

Stakeholder Debate: Genetically Modified Food

Purpose

To integrate all the knowledge from the AMBIENT Food Module by creating a presentation taking a particular ethical stance or point of view which is researched and substantiated.

Overview

This is the culminating experience of the AMBIENT Food Module. Students will be asked to work in teams to develop a presentation and handout representing a particular point of view in Genetically Modified Food Debate. This experience will require the students to synthesize their varied knowledge of food, food contamination, nutrition, and their issues, organize this knowledge, and present it persuasively to their peers.

Of note, this Debate on Genetically Modified Foods can be enriched by performing the Ethical and Critical Thinking activity on Genetically Modified Foods first since it uses the same readings and requires the students to critically evaluate and research this issue.

Time

3-5 two hour block class periods with team homework in between; the session is to start the students, the second is to evaluate their progress, and the third is for them to present their debate/role play. This experience should involve time in and out of the classroom to collect, organize, and create the Team Presentations.

Key Concepts

This section particularly focuses on the ethical issues engendered by Genetically Modified Food. There are many different points of view in the Genetically Modified Food Debate, ranging from health and social to economic. There is also the issue of the use of limited public resources to solve environmental problems, as well as how to prevent similar environmental problems in the future.

Skills

Students will work in teams to synthesize their food, food contamination, nutrition knowledge as well as additional research to represent a particular point of view persuasively. They will create a handout and presentation materials to help communicate this knowledge and point of view. Finally, using these materials, they will practice public speaking to present their work.

Materials

Computer access to presentation software such as PowerPoint would be useful, but not essential since transparencies could be used to illustrate the speaking points. Although software (such as Microsoft Word or PowerPoint) would facilitate the creation a Brochure, Rap/Song or Poem or a Play, or Poster, these could be done purely on hardcopy incorporating pictures and text. Creation of a video would require video camera equipment.

A transparency projector or slide or LCD projector for presentation of transparencies, slides or computerized PowerPoint presentation.

Facilitator Preparation

You will need to divide the students into groups or teams representing different sides of the debate questions or as individuals/teams representing different roles. Knowledge of and facilitating access to the computerized software with training will optimize this session. Prior knowledge of the Food Primer, as well as other modules, will prepare you for the range of issues addressed in this section.

It is recommended that Facilitators initially organize the students into group representing a particular debate or role playing point of view. The facilitators should meet with each group to evaluate their progress in deciding the type of handout, the medium, and the different parts in the presentation. Facilitators should encourage the groups to practice their presentations before and keep to the time limits.

Background

What are the various issues raised by food, food contamination, nutrition, and in particular the expanding use of genetically modified food as environmental health issues? What is genetically modified food? What are the human health, economic, and ecological ramifications of using genetically modified food? As a political, historical and ethical issue? What does a society do if there are limited resources to produce food, many starving people, and genetically modified food may offer the opportunity to feed millions of people and use less harmful pesticides at the same time? On the other hand, if genetically modified food can potentially harm our environment, how does a society prevent this sort of environmental disaster from occurring in the future? What is the role and responsibility of the individual when faced with an environmental health issue?

In the situation of genetically modified food, is it safe for humans? All humans or just some? Is it safe for the environment? What are the negative and positive consequences of the use of genetically modified food? What is your response as an individual, a citizen, a scientist, a policy maker, a food grower, a hungry person, an environmentalist? How much money and resources should be devoted to this issue?

Other aspects are teamwork of the students in synthesizing, creating and presenting data and a particular point of view. If available, the use of various software packages can be incorporated to enhance presentations. Effective communication is one of the objectives of this section.

Culminating Activity -- A "Classroom Concern" – If the culminating experience for this module will be a potluck type classroom activity, be sure that planning for the safe handling and transport of the food is part of the effort. Make arrangements with the school kitchen for the appropriate cold storage and/or reheating of dishes brought from home. Perhaps ask students to share what extra steps they took in their home preparations to preserve the safety of their chosen dish

Procedure

Read the following responses representing different points of view on genetically modified food. Students should be encouraged to seek out other sources of information on genetically modified food.

- Editors at Science magazine are collecting responses to seven questions about genetically modified foods. The responses will come from a variety of individuals living in different places in the world and thus provide a wide range of perspectives on the issues. You can view the question responses in different ways -- responses by one person to all the questions, responses to one question by all the respondents, or just one response, one person at a time. You can also submit your own responses to the same questions (<http://scope.educ.washington.edu/gmfood/position/>). As a starting point of discussion, responses to the following question are included at the end of this exercise: **What are the health advantages, disadvantages, of Genetically Modified Foods?**

Organize a **Genetically Modified Food Debate**, taking different points of view as starting points to discuss the different issues raised by the current and possible future uses of genetically modified food. Have each group develop a **Power Point Presentation** (or similar software) as part of the debate to organize and illustrate while they talk. Have the rest of the students participate as an audience representing US Citizens, Politicians, Scientists, or any of the roles suggested below.

In opposing groups, **Possible Debate Issues** include:

- Genetically Modified Foods are the solution to world hunger vs. Genetically Modified Foods are the most dangerous environmental health development of the 21st Century
- Genetically Modified Foods have major implications for human health: For and Against
- Genetically Modified Foods have major implications for environmental health: For and Against

Have each group in the debate develop a **Brochure** briefly describing the health effects and differing issues of Genetically Modified Foods from their debate point of view. Alternative work products could include: making a **Video**, creating a **Webpage**, making a **Rap/Song** or **Poem** or a **Play**, or creating a **Poster** to communicate their position on these Genetically Modified Food issues.

The debate could also involve **Role Playing** using some of the following roles to illustrate different views in the Genetically Modified Foods Debate.

- Scientist against Genetically Modified Foods
- Scientist for Genetically Modified Foods
- Environmental health specialist involved in Genetically Modified Food
- Reporter of local newspaper
- Scientist studying the habitats of the monarch butterfly
- Agronomist arguing for organic farming
- Small Business owner of a Supermarket with large produce section
- Small Family Farmer using Genetically Modified seeds
- Large Corporate Farmer
- Parent with small children

- Banana Farmer from developing nation
- Pesticide and Fertilizer chemical worker
- Owner of hotel on the beach
- Politician with limited monies and resources for public and environmental health
- Lawyer representing the Union against importation of Genetically Modified Foods
- Lawyer representing the US Government on the export of Genetically Modified Foods
- Director of the Health Department

Additional Activities

- If they have not done so already in the Ethical and Critical thinking, have the students read the responses, and first identify the facts and then identify the opinions by underlining or highlighting in different colors; then summarize in a paragraph the facts concerning Genetically Modified Foods and/or discuss their conclusions in class.
- Questions to ask about the Readings: With regards to evaluating different opinions on Genetically Modified Foods, does it matter who gives the opinion? How do you know from what point of view person is going to speak? Does it matter to you if the person has a conflict of interest? What is a conflict of interest?
- Some interesting websites on this subject include:
<http://www.usda.gov/agencies/biotech/faq.html>
<http://special.northernlight.com/gmfoods/>
<http://www.pbs.org/wgbh/harvest/>
<http://www.truefoodnow.org/shoppinglist.html>
<http://www.usda.gov/agencies/biotech/faq.html>
<http://scope.educ.washington.edu/gmfood/position/>

Follow up Activities

Students can use their handouts and presentation to discuss Genetically Modified Foods as an environmental health issue for other students, families and neighborhood organizations.

What would the student(s) do about Genetically Modified Foods? What can a group of people do? How can this situation be prevented, modified or made better for Genetically Modified Foods and for similar environmental issues?

Students can assess environmental issues for their own neighborhoods, prioritize these issues, and create plans of how to address these issues to either remediate or prevent them. Students can visit or have presentations by a farmer, an agronomist (for example from the Agricultural Extension Services), and an owner of a supermarket or restaurant.

Student Assessment

Give the following presentation design components to each student team as a guide to their group presentations:

- ❖ Decide what facts are important to include to support their particular view point on the Genetically Modified Foods issue
- ❖ Design a Handout that summarizes this information and their point of view (i.e. Brochure, Video, Webpage, Rap/Song, Poem, Play, Poster)

- ❖ Practice and keep their presentation within the time allotted
- ❖ Each group member should take part in the Presentation, even if it is just to read or explain one piece of the presentation
- ❖ Each group member should answer at least one question from the audience at the end of their Group presentation.

Assign points for the following components of the Team Presentation:

- ❖ Were the handout and presentation easy to read/effective at communicating the facts and the particular point of view?
- ❖ Were pictures/maps/illustrations used?
- ❖ Were proper science terms used?
- ❖ Was each group member actively involved in the presentation?
- ❖ Did the group report their sources?
- ❖ Could the group members answer questions from the audience about the facts and defend their point of view?

Readings on Genetically Modified Food

- Editors at Science magazine are collecting responses to seven questions about genetically modified foods. The responses will come from a variety of individuals living in different places in the world and thus provide a wide range of perspectives on the issues. You can view the question responses in different ways -- responses by one person to all the questions, responses to one question by all the respondents, or just one response, one person at a time. You can also submit your own responses to the same questions (<http://scope.educ.washington.edu/gmfood/position/>).

What are the health advantages, disadvantages, of Genetically Modified Foods?

Response by Shahal Abbo (Field Crops, Vegetables and Genetics, Faculty of Agriculture, Food & Environmental Quality Sciences, The Hebrew University of Jerusalem, Rehovot 76100, Israel)

Again, reduced amounts of pesticide residues are a blessed effect. The question of greater allergenicity (because of the presence of novel chemicals) remains to be proven but the risk should not be overlooked.

Response by Prof. E. Ann Clark (University of Guelph, Canada)

To date, the only case in which GE has been implicated in human death and disability was the famous Showa Denko debacle, in which 37 people died, 1535 were left permanently and severely disabled, and another 5000 were temporarily disabled.

Serious human health problems have been implicated only rarely for GMFs, which may be related to the absence of segregation and labeling of GMFs, which precludes epidemiological studies.

Nonetheless, GE methods have the potential to create unanticipated dangers for which it could be difficult to test. Insertion of transgenes can affect unintended traits of the target

organism as well as the intended trait, although this is not reflected in the food safety testing protocols used in the United States and Canada.

It does not seem implausible that unintended side effects could occur in food safety traits. Thus, consideration of the potential effects of transgene insertion need not be restricted to the target trait but should acknowledge the very real potential for other traits to be expressed unpredictably.

Is this risk any greater than that from conventionally bred crops? I do not know, and I have not been able to find anyone who can point to any research that specifically addresses this pivotal question.

However, it does not seem imprudent to take this as a testable hypothesis instead of just assuming it away as a nonissue--as has been done often when concerns about biotechnology have been raised. Many of those confident early assumptions were refuted when they were actually tested. A more cautionary and scientifically defensible approach is clearly warranted.

In sum, a critical point to keep in mind--particularly pertaining to food safety issues--is that the premise that the off-types, silencing, and trait instabilities inherent to transgenic crops can simply be detected and discarded before commercialization has already been disproven. What will it mean to human, livestock, and wildlife health when the types of unintended, unexpected, and adverse outcomes that have already occurred with agronomic traits occur with food safety traits?

Response by Dr. Liz Dennis (Chief Research Scientist, CSIRO Plant Industry, CANBERRA ACT 2601, AUSTRALIA)

Crops with defined health benefits will become available. Two examples of particular significance to developing countries are the recent announcement of "golden rice"--rice genetically modified to produce enhanced levels of vitamin A--and attempts in the Commonwealth Scientific and Industrial Research Organization and elsewhere to produce rice with elevated levels of bioavailable iron. These technologies offer solutions to dietary deficiencies that affect millions of people for whom rice is the staple diet.

Another health improvement is modification of plant oils to increase monounsaturated oils and decrease the levels of polyunsaturated and saturated oils, which should give decided health benefits in lowering cholesterol.

Developing vaccines in plants is very attractive and appears to be quite feasible--for example, people may be immunized against measles or other diseases by eating bananas. This technology may make a big difference to the health of the developing world.

Response by Katherine DiMatteo (Organic Trade Association, Greenfield, MA, USA)

Although there have not been reported health problems linked to GMF, there are concerns that the possible transfer of new and unidentified proteins from one food to another may trigger allergic reactions to the altered food. Also, there has been no research regarding whether genetic engineering changes the nutritional content of food, nor have there been studies on the human safety of consuming genetically engineered

foods. Although the biotechnology industry is quick to claim that no deaths or illnesses have been linked to genetically engineered food, how is it possible to be sure? Without labeling, there is no way to trace whether someone who gets sick has eaten a GMF. Long-term effects are also unknown. Further study--and prudence--are needed.

Response by B. K. Ndimba (Durham University, Durham, United Kingdom)

If GM farming is aimed at replacing or reducing pesticide use, there is a great benefit to humans and harmless insects such as butterflies and ladybirds from reducing their exposure to harmful chemicals.

Response by Prabhjeet Singh (Research Associate, Department of Biology, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong)

Some of the many health advantages of GMF include the edible vaccines, which can help curb various diseases in India and other developing countries. Nutritionally improved crops with a higher content of proteins and vitamins can supplement the nutritional requirements of the lower strata of the population, who cannot afford a nonvegetarian diet. Pulses constitute a major source of protein in India. However, the presence of raffinose-like sugars can cause digestive problems. The genetically tailored pulses that contain reduced amounts of raffinose and similar sugars can result in enhanced digestibility. GMF that contain sweet proteins like thaumatin will be good for people with diabetes. And GMF that have greater iron content can be especially beneficial for Indian women, as they are susceptible to anemia.

There is a need for caution in dealing with GMF. One should be careful and alert to the immediate and long-term adverse effects of these GMF on health.

Response by Senthil Subramanian (Department of Biology, Hong Kong University of Science and Technology, Kowloon, Hong Kong)

GMF technology is capable of producing food crops with enhanced nutrient content and also nutrient balance. For example, it is possible to engineer fruits and grains with higher concentrations of calcium, iron, vitamins A and C, and more protein with essential amino acids. Other possibilities are GMF with antipathogen proteins and products (for example, bacteriocins) to keep us healthy and protect us from food pathogens (for example, aflatoxins). Also GMF can synthesize human and animal vaccines, which may make vaccination programs easier and more successful. Indirectly, GMF help to reduce the amounts of chemicals that are used in their production and hence residues in food and feed.

Direct health threats arise from the newly introduced proteins, especially DNA vaccines in the meat industry, which might cause allergy and illness to consumers. The indirect threat arises from the use of bacteria engineered with resistance to several common clinical antibiotics that are used in GMF technology. Care should be taken to avoid transferring genes into the natural environment, which may lead to pathogenic bacteria that are resistant to antibiotics. Another indirect effect could be larger amounts of herbicide residue present in food and fodder because of the use of herbicides in larger amounts on highly resistant herbicide-tolerant crops.

Response by Mark Tester (Department of Plant Sciences, University of Cambridge, Cambridge, CB2 3EA UK)

Exposure of human populations to large amounts of novel proteins that have never previously been in the human food chain could cause unpredictable problems. In particular, allergenicity could cause problems that would be difficult to detect, as symptoms can take a long time to develop. Previous low-level exposure of human populations to such toxins is not an argument against this concern, as the quantitative differences between exposure to, for example, Bt toxin (an insecticidal protein) from soil contamination of food and chronic ingestion of significant quantities of this protein in a range of foodstuffs could easily prove crucial. Current testing regimes are not adequate to screen for such responses, although it is difficult to see, technically, how such screening could be done; the low quality (both scientifically and statistically) of the feeding experiments of Arpad Pusztai provide an example of the difficulty of such work.

Nevertheless, I think it is notable that extensive testing is required before new drugs are introduced (which usually are not taken chronically and whose benefits to the patient usually are clear). In contrast, the new GM could lead to an increase by orders of magnitude in the quantity of a protein in the food chain, with this protein being ingested chronically (and with little, if any, benefit to the consumer); yet this can be done with a testing regime that is much more modest than that required for new pharmaceuticals. I think the pro-GM lobby should take this concern on board more seriously, especially when considering the outputs from "wide transfer" (an important, novel power of the new GM).

Contact SCOPE through email.

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