Biotechnology Advisory Panel

Third Report
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THE Keystone CENTER

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“...it is important to remember that

culture and science

co-exist and both have a role in improving the quality of life.”

~Dr. V. Prakash

Table of Contents

Background

Biotechnology Advisory Panel

DuPont's Biotechnology Advisory Panel, a prestigious multi-national group with diverse backgrounds, meets twice a year to exchange information and opinions on various aspects of biotechnology. Occasionally, the Panel also interacts electronically and via telephone on important issues.

In 1999, Charles O. Holliday, Jr., DuPont Chairman and CEO, described DuPont's intention to form an independent panel "to guide our actions, help us create positions on important issues, and guide and challenge us in the development, testing, and commercialization of new products based on biotechnology."

Panel Membership

The Biotechnology Advisory Panel members represent a diversity of international interests, academic and vocational expertise, and cultural backgrounds. All are cautiously optimistic about the good biotechnology can potentially do to help deliver safe and nutritious food to the world's populations while decreasing the need for energy, labor, and agro-chemicals. At the same time, the Panel members are well aware of the unknowns and potential downsides associated with biotechnology. It is part of their role to raise these concerns and push DuPont's thinking on these issues. Panel members believe companies, communities, and governments need to work cooperatively in an effort toward sustainable development and that it is important to draw on a diversity of experience to navigate beyond historical mistakes and properly address future challenges. The Panel asserts that this type of interactive dialogue can have value for the multi-national corporation as well as for the regions of the world represented on the Biotechnology Advisory Panel.

Panel membership varies from five to eight participants who serve for a period of time and then rotate off the Panel to allow for new perspectives to have a seat at the table. Panel members also receive an honorarium and reimbursement for travel and meeting expenses.

Purpose of the Report

The intention of this report is to provide a third assessment of the Panel's interaction with DuPont and their level of satisfaction in participating on the Advisory Panel. All Panel members have approved this report.

This report includes three sections:

Background information regarding the Panel and current membership;

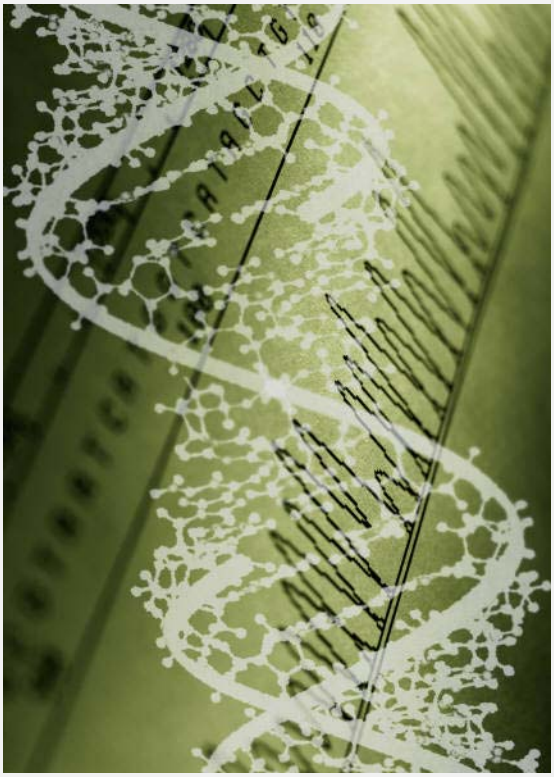
Panel members who have attended meetings between January 2004 and April 2007 provide a consensus view regarding their participation on DuPont's Biotechnology Advisory Panel;

Individual perspectives from each of the Panel members regarding their particular areas of interest and expertise as it relates to biotechnology.

Panel Members

Dr. Marcelo C. de Andrade (Panel member from November 2004 to present)

Dr. de Andrade is the founder and chairperson of Pro-Natura, the first international non-governmental organization based in the Southern Hemisphere to specialize in sustainable development. An ardent advocate for sustainable community development, Dr. de Andrade has dedicated his career to biodiversity conservation, environmental preservation and restoration, and improving the quality of life for societies around the globe. A testament to his dedication and vision, de Andrade was the 1997 recipient of the George and Cynthia Mitchell International Prize for Sustainable Development, which is equivalent to the Nobel Prize in the sustainable development area. Dr. de Andrade was the first person in the history of this mark of distinction that singularly received both the Mitchell prize and the related cash award. He is currently also a member of CONCEC—a private-sector advisory panel for the Brazilian government—and Counterpart International and Earth Restoration Corps.



Dr. Jason Clay (Panel member from April 2007 to present)

Dr. Clay, with a particular interest in biofuels and research in product-lifecycle carbon balances, serves as Vice President and Managing Director, Markets, World Wildlife Fund–U.S. He has worked extensively to identify and analyze better management practices to reduce the social and environmental impacts of agriculture. Dr. Clay has spent more than 20 years working with human rights and environmental organizations. In the 1980s, he was one of the inventors of "green marketing" and established a trading company that developed markets for rainforest products with nearly 200 companies in the U.S. and Europe. Dr. Clay was also the founder and editor of the award-winning Cultural Survival Quarterly, an anthropology and human rights publication with the largest circulation in the world.

Father Kevin T. FitzGerald, S.J., Ph.D (Panel member from November 2003 to present)

Father FitzGerald is internationally known and sought after for his expertise regarding the ethical issues surrounding human genetic engineering, cloning, and stem cell research. As a Research Associate Professor in the Department of Oncology at Georgetown University Medical Center, and the Dr. David Lauler Chair in Catholic Health Care Ethics, his research interests include investigation of abnormal gene regulation in cancer and ethical issues in genetics. Father FitzGerald

has served as an ethics consultant for the National Society of Genetic Counselors, the March of Dimes, the United States Catholic Conference, and is a member of the American Association for the Advancement of Science Dialogue on Science, Ethics, and Religion. Currently, he is also a member of the Department of Health & Human Services (DHHS) Secretary's Advisory Committee on Genetics, Health, and Society.

Professor Li
(Panel member from April 2007 to present)

Professor Li serves as principal investigator with the Institute of Genetics and Developmental Biology, Chinese Academy of Sciences (CAS). In addition to his role at CAS, he holds several other leadership positions, including serving as a member of the Asia-Pacific International Biology Network and president of the Genetics Society of China. He previously served as secretary-treasurer of the International Association for Plant Tissue Culture & Biotechnology and director of the International Society of Plant Molecular Biology. As a leading scientist in plant molecular genetics, Professor Li has been selected as academian of the Chinese Academy of Sciences and fellow of the Third World Academy of Sciences. He also received the Ho Leung Ho Lee Foundation Award for Life Sciences. As Professor Li's first meeting was in October 2007, he was not involved in the detailed discussions that resulted in the generation of this Panel report.

Biotechnology Advisory Panel 2007 *(from left to right)*: Dr. V. Prakash; Dr. Jason Clay; Father Kevin T. FitzGerald, S.J., Ph.D; Dr. Sven Thormahlen; Dr. Marcelo C. de Andrade; Mr. Chebet Maikut; and, Professor Li.

Mr. Chebet Maikut
(Panel member from October 2005 to present)

Mr. Maikut is the former president of the Uganda National Farmers Federation (UNFFE), one of the largest farmer organizations in Uganda. Mr. Maikut is a farmer in the Kapchorwa District, Uganda and has dedicated his career to empowering others to create a better quality of life through the development of a sustainable African agricultural industry. In addition to his role at UNFFE, Maikut holds several other leadership positions, including vice president, Eastern Africa Farmers Federation (EAFF) and has recently been appointed a member of Uganda's National Biosafety Committee. Maikut also served as a member of the Interim Panel of Eminent Experts to the Global Crop Diversity Trust from January 2003-December 2006. He is also an active participant of the CGIAR Africa Sub-Saharan Challenge Program and a member of the Executive Committee of the International Federation of Agricultural Producers (IFAP). Formerly, Maikut was chairman of the International Federation of Agricultural Producers' Committee on Science and Technology; a District Councilor for Kapchorwa; a Constituent Assembly Delegate (CAD); and a Member of Parliament (MP) in the National Assembly of Uganda representing Kween in the Kapchorwa District. Before then, he worked with the Republic of Uganda Ministry of Agriculture, Animal, Industry, and Fisheries (MAAIF).

Dr. V. Prakash
(Panel member from December 2002 to present)

Dr. Prakash, recognized internationally for his work in sustainable food and nutrition security, serves as the Director of the Central Food Technological Research Institute (CFTRI) in Mysore, India. CFTRI is highly regarded as a networking R&D Institute in Food Science & Technology, which works to build sustainability into the technologies of post-harvest agricultural practices of large producers and growers as well as small entrepreneurs. He is a fellow of the Indian Academy of Sciences, the National Academy of Agricultural Sciences, the Association of Food Scientists and Technologists in India, and the International Union of Food Science and Technology. Dr. Prakash is a member of several international committees, winning a large number of awards as a scientist in the area of biotechnology. On June 30, 2004, the President of India presented Dr. Prakash with one of the highest civilian awards, "Padmashree."

Dr. Sven Thormahlen
(Panel member from March 2004 to present)

Dr. Thormahlen is Vice President of the Research and Development Organization of the Danone Group, a world leading company in the field of dairy products, biscuits, and mineral water. Dr. Thormahlen has held a variety of positions within the Research and Development organizations of leading healthcare and consumer goods companies throughout France, Germany, and the United States. His experience covers product research, product development, clinical studies, and quality assurance.

Panel Alumni

To allow for new perspectives, Panel members rotate off the Advisory Panel. Panel alumni who have contributed important perspectives to DuPont include:

Dr. Arthur Caplan, Emanuel and Robert Hart Chair for Bioethics and Director of the Center for Bioethics at the University of Pennsylvania.

Dr. Andre Capron, held the position of Director of the Institut Pasteur de Lille in France during his tenure on the Panel.

Professor Chen Chunming, Founding President of the Chinese Center for Disease Control and Prevention.

Dr. Pablo Eyzaguirre, Senior Scientist for Anthropology and Socio-Economics in the Genetic Resources Science and Technology Group, International Plant Genetic Resources Institute (IPGRI), now Bioversity International.

Jonathan Lash, President of World Resources Institute (WRI), United States.

Ms. Tiahoga Ruge, held the position of Director General of the Center for Education and Training for Sustainable Development, Mexico during her tenure on the Panel.

Dr. Braulio Fereira De Souza Dias, held the position of Director of Biodiversity Conservation/Secretary of Biodiversity and Forests, Ministry of the Environment, Brazil during his tenure on the Panel.

Ms. Carol Tucker Foreman, Distinguished Fellow and Director of the Consumer Federation of America's Food Policy Institute.

Dr. R.K. Pachauri, held the position of Director-General at the Tata Energy Research Institute (TERI), India during his tenure on the Panel. Presently Chair of IPCC and Nobel Peace Prize recipient.

Dr. Florence M. Wambugu, founder and Chief Executive Officer of Africa Harvest Biotech Foundation International (AHBFI) and Gates Foundation Board Member.

Biotechnology Advisory Panel Assessment

The following are observations from the Panel members based on interaction with DuPont.

Converting Corn Stover to Ethanol—A Partnership with the U.S. Department of Energy

Since 2003, DuPont has been working with the U.S. Department of Energy on a four-year project to convert corn stover—the agricultural byproducts of crops—into ethanol.

The Next Generation of Biofuels—A Partnership with BP

In June 2007, DuPont announced a partnership with BP to produce and market the next generation of biofuels called biobutanol. Biobutanol is 100% renewable and delivers environmental benefits beyond that of ethanol. Biobutanol lowers greenhouse gas emissions and has the potential to utilize locally grown feedstocks such as sugar beets, corn, wheat, sugar cane, cassava, sorghum, and, in the future, cellulosic feedstocks.

Shifting Focus for the Panel

It is noteworthy that the early years of the Panel focused largely on questions related to the safety of biotechnology, particularly as it related to the human food supply. Since that time, Panel confidence has grown in the technology's food safety record. Panel members are now more focused on how biotechnology might be applied in ways that decrease environmental footprints and alleviate poverty. Some lingering concerns remain about agricultural biotechnology's environmental impacts as it relates to biodiversity and protecting centers of origin for food crops.

Global Climate Change and Energy Security—The Call for Alternative Fuels

As DuPont prepares for the 21st Century, the company has sought businesses and products that capitalize on sustainable development while decreasing its overall environmental footprint. The Panel recognizes DuPont's long-standing leadership on the issue of global climate change. The Panel particularly commends DuPont's recent enterprises that seek to find the next generation of biofuels. This past year, the company has engaged in several renewable energy initiatives and partnerships that hope to bring plant-derived renewable energy to the market. These efforts expand the application of biotechnology into the high impact areas of alternative fuels and renewable energy.

These renewable energy initiatives have the potential to decrease the world's reliance on petroleum and increase energy security for nations like the U.S. The Panel is particularly pleased to see that the company is forming public and private partnerships in pursuit of its goals around renewable energy. As a Panel, we think the goal is to make the production of all fuel types more sustainable—both agriculturally-derived fuels as well as petroleum-based products. In order to do this, very good product throughput data is needed for different fuel types, and metrics and performance measures will be needed so that different fuels can be compared. DuPont can be an important voice in the dialogue regarding this analysis. Additionally, the Panel urges the company to look at how DuPont might contribute to conversations and strategies that focus on adaptation to global climate change. DuPont's seeds, insulation, and containment products might be particularly suited in this arena.

Measuring Company Performance—Metrics for DuPont's Bioethical Principles

In 2005 the Panel stated, "Principles and positions are only as strong as the metrics by which you evaluate your performance and progress." The company agreed with the Panel's feedback, and defined a set of metrics by which they would measure their progress and performance against the Bioethical Principles. While there remains a great deal of discussion among Panel members over the precise form and function of the metrics, they are pleased at DuPont's dedication to measuring performance. These assessments will occur every two years. The first assessment can be found at: http://www2.dupont.com/Biotechnology/en_US/difference/principles.html

In 2003, DuPont led the industry in developing a set of bioethical principles and positions. The principles and positions were developed over the course of a year and in close coordination with the Panel members. The eight principles to be measured are:

1. **Commitment to Food/Feed Safety**
   DuPont will develop products derived from biotechnology that are at least as safe as their conventionally produced counterparts for both human food and animal feed using the best scientific knowledge.

2. **Environmental Focus**
   DuPont will endeavor to apply biotechnology in production systems so there is a net gain for the environment.

3. **Conserving Biodiversity**
   DuPont will strive to protect and conserve natural resource biodiversity.

4. **Transparency of Information**
   DuPont believes in the individual's right to information regarding product safety. DuPont will apply a strict and transparent standard in determining what product information is proprietary. DuPont will disclose safety information on its products in a clear and accessible manner.

5. **Engaging Stakeholders**
   DuPont will routinely engage stakeholders (shareholders, customers, society, and employees) and consider their diverse viewpoints in its decision-making process for products derived from biotechnology.

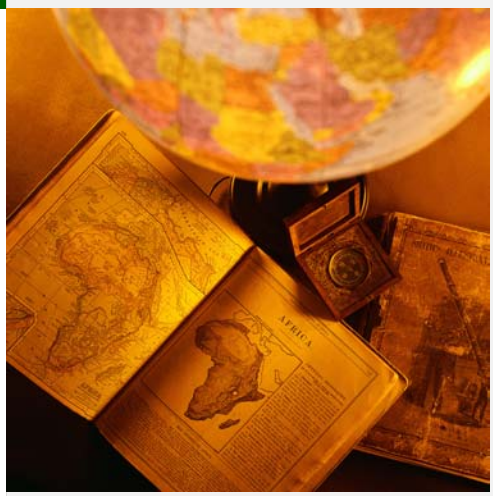
6. **Advocating Independent Research**
   DuPont will seek opportunities to advocate and/or find biotechnology research important to its business at public institutions, research centers, and non-governmental organizations that follow accepted science protocols and peer review standards.

7. **Contributing to Developing Economies**
   DuPont will endeavor to be socially and culturally responsible as it shares knowledge and appropriate technology in developing economies to help improve food, nutrition, and the quality of life. DuPont will seek to utilize its intellectual property in ways that help alleviate hunger.

8. **Formalizing Access to Genetic Resources**
   DuPont will strive to identify the owner(s) of natural biological resources and knowledge selected for research and product development and will develop fair and equitable business arrangements that recognize the contributions of the involved parties. To the extent possible, arrangements will be made public.

DuPont's Contribution Toward Sustainable Agriculture and the Needs of the Poor

The Panel is pleased with and continues to encourage DuPont's sustainable agricultural work aimed at alleviating the needs of the poor. The Cura Village Community Project (in partnership with Africa Harvest), a project providing farmers with disease- and insect-free tissue culture and banana planting materials to increase yields and productivity, continues to grow and thrive. In addition, DuPont has several other efforts aimed at helping the world's poor. These include:



African Biofortified Sorghum Project

The Panel commends DuPont's involvement in the Biofortified Sorghum Project. This effort seeks to improve the nutritional value of grain sorghum, a staple grown throughout most of Africa. The Bill and Melinda Gates Foundation is the project's primary funder with a $16.5 million grant over five years. Project leadership is provided by Africa Harvest Biotech Foundation International. Participants include companies like DuPont, as well as Africa-based academic and non-profit partner organizations. DuPont has donated technology valued at $4.8 million and is hosting researchers from Africa at laboratory facilities in Des Moines, Iowa. The intent of this collaboration is to develop this "super sorghum" and for African researchers to return to their countries with additional knowledge about key technologies.

Panel members urge DuPont to remember that while the company views this product as a "technology," people who consume sorghum view it as a food. With that in mind, Panel members encourage the company to continue to work with the intended recipients of the biofortified sorghum to ensure that taste, texture, and cooking properties aren't compromised while developing the enhanced seeds.

Drought Tolerance Research for Maize

As the world experiences more and more extreme weather events in the form of droughts and flooding, the Panel encourages DuPont to continue developing crops that can withstand such fluctuations. Because developing economies are less resilient when faced with extreme weather events, the Panel believes DuPont's drought tolerance research may play a particularly crucial role in providing food security for the world's poor. Some Panel members suggested there may be a moral imperative to develop such technologies, even if the return on investment was not significant. The Panel encourages DuPont to seek public financing partners for this important effort and to find ways to integrate drought-tolerant technology into locally grown crops for specific regions.

Leadership Action—Seeking Agriculture Practices with Least Impact to Soil, Water, and Habitat

The Panel has encouraged DuPont to take on more leadership roles and to use its influence as a large and successful multi-national company. The Panel commends DuPont's leadership as it participates in a multi-stakeholder group working to identify sustainable agricultural practices. While the task is complex, the group seeks to identify six to eight desirable environmental outcomes resulting from sustainable agricultural practices. These are likely to focus on soil, water, and habitat conservation. Once those outcomes are identified, the group will seek the preferred agricultural practices that best meet those environmental outcomes. The coalition hopes to implement a pilot program in the spring of 2008, focusing on the U.S. Should this pilot prove successful, the Panel encourages DuPont to take this initiative globally.

Increased Dialogue Regarding Products Early in the Research & Development Stages

In the last report, the Panel shared their hope that the company would increase its level of interaction with external stakeholders early in a product's life, prior to significant investments. The Panel is pleased that DuPont is bringing more technologies and products that are in the early incubation stages of Research & Development. In the last two years, the Panel has discussed new technologies near commercialization, as well as products and leading edge technology that are in their infancy. While the Panel understands the sensitivities entailed, we would continue to encourage DuPont to reach out to stakeholders beyond the Panel as early in the Research & Development process as possible.

Areas the Panel Would Like to Continue to Challenge DuPont's Thinking in the Future

Moral and Ethical Obligations: The Food Versus Fuel Debate

As evidenced by the recent "food versus fuel" debates, being in the "business of food" is fundamentally different than being in almost any other business. As the Panel continues to stress to DuPont, because food is a basic human need and not a luxury, it carries different moral and ethical obligations. In much of the world, it is difficult for people to understand growing a traditional food crop for the purposes of fuel. Additionally, the Panel believes that water issues will be a vital focus in the future. Careful tracking and monitoring of DuPont's water usage and the company's potential contribution in securing healthy and sustainable water supplies will be imperative. The Panel looks forward to additional dialogue about the morality of basic needs such as food, water, and shelter and its implications for contemporary corporate responsibility.

DuPont's Contribution to the World's Nutrition

The Panel encourages DuPont to honor both parts of their "Agriculture & Nutrition" platform. While DuPont—and specifically Pioneer—has a long agricultural history, the Panel hopes the company will continue to look for ways to improve the quantity and nutritional quality of the world's food supply. Recognizing that DuPont's comfort zone has traditionally been in commodities markets, and given recent political and economic enthusiasm for biofuels, the Panel hopes DuPont does not overlook the important contributions agricultural biotechnology is poised to make regarding world nutrition.

Given DuPont's long record of accomplishment in safety and innovation, the Panel urges the company to continue to push itself in the area of nutrition and to grow its research portfolio in this arena. It will also be important for DuPont to collaborate locally and to remember that while the company views its product as a "technology," people who consume it view it as a food. Panel members urge DuPont to remain sensitive to different geographies and food preferences, taste, texture, and traditional food preparation that might alter DuPont's nutritional targets.

Encouraging Public/Private Partnerships

The Panel continues to encourage DuPont to seek public and private partnerships. While these partnerships are beneficial in all areas of biotechnology development and commercialization, the Panel suggests they are particularly important as DuPont works internationally. In the complex and highly conservative European regulatory environment, which occasionally borders on protectionism, the Panel recommends that DuPont seek strategic alliances with leading European partners (companies, academia, NGOs, and others) in order to engage jointly in regulatory-related activities. Teaming with NGOs, governments, and other private companies allows for the expedited sharing of information, creation of goodwill, and building in-country capacity that ultimately leads to stronger, more viable markets for DuPont's products.

The Panel commends DuPont's generous donation of technologies in developing countries, but suggests that it is only one essential piece in the larger sustainability puzzle. While the Panel respectfully understands DuPont's desire to stay focused on the company's area of agricultural expertise, it will take a holistic approach for DuPont's technology to take hold and have a positive effect. The Panel encourages DuPont to experiment further with public/private partnerships and to team locally whenever possible. The Panel would welcome additional conversations about how to identify and evaluate potential partnering opportunities.

Where to "Draw the Circle"—Taking a Closer Look at Total Product Lifecycles and Footprints

Increasingly, advocates and policymakers are asking for more detail about where companies "draw the circle." This refers to how far backward and forward in the value chains energy inputs and ultimate impacts are measured. For corn, the company is actively assessing the water, soil, land, and labor inputs in order to have a clear understanding of its impacts. With all crops, it might also be important to factor in subsidies in the final evaluation of impacts. Of particular interest to DuPont will be those impacts that negatively affect the environmental and social commitments detailed in DuPont's Bioethical Principles. While this detailed assessment will entail sophisticated modeling and absolute transparency regarding assumptions, it is essential in helping decision makers determine the sustainability of a product. The Panel highly recommends that DuPont continue to engage external stakeholders as the company builds its assumptions for how it assesses a product's feasibility including its total energy lifecycle.

Panel Member Perspectives

Dr. Marcelo C. de Andrade
Chairman, Pro-Natura

Question: How would you advise that responsible companies integrate sustainable development into their long-term planning?

> *"Long-term strategies regarding sustainable development must be built into the business models."*

Dr. de Andrade: I think of sustainable development as a practice in which socio-economic variables are linked with nature conservation objectives in the search for alternatives to improve the quality of life in human habitats without degrading the environment. Long-term strategies regarding sustainable development must be built into the business models. Companies make a mistake when sustainable development is only at the corporate strategy level and has not been properly implemented at the business level. As a company like DuPont looks to move from oil-based inputs to bio-based inputs for products, the pressures for water, land, and labor become very important. To the extent that a company can work to improve the quality of labor, land, and water use, this is significant. If additionally the company is able to employ and responsibly partner with local labor forces, then the company is also building capacity in developing economies.

Question: How can DuPont increase their consumer base within a sustainable development framework?

Dr. de Andrade: DuPont is currently reaching nearly one billion people with their products. In order to start to reach the additional 4.5 billion, the company will need to invest in developing economies. This helps in the short term by increasing the supply side of bio-based inputs for a company like DuPont. If DuPont is able to provide the necessary technologies and training for those in developing economies, then those small- and medium-scale farmers are able to contribute to the supply base of materials that the company needs in order to make products. In time, those farmers will have earning potential that allows them to invest and expand their own wealth. With an increased earning potential, those in developing economies will emerge as consumers in the world marketplace.

Question: How should success be measured in the practices of sustainable development?

Dr. de Andrade: The successful implementation of a sustainable development framework means that the environmental, economical, and societal aspects of an initiative are all healthy and compatible for the long term. There needs to be performance indicators for each of the three aspects of sustainable development: environmental, economical, and societal. For example, under a sustainable development model you might seek to decrease or decelerate deforestation in a particular community or region and measure progress against such goals. Additionally, you would have a metric for economic health such as family average income and how it changes over time. A metric for societal health might be applying a Quality of Life index for the region's people.

Dr. Jason Clay
Vice President and Managing Director, Markets
World Wildlife Fund–U.S.

Question: In your view, what's been lacking in most conversations about sustainable agriculture?

Dr. Jason Clay: I think there's been a real lack of discipline about sustainable practices and how they contribute to the whole. Sustainability is a somewhat vague concept that needs rigor applied to it. It's important to start with conversations about where we "draw the circle." Issues of health and safety, food quality, and worker rights are all essential when discussing impacts within the value chain. These deserve attention, regardless of whether the company has direct control over them. Increasingly, companies are being asked to monitor and justify their water and carbon footprints. In the future, we may find this is embedded as a "license to operate" type of requirement.

> *"...we need to at a minimum understand the trade-offs we're making and ensure that we are looking at sustainability holistically."*

Question: What are the crucial factors in thinking about a truly sustainable agricultural system?

Dr. Jason Clay: A sustainable agricultural system not only produces healthy food sources, but also causes the least harm to the environment while improving the social and economic well-being of agricultural communities. It seems to me that it's most important to figure out what is the "end game" when it comes to agriculture. In my view, sustainable agricultural practices are those that can improve productivity with the least impact to the environment. If a particular agricultural practice uses less water, but results in increased habitat loss, we need to at a minimum understand the trade-offs we're making and ensure that we are looking at sustainability holistically. Ideally, we will identify a portfolio of better management practices for farmers—who know their land best—to choose from to make their operations more sustainable and measurably reduce key on-the-ground impacts.

Question: What is a company like DuPont's role in identifying and developing sustainable agricultural practices?

Dr. Jason Clay: DuPont and other industry leaders have a very important role to play. It seems to me that it is the job of the environmental community, in partnership with the full agricultural supply chain, to identify the outcomes we are hoping for and help producers achieve them with whichever practices work best for them. Some of this work is underway in an initiative that DuPont, World Wildlife Fund, and other partners are engaging in regarding outcomes and standards in sustainable agriculture. The goal is to identify desirable outcomes for soil, water, and habitat and to provide farmers with information to help improve their practices and achieve better results. Once those have been identified, then the hope is that industry will do what it does best—drive innovation to meet those goals. DuPont has a 200 year-long history of driving innovation, and I urge them to continue to lead in developing and encouraging sustainable agricultural processes.

Father Kevin T. FitzGerald, S.J., Ph.D.
Center for Clinical Bioethics
Georgetown University Medical Center

Question: Does being in the food business, or in DuPont's case providing seed that grows into food for humans, predicate a different type of ethical and moral obligation?

Father FitzGerald: I think that being in the business of "basic needs" such as food, water, and shelter carries an increased moral and ethical obligation, as it can be a matter of life or death for struggling people. That being said, many companies are willing to take on these responsibilities because not only is the company able to provide something critically important to survival, but it's also wise to be in the business of selling something that everyone needs—such as healthy food or clean water. These mutual benefits are quite compatible, but need to be addressed responsibly.

Question: Are there moral and ethical obligations that should be considered by multi-national companies when entering partnerships with developing economies?

Father FitzGerald: When multi-national companies look at doing business in developing economies, they are often focused on the legal and regulatory questions. Almost never adequately explored or discussed is the inequality of power between a multi-national company and people who desperately need good, nutritious food. At first glance it looks like a seed or food company holds all of the cards. However, the reality is that it is not without some risk that companies hope to forge partnerships with those in developing economies. The company's hope is that as standards of living continue to rise, there will be additional capacity for those farmers and citizens to buy and choose products as they see fit. This can absolutely be mutually beneficial to companies, as well as to those living and participating in the developing economies.

From my perspective, companies have an obligation to openly dialogue with farmers, citizens, and government officials in developing nations about their hopes and goals. Companies need to be open to the possibility that they may hear that the current circumstances are not right for them to enter a particular market. Companies that are patient and looking at a long-term strategy will be ready when conditions change, especially if they remain in dialogue with these communities. Also, dialogue should focus on the overall livelihood and health of the people, not just on seeds or food products. This approach makes good business sense and it's also the responsible approach to take when you are in the business of basic necessities.

Question: What role does religion have in the considerations about biotechnology?

Father FitzGerald: Religions provide frameworks and guidance that articulate the fundamental principle that people count, and that their lives are valued. The emerging biological and genetic technologies have moved past the manipulation of inorganic material, to the manipulation of life and the living. Religions and religious frameworks are only starting to grapple with the moral and ethical questions raised by these emerging technologies.

Mr. Chebet Maikut
Vice President, Eastern Africa Farmers Federation (EAFF), A Member of Uganda's National Biosafety Committee

Question: As a farmer in Uganda, what might you share about the day-to-day concerns?

Chebet Maikut: Growers in Uganda are mostly subsistence farmers. They work on traditional lands and hope to produce food for their families and perhaps a surplus to sell. Like farmers everywhere, Uganda farmers want access to the seeds that will work best for their climate and soil. At present, genetically-modified seeds are not an option because there aren't the necessary regulatory frameworks in place in Uganda. In the meantime, there have been massive anti-GMO campaigns in other African countries. I would like to see that the farmers in my country have access to a diversity of different seeds for different climate conditions—whether those are hybrid seeds or genetically-modified seeds. Then individual farmers can decide what seeds are best for them and their land.

Question: In your view, what are the biggest barriers to biotechnology in the developing world?

Chebet Maikut: There are imposing regulatory barriers in the developing world. In many countries, there are no rules, regulations, or frameworks for how to address agricultural biotechnology. Lacking frameworks, countries will reject biotechnology outright, or not have the proper infrastructure to adequately monitor agricultural biotechnology activities. Lastly, the regulatory agencies within developing economies lack the internal capacity to develop a robust regulatory system—they will likely need help from those in the developed world.

> *"... the sharing of best practices, legal frameworks, and templates of enabling legislation would help to increase capacity within the regulatory agencies."*

Question: Are there ways that a company like DuPont can help with the regulatory challenges?

Chebet Maikut: Absolutely. If the company could lend its experience in order to help developing countries put workable regulatory frameworks in place, this would help immensely. As part of this effort, DuPont should work with development groups and other respected and known organizations within the country. Also, the sharing of best practices, legal frameworks, and templates of enabling legislation would help to increase capacity within the regulatory agencies.

Dr. V. Prakash
Director
Central Food Technological Research Institute

Question: What are the factors that influence what people in India choose to eat?

Dr. Prakash: It is important that any new concept introduced in India must honor and be responsive to the variation in lifestyle, religion, culture, and regional biodiversity in order to maximize success.

India is a conglomeration of many cultures. A short distance in any direction and you can find yourself in a different region with its own language, customs, and traditional foods. It should be noted that the Indian diet continues to change to reflect alterations in lifestyle, for example the trend toward convenient or instant foods is a recent phenomenon. At the same time, religion, culture, and custom continue to heavily influence the types of food selected and eaten. Interestingly enough, many of those eating habits and practices go beyond a 5,000-year history and have been found to be quite scientific as we continue to understand the nutritional contributions and the different needs of gender, age, and other factors. Lastly, nutritional and health data from scientists influence how people think about their diet. An example of this is that there is a trend in the urban areas toward the eating of lesser-known grains and pulses for their nutritional merits and health benefits, because of awareness of nutrition. Health foods are emerging and are here to stay in our markets.

> *"...it is important to remember that culture and science co-exist and both have a role in improving the quality of life."*

Question: How might biotechnology address some of the agricultural needs in India?

Dr. Prakash: There are two major types of lands in India, the fertile agricultural land and the "wasted land," which has not grown anything for years. I think that if biotechnology can aid in making the less used lands agriculturally viable, then biotechnology will have made an important contribution to India, while also enhancing biodiversity with food and nutritional security for a safe food. This specific and localized contribution will pave the way for larger biotechnology acceptance.

Question: What is your best advice on how applications of biotechnology can best interface with culture?

Dr. Prakash: It is important when we address the application of biotechnology that we are honoring people and the strong practices and beliefs they have had for thousands of years. Additionally, one has to bring in awareness and explain how science can help fight hunger and poverty around the globe. At the same time, it is important to remember that culture and science co-exist and both have a role in improving the quality of life.

Dr. Sven Thormahlen
Vice President of Research & Development
Danone Group

Question: Is the biotechnology debate evolving in Europe? Do you sense that the climate for acceptance of biotechnology is changing?

Dr. Thormahlen: I do not think that the Europeans are moving toward the acceptance of biotechnology. I think this is for a few reasons. First, Europeans revere tradition and old world ideals and they are invested in the economic and political stature they enjoy. This is quite different from the United States, which has a comparatively short history steeped in rejecting traditional ways and valuing change and exploration. The feeling in Europe is that new technologies are a particular threat to cultural values.

Second, Europeans are generally conservative when it comes to risk. If there is a real or perceived risk then they will likely reject the technology until there is more data to prove the safety and efficacy of it. Furthermore, the sequencing of products was all wrong for Europe. If biotechnology companies had first introduced products that had a consumer benefit, then Europeans would have been much more likely to accept the risk. Instead, companies introduced products for farmers. Europeans, in general, are far removed from this aspect of the food value chain. Thus, they felt no benefit and felt it unnecessary to accept potential risks without benefits.

Lastly, Europeans are sympathetic to the disadvantaged. Biotechnology companies have not adequately made the case that these technologies are not only safe, but that they may hold the best opportunity for addressing issues of malnutrition and hunger.

Question: How might a responsible biotechnology company approach doing business in Europe? How could the company be responsive to the concerns voiced?

Dr. Thormahlen: First, share your science openly with thought leaders, politicians, and non-governmental organizations. Go and visit with them, the more that they know about your technology and products, the better. Even if they have different views on the risks and what level of risk they think is reasonable, at least they will understand the science behind it. Second, address the youth in Europe. They are trying to find their way in a culture that wants to hold onto the past. The youth may be more open to the promise of emerging technologies. Lastly, Europe is not immune from the fast pace, entertainment culture found around the world. Pursue compelling advertisement campaigns that convey what your company stands for, what your values are, and what your products are.

Question: Are the concerns the same for bio-based products as they are for agricultural biotechnology?

Dr. Thormahlen: Europeans care deeply about the issue of renewable and sustainable fuels and materials. They will likely be very open to applications of biotechnology that are not linked to food and agriculture.

The Center for Science & Public Policy

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The Keystone Center serves as a third party neutral facilitator for DuPont's Biotechnology Advisory Panel. Please contact Janesse Brewer with questions or comments regarding this report.

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