label – it would either be overwhelming to the customer or so overwhelming as to be uninformative. Calgene voluntarily provides information to grocery stores so that notice of bioengineering is posted on the signs that identify our tomatoes for consumers who care to look.<sup>29</sup> We are not trying to conceal anything. But we do not feel that mandatory labeling is appropriate.

*Ikaika Kapoho and his two colleagues have traveled from Hawaii to represent the Papaya Administrative Committee. Ikaika’s family has always grown papayas, but the crop was hard hit by the papaya ringspot virus in the mid-1990s. He feels that the development of transgenic strains of papaya, “inoculated” against the virus, is the only reason he and other farmers are still in business. He also knows that genetically adding disease resistance to crops has saved other important food industries, including sugarcane and wine grapes.<sup>30</sup>*

In 1997, I thought the papaya industry in Hawaii would be lost forever. I was in financial ruin and could barely support my family – my crop had failed for four consecutive

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<sup>24</sup> Rissler and Mellon 1996.

<sup>25</sup> Christine M. Bruhn. July 26, 2000. “EPA Document Explains Agency’s Confidence in Bt Crops.” Online at [ccr.ucdavis.edu/biot/html/new/epa.html](http://ccr.ucdavis.edu/biot/html/new/epa.html)

<sup>26</sup> Raeburn 1995.

<sup>27</sup> Ibid.

<sup>28</sup> UC Davis Center for Consumer Research. “What if a Person has Food Allergies?” Online at [ccr.ucdavis.edu/biot/html/safe/safe-2.shtml](http://ccr.ucdavis.edu/biot/html/safe/safe-2.shtml)

<sup>29</sup> Mather 1995.

<sup>30</sup> Raeburn 1995.

years, devastated by the papaya ringspot virus. The whole state was in serious trouble: papaya is Hawaii's fifth largest crop, and a valuable source of important vitamins. It normally generates \$45 million annually.<sup>31</sup> The development of transgenic papaya saved my livelihood. Hawaiian growers helped to finance the research, so we felt as though we had a role in the process. The seeds were distributed free of charge, so there was no extra expense for us farmers. And the transgenic plants, which carry a weak strain of the virus, are completely unaffected by the ravages of the disease!<sup>32</sup> Consumers have accepted them willingly, and we love working with the crops. Genetic engineering makes farming predictable and uniform.<sup>33</sup> I personally appreciate that less application of pesticides is necessary, as I hate the thought that I am poisoning the soil and the water that runs off my land. We used to spray the trees heavily with chemicals to protect them from the aphids that carry the ringspot virus, but with the transgenic crops, this is no longer needed. We oppose labeling because we are afraid it will frighten consumers unnecessarily. There is no evidence that GMOs harm people, and it would hurt our business if buyers worried that our papayas were unsafe.

*Hope Greenway is a plant scientist and nutrition expert, representing an international group of scientists who wish to use agricultural biotechnology for humanitarian purposes. She is in her fifties and has devoted her entire career to improving health and preventing disease both in poor areas of the United States and in developing countries through the nutritional enhancement of staple crops.*

Agricultural biotechnology is offering us a unique opportunity to improve world health: European scientists have bred vitamin-rich tomatoes that can help fight cancer and rice that can prevent blindness and vision disorders that affect hundreds of thousands of people in Asia.<sup>34</sup> To withhold such technology is to deny humanitarian aid. There is absolutely no evidence of genetically engineered foods causing harm to human health: labeling GMO foods in the United States will not only unduly worry domestic consumers, but will also make people in other countries who really need the benefits transgenic crops can provide very wary. They will wonder what we are concealing from them and think this is one more instance of the industrialized world trying to pass unsafe technologies on to the developing world and make a buck. This is not the case! Nutritionally enhanced crops only contain genes that humans already consume and that are beneficial to them.

There is also no evidence that agricultural biotechnology, if it is used carefully, presents concrete environmental hazards.<sup>35</sup> The EPA and the US Department of Agriculture have found it to be completely safe and even beneficial to the environment.<sup>37</sup> Nor do GMOs threaten biodiversity: in fact, genetic engineering could play an important

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<sup>31</sup> John Zakour and Linda McCandless. April 28, 1998. "First Genetically Engineered Papaya Released to Growers in Hawaii." Prepared for New York State Agricultural Experiment Station, Cornell University. Online at [www.nysaes.cornell.edu/pubs/press/1998/papayarelease.html](http://www.nysaes.cornell.edu/pubs/press/1998/papayarelease.html)

<sup>32</sup> Gonsalves et al 1998.

<sup>33</sup> Mather 1995.

<sup>34</sup> UC Davis Center for Consumer Research. July 1998. "Genetically Altered Tomato Could Combat Cancer" Online at [ccr.ucdavis.edu/biot/html/new/tomato2.html](http://ccr.ucdavis.edu/biot/html/new/tomato2.html)

<sup>35</sup> Ingo Potrykus. 2001. Response to Marion Nestle, Ph.D. "Genetically Engineered 'Golden' Rice is Unlikely to Overcome Vitamin A Deficiency." Online at [www.biotech-info.net/nestle\\_response.html](http://www.biotech-info.net/nestle_response.html)

<sup>36</sup> Ibid.

<sup>37</sup> Bruhn 2000.



role in maintaining biodiversity in crops, since it allows introduction of useful traits into all varieties. This means that crops could be both locally adapted and genetically enhanced.<sup>38</sup>

Agricultural biotechnology offers the possibility of practicing farming in areas where we have not been able to grow crops productively before. We are developing plants that are resistant to heat, cold, drought, and high salinity in soils and water.<sup>39</sup> This will allow us expand agriculture around the globe, which will be crucial if we are to feed our growing world population. In the next twenty years, humans will have to grow as much food as they have grown since the beginning of agriculture, 10,000 years ago.<sup>40</sup> Biotechnology is our best hope for a healthy, more equitable future.

**In small groups, students should consider:**

1. What is your group's single strongest argument?
2. What parts of your argument might you be willing to concede in order to come to a solution?
3. What are some points of agreement and disagreement your group has with each other group? Name at least one of each.

**Class discussion questions:**

1. Should the United States government require mandatory labeling of GMOs? Why or why not?
2. If yes, what are the potential problems or harms to each group and how should they be addressed?
3. If no, what are the potential problems or harms to each group and how should they be addressed?
4. Realistically, what is the future of agricultural biotechnology in America? Will genetically engineered foods dominate the market? Will we see stricter regulations? What will the environmental impacts be?

**Teaching Notes:**

This exercise is designed to take about two-and-a-half hours. It is best taught over two one-and-a-half class session. On the first day, after a half-hour discussion of the relevant reading, students should meet in their small groups for 15 minutes to discuss their positions. Then each group should present its argument (20 minutes). The rest of the class time may be devoted to rebuttals and discussion. On the second day, students should again meet in the small groups to consider the discussion questions. At the teacher's discretion, the class will then meet as a whole to attempt to arrive at a compromise position on mandatory labeling.

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<sup>38</sup> Raeburn 1995.

<sup>39</sup> UC Davis Center for Consumer Research. "Benefits of Biotechnology." Online at [ccr.ucdavis.edu/biot/html/benefit.html](http://ccr.ucdavis.edu/biot/html/benefit.html)

<sup>40</sup> Vaclav Smil. 2000. "Feeding the World: A Challenge for the Twenty-First Century." Cambridge, MA: The MIT Press, p.140

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