Breakout Sessions Summary of Discussions[*]

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Discussions in the workshop sessions followed the themes of the plenary-session modules. To help initiate exchanges, participants (assigned randomly to groups) were invited to address the questions below. Facilitators[*] guided the discussions towards developing policy recommendations.

- Diminishing the Ecological Footprint
  - — What priority should the environmental consequences of agricultural biotechnology be given?
  - — How and by whom should policies be set?
- Improving the Quality of Life
  - — To what extent might agricultural biotechnology affect quality of life by creating changes in the relationships that people have with food and the ways in which it is produced?
  - — What are the North-South implications for policy?
- Ensuring Safe and Healthy Food
  - — What must policy-makers do to ensure that agricultural biotechnology enhances access to safe and healthy food?

[*]This summary draws on verbal reports delivered at the end of the conference by facilitators David Castle, Stewart Hilts, Sally Humphries, Ricky Yada (all of the University of Guelph) and Tony Shelton (Cornell University). The workshop proceedings were recorded by Mei Bi, Janice DeMoor, and Carol Hannam (all of the University of Guelph), Sarah Bates (Cornell University) and Allan Eagleshem (NABC).

Diminishing the Ecological Footprint

The consequences of biotechnology could be positive or negative for the ecological footprint. Positive effects include decreased chemical inputs, less soil erosion [insofar as agricultural biotechnology (agbiotech) supports no-till practices] and opportunities for bio- or phyto-remediation. Also, there are possibilities of developing traits like salt tolerance and salt-accumulating ability. Feed-use efficiency may be improved in animals and fish. On the negative side, promotion and acceptance of agbiotech may result in increasing reliance on fewer species and fewer crop types, with more monoculture farming. The effects could be widespread particularly in combination with gene flow, including hybridization with wild relatives. A community-ecology question arises on scale effects of farm consolidation, which tends to go hand-in-hand with agbiotech: to what extent does farm size affect the ecological footprint? A case can be made that agbiotech has focused predominantly on profitability, begging a counterfactual question: what if the focus had been on a different array of products targeted specifically toward ecological sustainability?

Adoption of an ecological paradigm—a systems-oriented approach—was recommended as a basic tenet. But, how and by whom should policies be set? The process should be consultative, including input from scientists, pro- and anti-biotech groups, and members of the public and industry. In Australia, the consultative process has not included economic-benefit analyses since industry representatives felt that government was not qualified to judge and the public was afraid that a technology with high economic benefits would be pushed through. The policy-making process should be science-based, and should include, from the outset, persons from developing countries in which impacts and potential trade disadvantages are likely to be greater.

Improving the Quality of Life

Again, the concern was raised that success of agbiotech in the South may lead to monoculture farming. In particular, as crop losses are minimized because of reduced risks from disease and insect predation, farmers are likely to reject species and varieties that have been used in the past, which will affect biodiversity. Planting of *Bt* cotton quickly expanded in the Punjab and Gujarat when its benefits became evident to farmers. If there was any perception of environmental risk, it did not impede this spread, nor did concerns about intellectual property rights. There is a need to be wary of the implications of the success of biotechnology.

Gender aspects of adoption of genetically engineered crops received significant attention. Introduction of crops that reduce labor demands—such as herbicide-tolerant varieties—is likely to have negative consequences for female field laborers. Also, as crops become commercially successful, control over them often passes to men from women, who are disempowered as a consequence. Gender aspects of agbiotech need to be fully explored along with concerns about health and nutrition, all of which affect quality of life.

Food security, standard of living and quality of life are nested concepts, which relates to a point made by Ruth Chadwick: you cannot get to quality of life without considering antecedents that indicate a priority for action. First you need food security and then you can talk about quantitative and qualitative measures of standard of living and quality of life. These are underpinned by trust in regulatory systems. Food labeling is an issue in industrialized countries where people want to maintain particular cultural associations with what they eat or they just want to know what they are eating. With labeling, they may not act any differently, or they may opt to avoid all genetically modified foods. In the developing-country context, the issue for improving quality of life is that agricultural biotechnology can lessen labor input. However, with fewer involved in farming, alternative gainful employment would need to be found. It cuts both ways.

It is hard to imagine how enabling technologies will be placed in the hands of the people who need them if there are trade subsidies in the form of research inputs that lead to intellectual property in developed countries and then trade barriers in the form of insurmountable licensing practices.

How are we to understand cross-country differences in acceptance and success of genetically engineered crops? It is likely that what makes agbiotech work is often due less to the technology itself than to the social conditions that must be in place for it to work.

The impact of agbiotech will depend considerably on the country; the higher on the socioeconomic ladder, the less is the potential for effect. In developing countries, subsistence farmers could benefit since they have limited access to pesticides and fertilizers.

Agricultural biotechnology is likely to significantly impact diets in terms of new functional foods and nutraceuticals. It could have considerable secondary impacts on agricultural intensification and soil fertility. Where adoption of salinity-tolerant varieties would promote yields, it may also perpetuate overuse of irrigation that contributes to soil salinity. Concern was expressed that agbiotech will contribute to increased farm size with negative social results from labor-displacement. Interactions between food and migration—internal and international—are complex: might biotechnology eventually have negative impacts?

Ensuring Safe and Healthy Food

The regulation of agri-business is important as is trust in regulators resulting from a positive regulatory influence. Setting up regulatory regimes in developing countries will involve continuous evolution of context-relevant policies. Policies for monitoring the safety and healthfulness of food are not available "off the shelf." While international harmonization of standards may be required, there is also need for contact-sensitivity that is appropriate to the place in which a technology will be applied.

Science education and communication are important. Need-assessments are necessary: what do people really need from agbiotech? What should they plant to

ensure food security and environmentally sustainable agricultural practices? The other part of this is the informational aspect: what do you need to tell people in order for them to be familiarized with a technology and to ensure that it actually provides promised benefits? One way is to establish an opinion-leaders' network by tapping into local government structures in a way that helps build trust in new biotechnologies.

There is need to demonstrate and discuss all possible benefits from a new product, which may present added opportunities in certain situations. For example, less susceptibility to fungal infection may occur with *Bt* corn as a secondary effect of less insect damage. In turn, less aflatoxin contamination could have tremendous significance in particular contexts.

The adoption and use of biotechnology and genomics should be approached within the context of conventional practices. Rather than view agbiotech as the wave of the future—it's new, therefore it's good—we should regard it as part of a mélange of new and old, balanced appropriately to meet local needs. The point was emphasized that agricultural biotechnology would be more readily adopted and food security would be more attainable as would environmental sustainability if it were blended back into conventional practices in order that value-added benefits would accrue alongside maintenance of traditions.

Again, stakeholder participation is essential in setting research priorities, including farmers, and, in the South, poor farmers. Public trust needs to be garnered and the public respects the opinions of farmers.

In the North American context, the best method of ensuring that agbiotech enhances access to safe and healthy food is via linkage to the healthcare system. If biotech reduces costs, it will garner attention. A central issue came up in terms of trust: do policy-makers trust, or even understand, biotechnology? Science is becoming more and more politicized, particularly in the United States, which impinges on how we should go about dealing with biotechnology.

In terms of regulation, we may not have to do much in North America where institutions already exist for the management of foods and drugs. We don't need to reinvent the wheel, but we do need to adjust it to fit particular circumstances. On the subject of food labeling, the Canadian system seems to be reasonably constructed—based on the product and not the process—and may serve as a useful model for other countries. However, regulation should be experience-based and should be appropriate to the country where the crop will be grown.

Recurring Themes

Several recurring themes ran through the discussions. Scientists need to communicate more effectively not only with the public, but also with politicians and policymakers. They need to learn how to write in plain language in half-page portions. Until then, there will be need for "translators." Also, there is need for such communication to be couched in questions that the audience being addressed is asking rather than simply trying to get a message across. Scientists must com-

municate with a range of different audiences. On one hand, there is the political "battle," which needs one style of communication whereas other audiences need to be listened to and questions answered in terms they will understand. Understanding risks and finding a balance between those risks is a key stumbling block in terms of public understanding. Communication may be improved if multiple disciplines are represented in graduate-student programs and on committees, to expose students in the biological sciences to social-science issues and ways of thinking. Related to improvement in communications, public education in agricultural biotechnology is needed. When 50% of the population feels that they don't want DNA in their food, you know you have a real challenge. Such challenges will be specific to each country. We should focus on a long-term educational outreach program in schools. Public outreach is also needed as is public dialogue—not a debate, but a dialogue on agricultural biotechnology—so that interested members of the public can form sound opinions. With traits that are important to the people in the country in question, the dialogue will be much more constructive.

When agbiotech is considered in the international context, private-sector investment must be replaced with public-sector investment. Clearly, there is need for significant public-sector funding initiatives if benefits are to reach resource-poor farmers in developing countries. It will be necessary to work with local communities to ensure acceptance and adoption from the bottom up rather than simply again trying to impose viewpoints from the top down. Thus, needs must be identified—nutritional and environmental (*e.g.* cutting down pesticide use)—so that product traits are country-relevant. The public sector will not make these products become a reality, it has to be in partnership with the private sector; increased investment in the public sector is needed.

Finally, a direct quote is worthy of mention: "Genetically modified crops are only a small part of the problem and only a small part of the solution." Enhancing food production using genetic engineering as a tool faces the same basic problems as with traditional breeding in terms of transferring benefits to the level of the resource-poor farmer.

Breakout Sessions Recommendations

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While NABC 16 participants gained from the opportunity of listening to a series of stimulating presentations with diverse viewpoints and having lively discussions in the meetings, breakout sessions, hallways and at social events, the real value of the meeting will be whether it can play some role in helping to implement policies for the wise use of agricultural biotechnology for the common good of international communities.

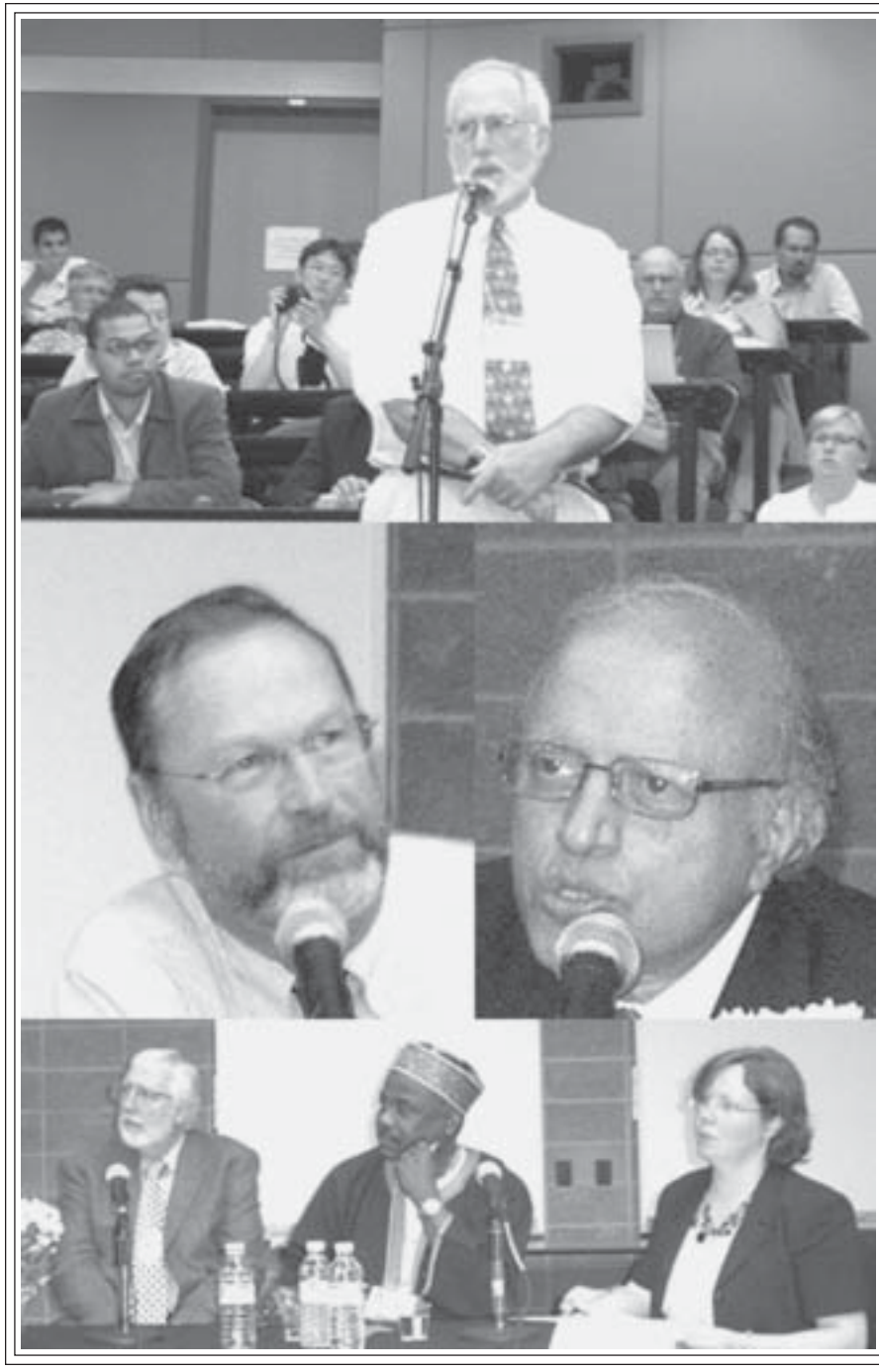
The broad discussions we undertook at the breakout sessions focused on three major themes that biotechnology should address if it is to have benefits to the international community: to diminish the ecological footprint of agriculture, improve the quality of life for the diverse segments of the world's populations and ensure safe and healthy food. These themes encompass the hopes and aspirations of the world community, regardless of whether one is discussing biotechnology or any other technology. However the hope—and perhaps the hype—of biotechnology have put it front and center in the world's eye and made it subject to increased scrutiny not only about the safety of the technology to humans and the environment but also about how it may affect social, political and economic structures throughout the world. Some would say that biotechnology is being examined more critically and perhaps unfairly than other technologies and that it is just a tool, neither good nor bad in and of itself. However, the tone of the public debate about biotechnology appears to demand more answers, and a list of recommendations, developed from the meeting, may provide some help in developing public policies to ensure that biotechnology is a tool that can be used to help the world community:

- When biotechnology is discussed, it is important to define what one is and is not talking about. To the biologist it is a set of tools of modern biology that are commonly used in most laboratories around the world, including those in many developing countries. This broad term "biotechnology"

encompasses many commonly used techniques for understanding how an organism functions or for testing for human diseases, and for developing new plant varieties or medicines. Genetic engineering is one technique within biotechnology that involves specific manipulation of genes, and it is this aspect that has garnered the most controversy. It is important that discussions on biotechnology make these distinctions to identify the real issues. The risks of using a technique such as PCR—common in biotechnology—to detect the frequency of resistance genes within an insect population in a field is far different from developing and releasing a plant tolerant to a specific herbicide.

- When discussing the potential impact of agricultural biotechnology, it is important to recognize that agriculture and food production overall have had tremendous impact on the environment, including biodiversity. The use of genetically engineered plants is but one component of this impact and should be evaluated as such.
- When evaluating the risks and benefits of using agricultural biotechnology, there needs to be a comparison of the risks and benefits of not using it. It must be recognized that every technology has an inherent set of risks and benefits, including older technologies that continue to be used. It also should be recognized that an analysis of risks and benefits should be an on-going process as new evaluation techniques are developed or as new risks or benefits are identified.
- It should be recognized that there are distinct and strongly held cultural values in the world and these must be respected. Each culture may emphasize different points when evaluating the impact of agricultural biotechnology on society. In areas where food is scarce, more emphasis may be placed on crop production than on another common good. No country or culture should be forced to accept or reject biotechnology based on the culture of another.
- The needs of a particular culture or country should come first. For a product of biotechnology to be adopted by a culture or country, it must be a consumer- or farmer-driven product that provides an advantage to that culture. What is perceived as an advantage to one culture may not be to another.
- For biotechnology to serve the needs of those in developing countries, programs in capacity-building within the country/region should be considered as the highest priority. In this context, capacity building should be thought of broadly to include the needed facilities and personnel so that techniques can be learned and policies can be developed. By developing the capacity within a country/region, then the citizens will be best able to develop products and policies that are "home-grown" and will most closely meet their particular needs.

- While intellectual property (IP) remains essential for the development of biotechnology, it should not hinder the development and deployment of products of biotechnology in regions of the world where they can be most useful. Companies have a moral obligation to ensure their scientific capacity in biotechnology provides benefits to the world and should develop appropriate partnerships and strategies so that IP issues do not stand in the way.
- It must be recognized that companies involved in agricultural biotechnology will remain profit-driven and the needs of some cultures and countries may not be fit a company's business model. Therefore, additional channels and resources need to be developed in the public sector. Within the constraints of their business models, companies should be encouraged to play some role in a public-private partnership of agricultural biotechnology for the good of society.
- Agricultural biotechnology may have positive impacts such as modifying foods to be more nutritious, grown with less pesticide or fertilizer, or increased yield potential, improved quality or storability. Use of agricultural biotechnology may also have social impacts such as increased consolidation of the industry, trade implications, or displacement of labor. The rapid, worldwide growth and spread of genetically engineered plants since their introduction in 1996 is likely to continue and make entry into more developing countries. Therefore, it is important to develop programs that will measure the impact of these products on the environment, quality of life, food availability and food safety and to develop programs that will minimize any negative effects. It is essential that such programs be transparent.
- Biosafety programs focusing on environmental and human safety need to be developed and put in place before plantings of genetically engineered plants are approved. Such programs can be difficult and expensive to institute, therefore countries should learn from those that have already enacted such protocols. If appropriate, protocols can be regionalized. The US and European regulatory systems may not necessarily provide good models for developing countries because of their high cost, which may hinder the testing and deployment of genetically engineered crops.
- A multi-focus, long-range educational program tailored to the culture is essential for the further deployment of agricultural biotechnology. The program should consist of a long-term approach through schools as well as outreach programs for the general public.
- It is important that knowledgeable scientists continue to express their opinions publicly in the on-going dialogue about biotechnology.



PART IV

MODULE I—OPENING GLOBAL DIALOGUE