Special Educational Forum:

Can Biotechnology Help Fight World Hunger?

Congressional Hunger Center

Rayburn Building, Gold Room

June 29, 2000 9am-12pm

REV. DAVID BECKMANN:

Good morning, I am David Beckmann. I am president of Bread for the World. This year we are working to pass the Hunger Relief Act and get a minimum wage increase. We also want appropriations for debt relief. That's my commercial. I want to thank you all for coming. This is a really important and complex topic. This forum is meant especially to help members of Congress, so we are especially grateful to the members and Congressional staff who have taken time for it. I want to thank our speaker, this is an all-star cast, a really diverse and truly expert panel of speakers.

Finally, I want to also thank the organizers of the forum, principally, Representative Tony Hall. Tony has been supported in this by the Consumers Choice Council headed by Chad Dobson, and the Congressional Hunger Center headed by John Morrill.

(technical difficulty) -- fight world hunger. There are 800 million people in the world, or something like that, who are so poor that they don't get enough to eat. They lack energy, they are often sick, their kids die in large numbers, they are tremendously vulnerable, they suffer abuse from virtually everybody above them in society. I am convinced that it is quite feasible to reduce the number of hungry people in our world to about 400 million by, say, 2015. Despite the population explosion, there are fewer hungry people in the world today than there were 25 years ago. And conditions in many of the developing countries, the policy framework in many developing countries, is much more favorable now than it was in the past. In my view, what happens here in the U.S. Congress, is critical to continued progress against world hunger. Because if our government provides leadership, I think many other governments and private entities around the world, would also do their part to reduce hunger. I think the main issue really is funding for poverty-reducing programs. The kinds of programs that improve

livelihoods for poor people, for hungry people, and agriculture is clearly central to that.

That brings us to the topic for today. Can biotechnology help fight world hunger? There are lots of debates about biotechnology, but I would ask us all to focus on this question: What's in biotechnology for the world's hungry people? We have a full program, so speakers will need to stay within their time limits. Our first speaker …(technical difficulty). More than any other member of Congress, Tony has identified himself with hungry people. He's the founder and Co-chair of the Congressional Hunger Center. Tony Hall.

REP. HALL:

Thank you, David, Senator Lugar, Congressman Kucinich and distinguished speakers. It's good to be with you. I can't think of a better person in the world to be moderator than David Beckmann. He is a great fighter and a great associate in this fight for hunger, and so I am so glad he is -- not only when he was asked, but he has been very excited about taking over this role. I also want to express my thanks to Kuang Kwak (phonetic), who is from my staff. She has been assigned to me in a very wonderful way, she is a legal fellow at my office and she has played a major part in organizing this event. Cameron Griffith of the Consumer's Choice Council and the Congressional Hunger Center of which Congressman Frank Wolf and myself are co-chairs. We are very excited about having all of you here and so many of you have come from long distances.

Sometimes people like David and I we feel lonely in our battle for hunger and for hungry people, not only in our own country, but overseas. I am glad to know that you and the diverse organizations that you represent are with us today. I hope you will continue to be with us on hunger beyond this debate over biotechnology. And I hope that people are not here in any way to be using these children for their own arguments. I think David and I, when we look at the faces here, and this picture is actually from my office, we kind of feel that these kids are our kids. We take responsibility for them. I don't mean to sound like Jerry Lewis, but the fact is that we care for these kids and we want this debate to be in a very, very bipartisan way. But at the bottom line, or after taking care of these kids, if this issue has relevance, we think it is important to talk about it.

Here is the situation that they face in the world. There are 841 million hungry people in the world today. That is one person in

five; 1.3 billion people live on just one dollar per day. Twenty-three percent of the world's population cannot afford -- and are hungry. Just recently, I did a tour of Appalachia in West Virginia, Southern Ohio, Southeast Ohio and Kentucky. People there, the bottom three percent of our people, are not making it. As a matter-of-fact, the World Health Organization just ranked them -- people in our own country, this very, very wealthy country -- as poor as any poor children in the world. How can that be in this prosperous nation that we live in?

That's the bad news. The good news is that twice as many children now survive the vulnerable years before their sixth birthday. Adults live 20 years longer than their grandparents did, and people around the world have one-sixth more to eat than they did 30 years ago. Of course, a lot more can and should be done and that's where biotechnology could come in. Biotechnology might be a big "if." Some people say there is very little in it, that it's irrelevant to the poor and hungry people, and its potential is uncertain. If this is about making money, I am not interested.

So many things on Capitol Hill are about making money. If this is about hungry kids, I am interested. We would be foolish not to see a future role for biotech and helping them. I don't want to be remembered as the guy who predicted a world market for maybe five computers as an IBM Chairman did in 1943. I am interested in what scientists are learning about biotech, and I would be wary of efforts to stifle their work. Scare tactics could do just that. Particularly, if they milk the concerns of people in developed nations and use those concerns to block solutions to the very different problems people in the developing nations face.

I am also pleased with the efforts that industry has made to share the keys to this vehicle to potential prosperity with people in developing countries. I hope more initiatives like this will be announced in the coming months. I hope the focus of biotech will shift to the foods and crops that are relevant to people in developing countries.

On the other hand, I share some of the critics' concerns that we shouldn't solve the wrong problem. People are not hungry because there isn't enough food in the world. They are hungry because they are poor and any real solution will require getting resources into the hands of the poor. So far, that is not happening. We need more political will. We need more education of people in our own country and overseas and we need more spiritual will. Likewise, the challenge to the environment and

people's health in developing countries is enormous and biotech should not compound these problems.

In closing, I want to thank the panelists and particularly those who have traveled a great distance to be with us. I'm very glad to see the full range of experts here and I appreciate the work each of you is doing. I want to thank again, Senator Lugar, Congressman Kucinich. I believe Congressman Bob Ehrlich and Tom Ewing and Cal Dooley will be with us for their interest and the energy that they have devoted to this issue. I hope that, as we do this work, the plight of poor people will remain on our radar screens and that we will not consider our job done until they no longer suffer from hunger and poverty. Thank you very much.

REV. BECKMANN:

Senator Richard Lugar is Chair of the Senate Agricultural Committee. He's also the number two Republican on the Foreign Relations Committee so every issue that Bread for the World ever works on, Senator Lugar is tremendously influential. He almost always comes down on the right side. Senator Lugar.

SEN. LUGAR:

Distinguished panelists, ladies and gentlemen, I deeply appreciate the organization of this conference on hunger, biotechnology, and congressional attitudes. I begin with a tale of technology, theology and ice. The revolutionary idea that ice from colder climates could be collected, transported to lower latitudes, stored and eventually used for refrigeration was the brainchild of Frederick Tudor. In 1833, Boston's ice king demonstrated the feasibility of summer refrigeration in dramatic fashion, loading 200 tons packed with sawdust aboard a ship bound for India. For 180 days at sea, through mostly warm waters, the ship arrived and successfully delivered half of its original cargo. Tudor drew considerable criticism from prominent theologians who argued that keeping ice underground in summer, similar to the practice of raising flowers under glass in winter, reversed the natural order of the universe and was, therefore, sinful.

Nonetheless, the benefits of a technology allowing for extended storage of meat, fruit and vegetables, were soon apparent. By the late 1870s over 700,000 tons of ice per year were being shipped throughout the United States. By 1920, however, mechanical refrigeration replaced ice and Frederick Tudor disappeared from the annals of American business. The rise and fall of ice delivery and the storage industry serve to illustrate three points that I believe are worth remembering

today at this conference on biotechnology.

First, opposition frequently accompanies technological innovation. Opposition arises from fact, myth or cherished belief, and the obvious difficulty is to determine an elusive truth.

Secondly, technologies that eventually win acceptance do so after demonstrating a clear benefit to society with few risks. A ready supply of ice fundamentally improved the safety and dynamics of food distribution, reducing disease and infection, especially for those living in America's expanding cities. Whether the natural order of the universe had changed remained the subject of debate, but living standards were undeniably higher.

Lastly, technology spawned by limitless bounds of human intellect continues to evolve as knowledge and understanding of our world increase. The advent of mechanical (technical difficult) -- the ice that often failed when it was most needed. Innovation often provides fixes for earlier deficiencies but, in the process, may lead to a different set of concerns. As an example, it is hard to imagine a Washington summer without refrigeration or air conditioning. But at the same time, electrical power production for cooling systems contributes to a net increase in greenhouse gas emissions.

Agricultural biotechnology is not unlike Frederick Tudor's ship leaving Boston Harbor with a cargo of ice. On the docks a crowd quickly gathers, split between voices offering encouragement and voices offering disapproval. My fear is not that agricultural biotechnology has inspired controversy, but rather the debate has become polarized, sometimes reactionary, so as to preclude reasoned public debate over the merits of new technology versus possible risks. Exactly why agricultural biotechnology has attracted such intense levels of opposition, especially in Europe, deserves consideration. Testimony received by the Senate Agricultural Committee during hearings last October strongly suggests biotechnology holds enormous potential to improve the human condition.

A prime example was testimony from Dr. Dean DellaPenna of the University of Nevada Reno, who has been doing cutting-edge research on the use of biotechnology to increase the vitamin content of certain staple crops like rice and corn. In an article published in Science magazine, Dr. DellaPenna writes that 250 million of the world's children, mostly in the developing world, suffer from vitamin A deficiency. As a direct

result, some 500,000 children are blinded each year. If staple foods that these poorest of poor children eat each day could be fortified with vitamin A through the application of biotechnology, a worldwide scourge of blindness from dietary deficiencies could be alleviated.

Biotechnology products in the market are already providing significant societal benefits. In 1999, cotton farmers were able to avoid using 84,000 gallons of insecticide by switching to Bt varieties. Dr. Roger Beachy, President of the Danforth Plant Science Center in Missouri, testified that Bt potatoes genetically engineered to resist the Colorado potato beetle could eliminate the use of 1.35 million kilos of chemical insecticides. Savings on Bt corn and Bt cotton are expected to be even larger. These are benefits for the farmers and their families who have had to handle these chemical products and for the environment in general.

Also worth considering are the environmental implications of not developing agricultural biotechnology. Demographers predict that the population of the United States will double over the next hundred years and world population is said to increase 50 percent by 2050. Development and the need for housing will place an inexorable pressure on land that now constitutes a significant percentage of America's and the world's treasured open spaces. Simultaneously, more food will be required to support population growth and improving standards of living. If agricultural efficiency remains static, then more land will be needed to grow more food. Faced with the choice of starvation or cutting down the rain forest, mankind will have few options. But this is a fool's game. An alternative does exist and if developed with intent to improve the lives of people everywhere, biotechnology can increase agricultural efficiency, reduce chemical pesticides, and improve food's nutritional value.

Finally, agricultural biotechnology is a difficult public challenge. A difficult set of issues requires that we act in a conscious and responsible manner. I am heartened by the way that the EPA has thoughtfully and carefully addressed the issues of potential risks. I applaud the efforts of the agricultural biotechnology stewardship-working group which makes useful and constructive recommendations to governmental regulators, permitting new technologies to be employed in safe and ecological sensitive ways. Finally, I hope that the public reporting of agricultural biotechnology will, in the near future, reflect similar levels of responsibility and scientific accuracy. I thank you very much.

REV. BECKMANN:

Two other members of Congress are slated to speak with us and just to reduce the jumping up-and-down, why don't you both come up at once. Representative Dennis Kucinich recently sponsored legislation to require labeling of genetically engineered foods. Representative Robert Ehrlich is Co-chair of the Congressional Biotech Caucus. Mr. Kucinich and Mr. Ehrlich, thank you.

REP. EHRLICH:

Since I got here first, I'm Bob Ehrlich from Maryland and I welcome you to this very important conference. I have an interest in agriculture. Maryland grows (inaudible) things and I have an interest in representing small businesses, particularly start-ups, in my law practice. A few months ago, leadership came to me and said "Ehrlich, you are one of the House Co-chairs of the House Biotech Caucus" and, since then, my schedule has been full. One of the main, primary folks on my staff who has had to handle this influx of appointments is Charlie Kuhn, who is sitting back here, all in black today. I hope that's not a symbol for the day. We would like to get out of town today, actually. So, Charlie now has even more to read because I took everything from the table outside and, Charlie, you're going to have a long week ahead. It has been fun and interesting for us, particularly from the state of Maryland. Maryland is the focal point for biotech start-ups and research. So I get to combine parochial interest, academic interest, intellectual interest and political interest, as well.

Can biotech help fight world hunger? The answer is clearly, "yes", for a variety of reasons. Assisting the environmental impact of farming, mitigating it, providing better nutrition and fighting the curse of malnutrition, helping feed a rapidly growing world population, promoting market competitiveness, assisting crop diversification, the list goes on and on. The Senator made a few good points, however. Sound science needs to be used and really the bottom line, one of the primary early goals of the House Biotech Caucus, is to talk facts. We have seen what has happened in Europe. We have seen what can happen in the age of the Internet and mass global communications, how easily ideas and movements can be demonized and demagogued. That's not an experience we want to see replicated in the United States. That is one of the primary reasons our bipartisan caucus is so excited about this truly innovative area of science. It's one of the reasons I'm so happy to see you all here today. I welcome you. I guarantee you we will read everything, on both sides, out on that table, and we will continue to help educate

the American public and the world in this exciting new field. I thank you very much. Dennis.

REP. KUCINICH:

Good morning, everyone. Hello, good morning. It's great to be here. It’s great to join you this morning and it's a particular pleasure to be here with my friend, Tony Hall, who, together, we and our friends represent the State of Ohio. I have to say how proud I am of the work Tony Hall has done on hunger. Wherever there are people who are suffering, Tony Hall will go there to be with them, to comfort them, and to bring back to Congress what we should do to help people.

This moment grows out of Tony Hall's passion for caring for people. I would ask that you would join with me in thanking him. [Applause.] I was hoping that someday I would get a chance to be in Congress to serve with you. So it is an honor to be here at this forum and, of course, to be here with Vandana Shiva, my sister from India, and also with Dr. Mae-Wan Ho. Together we shared a forum in Seattle on this same critical issue, and with all the other participants who are conducting this work. We come here, and Congressman Ehrlich, I appreciate your remarks, we come here all hoping to help feed the hungry. We all have a common interest and I think that's a good starting point.

Is biotechnology and its derivative, genetically engineered food, the solution to solving world hunger? The answer is "no." For the world is a cornucopia of food, yet people are still hungry in all nations, including this one. This paradox needs to be examined, and I'm sure it will be examined fully today. Is it possible that people go hungry because of political obstacles and severe economic hardship? We all know that even here in America, in this country of plenty, many American families go to bed each night hungry. Some because they can't pay for dinner. Perhaps a living wage would help them. In many less developed nations both financial hardship and poor distribution of food, to further a political cause, are the most troubling issues to face. Will biotechnology help alleviate these causes? Perhaps sustainable agriculture and sustainable economic development will help feed these people.

The so-called green revolution was supposed to solve world hunger. It didn't. Biotechnology offers a similarly powerful illusion. If the biotech industry wants to reduce world hunger, they can certainly use their great resources to protect the indigenous natural biodiversity of developing nations and to encourage sustainable agriculture that does not require

expensive agricultural imports. In that way, prosperity may be equally shared. Even if genetically engineered food has some yet to be discovered intrinsic benefit, this benefit certainly does not override the people's right to know and the necessary assurance that the food is safe. Working with many in this room here today, we have before the Congress two bills. The first requires mandatory labeling of all genetically engineered food because, of course, people have the right to know what they are eating.

The second requires mandatory safety testing because current safety testing is hidden from the public and is inadequate. I mention these bills because opposition to them has arisen on the basis that they will block a technology necessary for the prevention of hunger in the less developed nations. This is a false argument. No one should have to choose between food that has not undergone adequate testing and, on the other hand, no food at all. I believe that people in the less developed nations also have the right to know what they eat and that their food should be held to the same standards as the developed world. A recent examples of food aid delivered to India and Africa have contained genetically engineered food. This food was not labeled and I question the adequacy of its safety testing. We have an ethical responsibility to deliver food to other nations in times of need. But the food delivered should not be inferior to the food we eat. As Europeans, and now Americans, demand their right to know, all humans should be accorded the same basic rights. If we are to demand, and we are, that GE food be labeled and adequately safety tested, the same must be done for food destined for aiding those most in need. We are our brothers' and sisters' keepers. The New Testament asks "Who among us, when our brother asks for a loaf of bread, would instead give him a stone?" We must answer many questions before we can safely assume that the wonderful instinct which we have to feed the hungry is a true fulfillment of a spiritual mission when we feed the hungry genetically engineered food. Thank you very much and have a wonderful day. Thank you.

REV. BECKMANN:

Thanks to Mr. Ehrlich and Mr. Kucinich. We will now hear from four leading experts in the field. The members of Congress succeeded in staying on time so with them I couldn't be brutal about time limits, but with experts I can be. There is a trap door right here and after 10 minutes they drop-down there and I will also… (technical difficulty).

All of our speakers this morning have tremendous qualifications,

but I will be really brief in my oral introductions just to save more time for the real discussion. Our first speaker will be Martina McGloughlin. She is director of the Biotechnology Program at University of California Davis. She is also director of the Life Sciences Program that covers the entire University of California system. Martina McGloughlin.

DR. McGLOUGHLIN:

I appreciate the opportunity of being able to speak here today. I especially thank Rep. Tony Hall, the Congressional Hunger Center, John Morrill ,and the Consumer Choice Council. I must admit, as an academic, I feel very inadequate without my slides, so I will try to muddle through without my visual aids.

I was born on a little farm just a little bit east of here about 40 years ago. If you listen a little longer, you probably will hear exactly where I come from. On this farm, I spent my formative years on my hands and knees weeding and, would you believe it, sowing and picking potatoes. I've really learned this process. My father said, if something doesn't kill you, it will make you stronger. I firmly believe, though, that there are better ways to build character than to have to scramble in the dirt. For that reason, that's why I got into science. I absolutely agree with Rep. Kucinich that we need to feed and clothe the world's people while minimizing the impact of agriculture on the environment. The human population continues to grow while arable land is a finite quantity. In fact, it's estimated that in 50 years the amount of arable land will be reduced by half. So we must make optimum use of all tools to improve productivity and food production.

Many scientists believe that biotech could raise overall crop productivity in developing countries as much as 25 percent and help prevent the loss of those crops after they are harvested. You have all heard about the excitement of the human genome project this week but, in fact, the technology developed for that project will have a tremendous application in agriculture. We will be able to use biotechnology to enhance nutritional content of crops such as protein, vitamins, minerals, and antioxidants, remove anti-nutrients, remove allergens, and remove toxins. We will also be able to enhance other characteristics such as growing seasons, stress tolerance, yields, geographic distribution, disease resistance, shelf life and other properties of production of crops. The ability to manipulate plant nutritional content heralds an exciting new area and has the potential to directly benefit developing countries. Scientists can use similar plant delivery systems to

provide not just intense nutrition, but also vaccines and therapeutics that are especially important in developing countries.

Everyone is excruciatingly aware of the devastating numbers of under-nourished and starving millions around the world. The UN has put this number at about 800 million. Of course, the real issue is inequity and food distribution, politics, culture, and regional conflicts all contribute to the problem. Biotech isn't going to be a panacea for all the world's ills, but it can go a long way to addressing the issues of inadequate nutrition and crop losses. You all heard Rep. Lugar talking about the rice that has been engineered to increase beta-carotene and iron content. And this rice is actually going to be made available free through the International Rice Research Institute thanks to the Rockefeller Foundation and, in fact, to a biotech company, Zeneca.

In addition to improved nutrition, there are many other benefits biotechnology can deliver to developing countries. Stresses caused by pests, diseases and harsh environments cause enormous amounts of crop losses in developing countries. I will give some examples that are not often talked about and that are very specific to developing countries. For example, parasitic weeds are devastating in many regions. In some areas up to 90 percent of plants are parasitized. The problem is continuously propagated, as the parasitic weed seeds are adapted -- to be very difficult to separate from crop seeds. There is no method to control it right now because herbicides will kill the plant, as well. At Davis, we're working on methods to generate crops that are resistant to these parasites.

In Hawaii, the papaya industry was down to its last stand, destroyed by a tiny killer called papaya ring spot virus for which there is no natural resistance. A simple gene from the virus itself acted like a vaccine to completely protect the plant and restore the economy. A similar approach could be taken to address the myriad viral diseases that attack crops in developing countries, for example casava. Two years ago Africa lost more than half of its casava crop to the casava mosaic virus. This, of course, is a key source of protein on the African continent and, using this system, that virus could be controlled.

By reducing dependency on chemicals and tillage through the development of natural fertilizers and pest protected plants, biotech has the potential to conserve natural resources, prevent soil erosion and improve environmental quality. An example that

you heard already today is the huge reduction that has already occurred in the use of sprayed chemical pesticides. An additional advantage that was not mentioned is that through this protection corn mycotoxin contamination was down by 92 percent. Now these toxins produced by fungi are absolutely deadly. Among other things, they cause brain tumors in horses and liver cancer in children. Pretty nasty stuff. The only way to control them right now is using chemicals, but, using biotech, we will no longer will need chemicals.

Also to date, half of all economic benefits from these technologies have actually gone to the farmers. More than what has been appropriated by biotechnology companies and by seed companies combined. Environmental stresses such as drought, heat, cold and non-optimal conditions can also been addressed. For example, plants can be engineered with a gene that preserves osmotic integrity, and this will allow plants to grow in drought conditions and in extremes of heat and cold. Similarly a gene that produces citric acid in roots can protect plants from soils contaminated by aluminum and heavy metals. Genes such as these can allow crops to be cultivated in inhospitable regions and at wide ranges of temperatures, increasing the geographic range while reducing potential impact on fragile ecosystems.

Yield is also an issue in developing countries. By engineering metabolic pathways, we can greatly increase productivity by bypassing the physiological barriers that cannot be addressed using traditional crop breeding. Likewise, synthetic fertilizers are a very difficult problem in developing countries because they're not available to resource poor farmers. We have now the ability to engineer rice so it can be colonized by good bacteria that fixes nitrogen from the atmosphere and, therefore, you remove the dependency on synthetic fertilizers.

Of course, making these technologies available to developing countries is also an issue. Centers such as the International Rice Research Institute, the International Service for the Acquisition of Ag Biotech Applications, CAMBIA, IL-TAB, Agricultural Biotechnology for Sustainable Productivity, all of these organizations are working with international agencies, biotechnology companies and local communities to make relevant technologies available to farmers in developing countries. In addition, an increasing amount of biotech research itself is being carried out in these countries. Scientific, civic and religious opinion leaders from all over the world have expressed support for the value of this technology. Florence Wambugu, from Kenya, states that the great potential of biotechnology is to increase agriculture in Africa that this potential lies in its

packaged technology in the seed which ensures technology benefits without changing local cultural practices. She observes that, in the past, many foreign donors funded high input projects which have failed to be sustainable because they have failed to address social and economic issues, such as changes in cultural practices. Wambugu's position has been supported by various groups such as Bob Baker from the Church of England who said "genetic modification uses nature's own God-given techniques for improving crops. For me as a Christian there is an overriding reason for continuing with the trials," he said. Crops that are better able to resist enemies have the potential to transform the lives of whole countries. We are all called to love our neighbors and we owe it to people to explore this way of helping them.

Bishop Elias Egacia from the Vatican has said we are increasingly encouraged that the advantage of genetic engineering of plants and animals are much more important and these advantages are greater than the risks. The risks should be carefully followed through openness, analysis and controls without alarm. We cannot agree with the position of some groups that it is against the will of God to meddle with the genetic makeup of plants and animals.

The view that genetically modified organisms pose new or greater dangers to the environment or human health are neither supported by the weight of scientific research nor by a great majority of the scientific community. You heard already the National Academy of Sciences have stated that there is no evidence suggesting foods produced through biotech are less safe than conventional crops. And, in fact, they go on to say the scientific -- the growing crops using genetic engineering could have environmental advantages over other crops. Likewise, the subtly altered products on our plates have been put through more thorough testing than conventional food ever has been subjected to. Many scientists who worked in the past on crop improvement using much less precise practices of cross breeding, mutation induced breeding, wide species crosses, where hundreds of thousands of untested genes are combined, they didn't undergo this level of security. In fact, ironically, many of our daily staples would be banned if you were to apply this rigorous standard.

The most we can ask is that food produced by whatever method receive the same level of evaluation, both with regard to impact on the environment and safety to the consumer. Millions of people have already eaten the products of genetic engineering and no effects have been demonstrated. If we abandon the scientific process in judging the safety of food, we will slow

or destroy the advantages that will reduce the use of unsafe chemicals and agricultural practices and we will limit the incredible potential for improved nutrition and quality that promises to strengthen the agricultural economies around the world. As President Jimmy Carter said, responsible biotechnology is not the enemy, starvation is. Thank you.

REV. BECKMANN:

Thank you very much. Just so everybody realizes on this light system, the yellow light goes on when you have a minute left, and then the red light goes off when you should really quit. It would really help if you could stay to the time. People are standing in the room and we want to have time for questions.

Our next speaker is Vandana Shiva. She is the founder and director of the Research Foundation for Science, Technology and Ecology in Delhi.

DR. SHIVA:

I also will give a little bit of my background. Twenty-two years ago, I could have made the choice of being on a tenured track position to teach foundations of quantum theory a few miles from here at the University of Maryland. I decided instead to return to India and work in India and my history has been, in a way, the opposite of my predecessor. I have walked from academia to the farm. I decided to apply my scientific training as a physicist to agriculture because of how repeatedly I have seen facts distorted, theories based on mycology. Things you would never do with something as vital as food has happened repeatedly, when we are getting less food, being told we're having more food because of the way the assessment indicators have been evolved.

So it's 20 years now that I have been looking at agro-ecosystems in India, been practicing agriculture, doing conservation of biodiversity and I would like to begin, very briefly, with a discomfort with reading literature like this that was being circulating yesterday on the Hill. It's an ad about biotechnology helping. I don't think our newspapers, in spite of the poverty and illiteracy in India, would get away with stories like this. Stories that say that biotechnology is helping farmers of the U.S. grow a type of soybean. A type of soybean -- Why can't they just say a round of resistant soybean? A type of soybean that requires less tilling of the soil, that helps preserve precious topsoil and produces a crop with less impact on the land. It goes on to talk about how it's helping provide ways for developing countries to better feed a growing

population.

Now both that environmental claim and the food security claim is totally false. The environmental claim is false because Roundup Ready for herbicide resistant crops account for 80 percent of all planting, and every honest scientist will tell you there is nothing available on nitrogen fixing stress tolerance. All that is wonderful public relations, but there is neither the science nor the technology to deliver those applications. They have been talked about for 25 years and we don't yet have nitrogen fixing genetically engineered plants because nitrogen fixing is not a single gene trait. The European countries in debates will admit that. But what does herbicide resistant cropping look like -- huge rows of monoculture with soil exposed to the brilliant heat and the tremendous showers we get. I get 4000 millimeters in my valley. If I had to do planting like that, every bit of our topsoil would runoff. The only way we defend our soil fertility and protect our topsoil, is by having cover crops, by having poly-cultures. Wiping out poly-cultures through breeding crops that are resistant to herbicides is not just a threat to the biodiversity that is being wiped out, it's a threat to the soil and it's a threat to food security.

Let me just run through the farming systems that are actually providing food to people. They talk about Mayan peasants and the Chiapas not having high yields, 20 tons of food per acre, two tons of corn, but you don't live by corn alone. You need the squash and you need fruits. In my region in the hills, very, very shallow soils, terrace farming, six times more overall food yield than the intensive green revolution areas in the Punjab because Third World farmers don't grow monocultures, they grow poly-cultures. In Java, 607 species in one home garden, in sub-Saharan Africa 120 different plants used in the spaces left between the cash crops. Thailand, 230 species; Congo, green leaves, 50 species of trees used; in Nigeria, the home garden's cultivated by women on two percent of the land provide 50 percent of the nutrition.

It is not true that either the industrial monocultures of the green revolution or the 25 percent increase that was claimed helped because all these technologies are systems of destroying food production. If you look at the diversity of output, yield is about the yield of an individual crop per acre. But when you grow 150 crops, the output of nutrition per acre is much higher. I don't have time to show that. There is FAO data showing how small farms based on biodiversity can, at times, have 3000 percent, 3000 times more yields of food, more total output of food. And I think it is time we moved away from the monoculture,

one-dimensional assessment of yield to the poly-culture total output nutrition per acre assessments and do real honest calculations. We just have to look through and see in the world what's happening. One-hundred thousand farmers in Burma have increased their yields just doing poly-cultures. Guatemala and Honduras, 100 percent increase, not the 25 percent increase in output -- 100 percent increase in food by shifting to regional organic techniques. The movement I work with, Mubanya, the seed saving movement, we have had 100 percent to 200 percent increases in yields and output and very often three to four times increase in incomes of farmers.

In South Brazil, nine million hectares -- farmers of 9 million hectares have shifted to sustainable agriculture and the maize yields have gone up from three to five times per hectare and soy yields have gone up from 2 to 4.7 tons per hectare. It is not true that, without genetic engineering, the world will starve. It is definitely true that in the trials assessed in this country, there is no yield gain; in fact, there is a yield drag. Not only is the total output less, even the single yield is actually not showing up to be higher. But I would like to just point out, very quickly, that hunger, as has been mentioned before, is not just about the quantity of food available in the world of which there will not be more if we do genetic engineering in any case. Hunger is a creation of the destruction of entitlements, of people not having purchasing power. And purchasing power is collapsing around the world as agricultural systems push farmers to spend more on imports and get less for what they grow.

In the last three years, as the Indian economy has opened up to direct sales by global corporations -- earlier it used to be agricultural research that was a public sector driven research extension -- the seeds were supplied either by the farmers themselves, 80 percent or 20 percent by the public system. Now the companies can get right there, have advertising, show videos about farmers becoming millionaires, sell the pesticides give the credit because the farmers have the capital. And put it all together, the farmers are going into debt they can't pay. We have had, in the last three years, 25,000 suicides of farmers linked to farm debt. India is a country, you might remember, that believes in karma and in sorting things out in the next (unintelligible). So if, even despite of that feeling that this is just one life and can't ever get too intolerable, it's reaching the stage where farmers are committing suicide. Farmers are selling kidneys to pay back debt because of the new seeds and new costs of farming.

Genetic engineering will just aggravate that cost because in the meantime you will need herbicide, herbicide resistant soil or your Roundup Ready, or your Bt cotton because Bt cotton controls just the bollworm, not any of the other pests. And again, U.S. studies are showing that the other pests are increasing and expenditures on pesticides for other pests has actually shot up. But I would like to say that there's really a very deep crisis in the global agricultural system which is now starting to affect the Third World because of collapse of commodity prices. Farmers are paying huge amounts, getting nothing back. In this country, wheat prices dropped from $4.7 a bushel to $2.4, soy dropped from $8.4 to $4.2, corn dropped from $4.1 to $1.7. Farmers are not getting back enough to make a living to stay on the land. That is the issue we need to address. In India, coffee prices dropped from 60 rupees to 18 rupees per kilo and oil seed prices collapsed because of the import and dumping of soybean.

And I would like to conclude with the Canadian Farmers Union's submission to their parliament. It basically says that while the farmers are growing cereal grains, wheat, oats and corn and earning negative returns and are pushed close to bankruptcy, the companies that make breakfast cereals reap huge profits. In 1998, cereal companies Kellogg's, Quaker Oats and General Mills enjoyed return on equity rates of 56 percent, 165 percent, 222 percent, respectively. While a bushel of corn sold for less than $4.00, a bushel of corn flakes sold for $133. In 1998, the cereal companies were 186 to 740 times more profitable than the farms. Maybe farmers are making too little because others are making too much. And that crisis is going to be aggravated with genetic engineering and biotechnology which, even in the first instance, rice, might give it away free for one year or two years, six years, seven years down the line. Exactly what happened with the green revolution where subsidies were given for seeds and chemicals and are now being withdrawn which is the reason farmers are being pushed to suicide. We will then see the withdrawal of the public sector, takeover by the corporate sector and genetic engineering is just too monocultural, too impoverished, too non-sustainable to be our bet for feeding the hungry. Thank you.

REV. BECKMANN:

There are a few chairs at the front. Maybe you could take off that backpack so a few people could sit down. I'm learning a lot and I hope you are, too. Our next speaker is C.S. Prakash. He is director of the Center for Plant Biotechnology Research at Tuskegee University. Dr. Prakash.

DR. PRAKASH:

Thank you very much. I thank the organizers here, the Consumer's Choice and Professional Hunger Center. It is a great honor for me to be here and sharing the platform with very distinguished scholars and speakers and to be talking to such an esteemed audience.

Hunger is a disease and there's only one medicine for that and that is food. We could either produce food or we could buy the food. Producing food and buying food go hand-in-hand for 80 percent of the people in my country and most foreign countries who are engaged in farming. As an agricultural scientist, my research has been in how we can produce more food and better food and how we can develop improved varieties of crop lines. And my heroes, when I started studying agriculture and started majoring in genetics, were great environmentalists, that is Norman Borlaug and Swaminathan in my country. I call them environmentalist because it is the sheer application of science and technology and the knowledge of using genetics and many others that helped my country save so much valuable land from being under the plow and improved production tremendously when population was increasing by leaps and bounds.

Our food production and the application of knowledge helped improve food production in a very significant manner. We were producing 12 million tons of wheat in 1960. We produced 75 million tons and this has happened without practically increasing a single acre of land. And in the United States, by the application of science and technology, the breadbasket of the world here, 25 million acres that we used to farm in 1960 are not being farmed and these acres are now under forest. And so it is very easy to create fairy tales. I want to know where we can get 3,000 percent increased yield, because as an agricultural scientist, I don't care about that type of solution that this is coming from. I personally don't think genetic engineering and biotechnology is incompatible with any of the things we're talking about -- the poly-culture, monoculture, all the entities that are helping here in producing more food.

So the solution is to create more food. How could we do it? We could either bring more land under agriculture or try to think of every way we could produce more food with the given land that we have which is diminishing and with the increasing complexity of the water problems and the disease and the pests and all the complexities that are here. And there are not too many solutions that we have on hand. Biotechnology is, as the previous speaker, Martina, said, not going to solve all the world's problem and it

would be foolhardy to even talk about. What biotechnology can do is to help develop better varieties of crops that we have been growing for a long time. The genetic modification is not new. We started genetically modifying plants ever since we walked out of the caves in the Stone Age and we started civilization. For 10,000 years every crop that we grow today has been genetically modified through selection, a very, very slow process, and all the plants we eat today were once weeds and now they have been changed so much. And in the past 100 years, using the process of hybridization, wide crosses, and even more brutal techniques such as use of radiation, we have been developing newer varieties, and biotechnology is just one other tool that we have, one that is far better, more precise, it is more flexible. It's like the scalpel that we're using compared to the sledgehammer techniques.

You've heard about some of the tremendous benefits that biotechnology can bring: improved nutrition, producing more food within the area, about importantly designing cropland that is able to resist harsh conditions that we have in ground agriculture. And every esteemed scientific community -- the National Academy of Sciences, OECD just two days ago, World Health Organization, FAO -- issued a report saying that genetically engineered plants are safe and biotechnology crops are no more unsafe compared to the other chemicals and the hazards. The environmental hazards of biotechnology produced crops, there is nothing unique about it. We have been genetically changing plants, often even unnaturally. Tertecailie (phonetic) that is grown on a million acres in Europe is an unnatural hybrid between wheat and rye. And nectarine is a hybrid between peach and apple and this has not done anything catastrophic.

When we talk about genes, much of the Indian rice and wheat have gone dwarf, because we introduced dwarf genes and you're not seeing any dwarf wild rice varieties that are growing naturally in India. So why is there opposition to biotechnology? We see a lot of rhetoric. One of the things I want you to understand is some of the same people who are critical of biotechnology were the ones who were critical of the green revolution, who are critical of a lot of things. In fact, I was just reading one of the articles while coming here about how it took three years for an Indian computer manufacturer -- the largest software company in India -- it took three years for them to import the computer. We kicked IBM out of India because they were saying that it was going to reduce jobs and this was only going to help the elite in India, and we exported $4 billion in software this year.

The debate between Europe and America about this is just a transatlantic trade war. It has nothing to do with the safety or the environmental impact of this. Nevertheless, we see here -- and there's also this imperialistic attitude -- that somehow we need to keep the Third World farmers away from the clutches of this new knowledge, the western knowledge, the imperialism and the capitalism. I'm frankly sick and tired of hearing those kinds of arguments because I grew up seeing what local knowledge is. It's losing one-third of your children before they hit the age of three. Is that the local knowledge that you want to keep reinforcing and keep perpetuating?

DR. MAE-WAN HO:

It's a great honor to be invited to speak here. I'm a scientist who loves science and believes science and technology can help build a better world and combat world hunger. But it must be the right kind of science and technology, and it must be decided by people themselves. There is no alternative to the democratic process of seriously informing and empowering people. And I congratulate Congressman Tony Hall for putting on this special forum. I am among the 327 scientists from 38 countries who have signed an Open Letter to all Governments demanding a moratorium on GM crops because we have reasons to believe they are not safe. We are also calling for support of sustainable agricultural methods that are already working successfully around the world. There is genuine disagreement within the scientific community. The public are not served by portraying the debate as science versus anti-science.

Let me begin with recent report from Germany that GM genes in GM pollen have transferred to the bacteria and yeasts in the gut of baby bees. This kind of horizontal gene transfer involves the direct uptake of foreign genetic material. It has been found to happen also in the field. After GM sugar beet was harvested, the GM genetic material persisted in the soil for at least two years and was taken up by soil bacteria. Not only microorganisms, but animal cells, including human cells can readily take up the GM constructs and the foreign genes often end up in the cell's own genetic material, its genome. Not so long ago, the pro-biotech scientists were insisting horizontal gene transfer couldn't happen. Now, they are saying it happens all the time, so no need to worry.

So the crucial question is whether GM genetic material is like ordinary genetic material. The answer is no. There is a world of difference between GM genetic material and natural genetic material Natural genetic material in non-GM food is broken down

to provide energy and building-blocks for growth and repair. And in the rare event that the foreign genetic material gets into a cell's genome, other mechanisms can still put the foreign genes out of action or eliminate it. These are all part of the biological barrier that keeps species distinct, so gene exchange across species is held in check. And that has been so for billions of years of evolution. GM-constructs are designed to invade genomes and to overcome natural species barriers. Because of their highly mixed origins, GM constructs tend to be unstable as well as invasive, and may therefore be more likely to spread by horizontal gene transfer.

GM constructs consist of genetic material of dangerous bacteria, viruses and other genetic parasites from widely different origins. They are combined in new ways that have never existed, and put into genomes that they have never been part of. They include antibiotic resistance genes that make bacterial infections very difficult to treat. And, you never just put a gene in by itself. It needs a gene switch or a promoter to work. Typically an aggressive promoter from a virus is used to make the gene over-express continuously - something which never happens in healthy organisms. One viral promoter in practically al GM crops out there, including the so-called second generation GM plants such as the 'golden rice' is from the cauliflower mosaic virus, CaMV for short. This CaMV promoter has a recombination hotspot - a site where it is prone to break and join up with other genetic material. It is promiscuous in function. Plant genetic engineers thought it works in all plants and plant-like species, but not in animals. Just last week, we discovered in the scientific literature more than 10 years old that this same CaMV promoter works extremely well also in frog eggs and extracts of human cells. It is already known to be able to substitute for promoters of other viruses to give infectious viruses.

What will happen when these dangerous GM constructs spread? Remember, GM constructs are made from genetic material of viruses and bacteria and are designed to cross species barriers and to invade genomes. In the process, there's the obvious potential that they may recombine with viruses and bacteria to create new strains that cause diseases. The antibiotic resistance genes may also spread to bacteria associated with serious diseases such as meningitis and tuberculosis. GM constructs that invade genomes may recombine with, and wake up dormant viruses that have now been found in all genomes.

GM crops are turning out to be useless as well as unsafe. The bacterial Bt-toxins, engineered into many crops, are poisonous

for beneficial and endangered species such as lacewings, the Monarch butterfly as well as the black swallowtail. Bt crops encourage new resistant pests to evolve. Stink Bugs in North Carolina and Georgia are eating up the Bt-cotton crops and have to sprayed with deadly pesticides. A study in the University of Nebraska shows that GM Roundup Ready soya yielded 6-11% less than non-GM soya, confirming an earlier Univ. of Wisconsin study which also found that the GM soya required 2 to 5 times more herbicides.

The way to fight world hunger is definitely not GM crops. World population figures have been wildly exaggerated. The figure of 10 billion has been bandied about. In fact, figures have had to be revised downwards several times in the late 1990s. By mid-1998, the UN's estimate was that world population will peak at 7.7 billion in 2040, then go into long term decline to 3.6 billion by 2150, less than two-third of today's number.

Population arguments are based on the ecological concept of carrying capacity. Ecologists are increasingly finding that the more biodiverse the ecosystem, the greater the carrying capacity, and hence the more people and wildlife it can support. Biodiverse systems are also more stable and resilient. The same principles have guided traditional indigenous farming systems, and are now being re-applied in holistic approaches that integrate indigenous and western scientific knowledge. Some 12.5 million hectares around the world are already farmed in this way. The yields have doubled and tripled and are still increasing, at the same time reversing some of the worst environmental, social and health impacts of the green revolution. World market for GM crops has collapsed because people all over the world are rejecting them and opting for organic sustainable agriculture. An organic revolution is rising from the grass-roots and also sweeping across the disciplines within western science. From quantum physics to the ecology of complexity and the new genetics, the message is the same: nature is dynamic, interconnected and interdependent. Proponents of GM technology are stuck in the mechanistic era, it is that above all that makes the technology both futile and dangerous. It is just not innovative enough!

In conclusion, GM crops are not safe, not needed and fundamentally unsound. Far from helping to fight world hunger, they are standing in the way of the necessary global shift to sustainable organic agriculture that can really provide food security and health around the world.

QUESTIONER: (inaudible)

DR. SHIVA:

(technical difficulty)… twenty years of wheat particularly, started to create wheat problems, started to introduce some herbicides -- are resistant. The spread of Roundup resistant crops will introduce herbicides and increase the use of herbicides in agricultural (inaudible). That's the figure I'm talking about, I'm talking from experience. I'm talking from measurements done in farmer's fields across the length and breath of (inaudible) and about the terribly unethical means of advertising and pushing herbicides that the biotech industry is using to first contaminate ecosystems with herbicides and then say, hey, now we have a seed that will allow you to do farming because it's becoming difficult.

REV. BECKMAN:

Dr. Ho, do you want to address the other part? Is it sort of the view that maybe some of the opposition is because people don't mind if people (inaudible)

DR. HO:

I also would like to refer you to the same ag biotech (technical difficulty) summarizing university based studies which show increase in herbicide use as well as new -- there is a new study from the University of Nebraska. They put out a press release which found similar new (inaudible). As for the dioxides, I am totally against this kind of argument because, as I said in my talk, your own ecologists in this country are finding out that the more biodiverse the ecosystem, the more carrying capacity and, therefore, by implication, the more people it can support. It is not a fixed entity, carrying capacity is not a fixed physical entity. It actually depends on how well the system is organized, how well it's ecologically balanced, and this is why this kind of sustainable agriculture is a skilled agriculture.

REV. BECKMANN:

I don't know if everybody heard -- Mr. Smith, there is a report on the website, it's the Committee on Science. One more question before we go on to the next section from the congressional staff.

DR. PRAKASH:

Can I just add one thing?

REV. BECKMAN:

Sure, Dr. Prakash.

DR. PRAKASH:

Just as a follow-up on the pesticide issue, and I know this is something talked about. There is a tremendous amount of statistics, USDA has a lot of information on how much pesticide and herbicide is being used in this country. Generally, in the past three years, where we have been doing this work across, you will notice a tremendous reduction in the amount of pesticides that have been used. Cotton is really where the difference is, a crop that's grown on five percent of the farmland in this country but uses 50 percent of the pesticides. But in herbicide, it is true, we have not seen a dramatic reduction in herbicide usage and that was not the intent of the herbicide resistant crop, I want you to understand. But there has been a shift away from more toxic herbicides into a more broad spectrum herbicide, more benign such as Roundup, which is really two amino acids. It's not much different from (inaudible). So let's not lump them together. Then also we need to look at the equation of all the ecological benefits that this has brought.

REV. BECKMANN:

Dr. Shiva asks for one sentence.

DR. SHIVA:

I just want to add that the first trials of cotton were started in India two years ago, and we went and studied both the yields and the pesticide used. The yields came down compared to conventional cotton planting in every case of every farm. So in the same use, five to six times spraying, (inaudible) used three sprays, the micro farm used five sprays. This idea that Bt crops get rid of pesticide sprays is not at all true.

REV. BECKMANN:

I think everybody so far has agreed that biotechnology is not the solution to world hunger. Some people think it can contribute to the solution. Other people think it would do more harm than good, but I think everybody agrees that there are a range of other issues that are important, and especially issues of money and power. So whether it is getting rural roads out or how corporations market or whether governments are responsive, those issues of money and power surround and charge the question of whether biotech has a role to play.

Now in this next section, the idea -- all of the so-called challengers could also be presenters, but the organizers thought

to have 10 presentations would just numb us all. So what we have asked is for the six challengers to take three to four minutes apiece. Again, these people are people who could talk three to four hours and in a helpful way, but to just take three to four minutes apiece to probe or rebut or question. I would ask the challengers to try to be specific, to address your remarks to the discussion so far and to try to set it up so that one or two of the presenters can respond to your question and, in effect, to try to pull this together to the extent possible as a conversation.

And on the timing then, we will set it up so that you have got four minutes; the orange light goes off after three minutes. As I see it, we have got then six to seven -- we have 10 minutes per challenger and respondent, so if you have taken four minutes, then people get six minutes to respond -- to answer your challenge or question. So he'll set up the lights again, and at the end of that 10 minutes, I'll move on so that we have time for each of the challengers to help to frame the discussion.

The first challenger, questioner, is Therese St. Peter who works for Zeneca Ag Products, which is the company that is taking the lead in the distribution of golden rice in developing countries. You have to come up here, because you don't have mikes at your table. So do come up to the floor.

MS. ST. PETER:

You've heard mentioned today several times a new crop called golden rice. In my question, let me lay the foundation of what golden rice is and how it is to be distributed to the world's poor, to those children 500,000 strong who are developing irreversible cases of blindness every year because of vitamin A deficiency. The inventors of golden rice come from Europe, Dr. Peter Beyer from the University of Freiberg in Germany, and Professor Ingo Protrykus out of Zurich. It is their dream that this golden rice which contains beta-carotene which is not necessarily naturally found in milled rice, in which the body turns to vitamin A be available to subsistence farmers and to the world's poor so that this can be another way of providing and addressing vitamin deficiencies to those who have little access or ill access to vitamins.

Vitamin-A, or golden rice, according to the inventors' dream, is to provide two national research centers, is to provide the technology at no cost to those subsistence farmers. The seed can be used, be grown, the rice eaten from it, the seed used in

subsequent years by those farmers without any additional cost. The program, the vision of the inventors, is that the program continue indefinitely. Zeneca has a role only in the sense that we are catalysts. We are used to and experienced in doing the regulatory (technical difficulty) health assessments, the nutritional and compositional analyses. The eco-toxicology studies that must be done on this kind of technology before it ever reaches the commercial world, before it ever reaches the farmers.

Again, it is the dream of the inventors of golden rice that I want to address and applaud today, to provide this vitamin A or this beta-carotene enriched rice to the world's poor. By the way, all of the studies that are done to support the health and safety and eco-tox assessment will be available to the public and for independent scientific review. They will meet the requirements not only of the United States, Europe, and Japan, the industrialized world, but the regulatory requirements and go through regulatory review of all the nations in which this rice is provided.

My question today deals with this type of public-private collaboration. It's a new way of addressing one issue with regards to world's hungry, and I address it actually to Doctors Prakash and McGloughlin, but I welcome any of the presenters' comments on what they see are the benefits and downsides to a collaboration such as this, this public-private collaboration?

REV. BECKMANN:

Dr. McGloughlin, do you want to start?

DR. McGLOUGHLIN:

Actually, at this point in time, there are quite large numbers of collaborative projects going on between not just industry in the U.S., but specifically institutions that have been set up primarily to look at issues that are specific to developing countries, and I'll give you some examples of those particular centers such as obviously the International Rice Research Institute in the Philippines, the International Service for the Acquisition of Ag biotechnology. In Australia we have the Center for the Application of Molecular Biology to International Agriculture. In St. Louis there's the International Laboratory for Tropical Biotechnology, and in Michigan there's the Agricultural Biotechnology for Sustainable Productivity. And all of these institutions are working with industry and working with developing countries, with international agencies and with local communities to make sure that the relevant technologies are made

available to the farmers in these developing countries.

And again, I would like to quote what Florence Wambugu from Kenya has said and that is that "the great potential for this technology as to increase agriculture in Africa lies in its packaged technology in the seeds, which ensures technological benefits without changing local cultural practices." What she has said what has happened in the past is all of these well-intentioned agencies that came in there with high foreign donors funded for high-input projects, they were all high input and, of course, they were not sustainable because they demanded massive changes of local culture and that didn't happen, and they were failures. But by working with these particular institutions and by actually increasing the amount of biotechnology research that is going on in developing countries themselves, and at this stage at least 40 labs in developing countries are capable of developing and implementing biotech research specific to those countries.

So there is an enormous network of collaboration and interaction going on across the world to ensure that the technologies that are developed are specific to developing countries, and what is more, that they will be made available to the very people in those countries who need them.

DR. SHIVA:

I would like to make two very quick points. First, the language of giving away to the Third World hides a process that takes place before that, which is the process of bio-piracy, the process of taking genetic resources, very often patenting them, and then talking of giving away for free a patented genome that is private property. And I have very high objections to that.

Secondly, on the particular issue of vitamin A rice, we have very simple alternatives to it. Just in the state of Bengal, 150 greens which are rich in vitamin A are eaten and grown by the women. In (inaudible) I would tire you reading of that diversity. We don't have to wait until you get these very complicated partnerships together. But I would like to comment on the fact that two years ago, Monsanto developed the so-called partnership with the Institute of Science, totally secret. In spite of major demands from the public, the terms of collaboration were never laid out. After Monsanto has harvested the genomics from the researchers of our public institution, they have now folded up that partnership because these are not long-term commitments to capacity building in the south; they are short-term harvesting of the knowledge of the south so that

it can be concentrated in a handful of private-sector companies. Very often the entry through the public sector is either to get the genetic information, the genetic resources, to get low-paid scientists or to find easy market entry in a period of resistance.

DR. PRAKASH:

I personally don't see any incompatibility between eating all those vegetables and eating the vitamin A rice. And having some weeds rich in vitamin A is not a reason to prevent this golden rice. And we're not saying this will work, what we are saying is this is a technology that we think is appealing and let's give it a chance because it is conceptually appealing. Regarding bio-piracy, this is again rhetoric that I hear all the time, bio-piracy is stealing the genetic material, and I say thank God for bio-pirates. My forefathers did it in India. We are able to enjoy wheat, peanuts and apples and everything else -- the chilies that the Indians are so proud of -- everything else came from outside.

So genetic materials have traditionally moved from their places of origin to other places, and in trying now to protect what is within India and trying to put this xenophobic type of mentality within our culture that somehow everybody is stealing all of our genetic material, and passing laws against that. I think it flies against the development of science and technology that is very badly needed.

REV. BECKMANN:

I won't let all four speak on everything, but Doctor Ho just wrote an article about the golden rice.

DR. HO:

Just to draw attention to -- and I would like to see your reply to our sustainable science audit on the golden rice. Among the things that we point to is that there already are 70 patents on this golden rice, on the genes and constructs in the golden rice even before they patent golden rice itself. So I would like to know who pays the license fees for those things?

REV. BECKMANN:

Do you want to just respond to that specific question?

DR. HO:

How can you give it so-called free when there are so many

license fees and so many patents involved?

MS. ST. PETER:

Actually, that's still to be worked out and that's one of the reasons why Zeneca is involved by the inventors, is because we have experience with intellectual property management, because it is complex. It's not simple to go through, but yet it's something that must be done and done properly so that we can, for Pete's sake, get another option for these children of vitamin A where you don't and you may not have green vegetables available. They're lucky to have a bowl of rice and if it can be golden rice to help with the vitamin deficiency, let's try every way we can.

REV. BECKMANN:

Our next speaker will be Michael Hansen, he's a research associate with the Consumer Policy Institute which is a division of Consumers Union. Michael Hansen.

DR. HANSEN:

Thank you very much. I would like to actually make a few points before I ask a couple of questions. The first point that I would like to make has to do with diversity. I will just point out during the green revolution which brought all these rices to Asia that what you saw displaced was rice cropping systems where farmers would rotate rice with other vegetable crops. They also would have fish, frogs, and crabs in the rice fields, so they were harvesting not only the rice but all sorts of green vegetables and proteins. With the green revolution, we saw an increase in monoculture of rice, and you basically saw all these other things disappearing. Because of the chemicals that were used in these rice systems, they killed the fish and frogs and other things. For example, In Indonesia before the green revolution, 43 percent of the calories in the diet came from rice. Now that figure is 83 percent.

So partly this vitamin A deficiency which is actually an indication of poverty is coming because the diet has been simplified further and further and further, in part because of an inadvertent effect from the green revolution where people did not pay attention in the '60s and '70s to the importance of biodiversity and the importance of that. I would also like to point out that there is this paradox of plenty. We have 800 million hungry people and yet we have more food per person in the world than at any time in our history. There is an average of 4.3 pounds of food per person per day. That is 2.5 pounds of

grain, nuts and beans, about a pound of milk, meat and eggs, and about a pound of fruit and vegetables. So there is clearly enough to feed everybody.

The problem it seems to me is distribution. It is called the paradox of plenty. How can you have increasing numbers of starving people when there is so much production happening? So my question would be -- one of them -- in terms of all the money that is being spent on biotechnology as a theoretical way to increase world hunger, I would agree that in theory it could. I question whether it will in practice. But my question is, if you survey these peasant and farm organizations in the South, maybe some of them would like forms of genetic engineering. But when I talk to a lot of them, they say one of the major problems they have is land reform.

So I wonder if the people up here would talk about the importance of (technical difficulty) and feed the poorest of the poor, how important land reform is versus genetic engineering and how much money these international institutions and others are putting into genetic engineering versus land reform and other things which would be of use.

Secondly, my second point has to do with yield increases. I would just point out that with soybeans which is the major food crop so far that is engineered, we can't look at USDA's data because it isn't scientific; that is, it is not side-by-side yield trials. When those are done, Roundup Ready soybeans, there is a yield drag. There have been now three studies in the last three years. The most recent one was done by the University of Nebraska. I would just like to read from their press release for you; this was about two months ago. It says, soybean plants genetically modified to resist a popular nonselective herbicide yield less than conventional soybeans, University of Nebraska research shows. Two years of NU Institute of Agriculture and Natural Resource research showed Roundup Ready soybeans yielded 6 percent less than their closest relatives and 11 percent less than high yielding conventional soybeans. This averages to 3 fewer bushels per acre. They also point out, this research showed that Roundup Ready soybeans' lower yield stems from the gene insertion process used to create the glyphosate resistant seeds. So it isn't that they are putting it into lower yielding varieties, it's the process itself. So soybeans, there is a yield drag.

My second question would be, the first one is about the importance of both biodiversity and then land reform and how much money is going into that versus genetic engineering. And

the other thing is I would like to know if there is data from crops in developing countries or even elsewhere that show where there is actually -- when you do these side-by-side comparisons -- where there is actually yield increases and to show yield decreases.

REV. BECKMANN:

Why don't you say who you want to answer that.

DR. HANSEN:

For the importance of land reform versus biotechnology and the amount of money going into that, I would like Dr. Prakash and Dr. McGloughlin to respond.

REV. BECKMANN:

And the other one?

DR. HANSEN:

Also Dr. Prakash and Martina McGloughlin.

DR. PRAKASH:

I agree with you Michael…

REV. BECKMANN:

Would it better for them to stand up so we can hear and see better? Why don't you do that.

DR. PRAKASH:

I agree with Michael on the issue of land reform and I have nothing to do with it really. These are two different issues, and addressing one issue doesn't necessarily mean you can. But land reform and the land, it is an equal distribution of everything, and land and wealth are two of those things that -- wealth is something that I'm personally concerned about, and I wish -- well, that is there in all the rich people, and for the poor people it's not going to happen. Patagonia has a lot of land and what can you do with it? And, of course, within the land in India this is a very complicated issue and I recognize the importance of it. But it doesn't take away in anything the importance of biotechnology.

In fact, if anything, within the limited land area that we have, the farmers with low land, this is a skill neutral technology, conceptually at least. The whole technology is made available

through the seed. A farmer growing in one acre of this has as much benefit as a 1000-acre farmer. So biotechnology can address some of the inequities inherent in the other problem.

DR. HANSEN:

Is the seed more expensive?

DR. PRAKASH:

Not all the seed is like this golden rice, or all the genetically engineered rice coming from International Rice Research Institute is going to be made available free, battling all the licensing and patenting things. So it's not going to be any cost to the farmer like the green --

DR. HANSEN:

For the present crops, is it not true that the corn and the soybeans do cost more?

DR. PRAKASH:

Let's do a second question also, picking up one study that helps -- trying to say your argument the University of Nebraska comment. I mean, I can give you 10 studies, but we don't have to look into any studies, Michael. The bottom line is, the farmers are not stupid. They're going for these crops, they are paying more for it. The only reason is it makes an economic difference to them. They might get a little yield, but they're also saving down on the pesticides or the labor or whatever, so this is an economic equation of profit and loss. And so if one million Brazilian farmers -- in Brazil soybean is illegal, the GM soybean -- one million acres of the soybean was grown. Why are they doing it if they are getting less yield? So that is really the bottom line.

REV. BECKMANN:

Dr. McGloughlin, do you want to address both these same questions?

DR. McGLOUGHLIN:

Again, the issue with respect to land reform I think is the point I had made and have said several times from Florence Wambugu. The issue with respect to the existing systems or previous systems that were introduced to increase productivity failed because they demanded massive cultural changes. With biotech, it's a seed. You don't have to teach farmers new

cultural packages. You provide them with the seed, so you can greatly increase productivity without massive changes in the way that the farmers actually do the farming itself.

Likewise, the question with respect to the cost and reduction from the herbicide tolerant soybeans. In fact, in 1998 farmers saved $220 million when they used herbicide tolerant soybeans. And this statistic is from the U.S. National Center for Food and Ag Policy where they found that they had increased easier wheat management, less injury to crops, no restrictions on crop rotation, increased -- 20 million because they were now not using complex cocktails of less safe and more toxic herbicides. They didn't have to do these anymore.

And if you look at the studies across, not just in single studies in Nebraska where they looked at one particular variety, first of all, you get a lot of variation within soybeans themselves from year to year. And if you look at it across the board from all the studies that were done in Iowa, et cetera, you find that there is no net yield loss. But there is a humongous amount of gain not only from the savings from the point of the price which was the $220 million, but savings to the environment because you now have reduced tillage and you have increased sustainable approach to agriculture by being able to increase the types of crop management systems that you do. You have no restrictions on rotations, as I said, less injury to crops and less complex costly cocktails to be used. Thank you.

DR. HANSEN:

I just talked about Nebraska, but if you look at Ed Oplinger 's work, which looked at all eight soybean states, overall there was a four percent yield drag. The only place in any of the states where there was yield increases in side-by-side trials were in the western part of Illinois and the southern part of Michigan. Every place else there were yield drags and they averaged four percent. That is from the eight soybean states. That is up on the Web, so that is looking at 8,000 field trials. So it isn't just Nebraska but state after state. Out of each of those eight states, as I said, only in the western part of Illinois and the southern part of Michigan were there yield increases. Every place else there were yield drags.

REV. BECKMANN:

It's interesting, that's just a question of fact. I mean, you're saying on soybeans that you think that these studies suggest that farmers are just goofing in this country, but you're also saying that in general you don't think that biotechnology can

increase yields?

DR. HANSEN:

No, what I'm saying with the soybeans is the work is showing the soybeans cost more, the yield is slightly less. The reason farmers are using them is they simplify complicated herbicide decisions which allow them some more time with their family. But there have been some economic studies, and they showed that the net economic gain is about the same. So they aren't either making more money, so maybe in the North. But to then argue that this is going to be a good technology for the South since the yields aren't there, I mean -- in a lot of these southern countries you're not using a lot of --

DR. PRAKASH:

Let the farmers decide what they want. This is just one technology -- this is not a technology that is going to make it there for the Third World.

DR. HANSEN:

Let's ask them if they want land reform or other things.

DR. PRAKASH:

Nobody is preventing any land reforms. Doing one doesn't mean that you don't have to do the other.

REV. BECKMANN:

It's been a helpful exchange, I think. That's why they ask a preacher to do this. They picked a Lutheran preacher because we're used to people fighting. Our next challenger will be Per Pinstrup-Andersen, he's director general of the International Food Policy Research Institute. He's my guru on these issues.

DR. PINSTRUP-ANDERSON:

Thank you very much, David. In response to what I have heard this morning, I would like to make three points. I believe it's one point per minute. First I want to re-emphasize what Congressman Kucinich said. Political obstacles are extremely important to achieving food security for all. Governments who decide to prioritize food security for all will invest more in rural infrastructure. They will decide and implement policies to redistribute land to the rural poor who do not have access to land. They will help put in place institutions that would give access by poor people in rural areas to credit, and they would

invest in public sector agriculture research focused on developing technology that poor people need and want. And that would include, where appropriate, using -- genetic engineering if that is what is most appropriate and most likely to be accepted by the rural and urban poor. So yes, politics, policies, are extremely important in this context, but it is not a matter of politics versus technology. It is a matter of the combination of the two.

And that is why we have created a false dichotomy this morning by saying it is one or the other. No, it isn't; it's both. IFPRI has worked over 25 years in a large number of developing countries to help governments and national institutions in general to understand the consequences of alternative policies. It is their choice what the policy should be. We're trying to help them currently in 45 countries; we're trying to help for them to understand the consequences of alternative policies. So, yes, policies are extremely important.

My second point, I would like to expand on the statistics presented by Congressman Hall this morning. Yes, we need to talk about statistics, but we also need to talk about real people. We need to talk about the low income farmer in West Africa who on half an acre, maybe an acre of land, is trying to feed her five children in the face of recurrent droughts, recurrent insect attacks, recurrent plant diseases. For her, losing a crop may mean losing a child. Now how can we sit here debating whether she should have access to a drought tolerant crop variety? I don't understand that. She can reject it, but let's not block her access to it. It is her final choice if she has access. If we block it before it gets to her, if we don't the research, she will never have a choice.

Yes, we need to work with her on composting and manure, on crop rotation and mixed cropping, on whether she should have access to fertilizers, all of those things. Why are we again creating false dichotomies? You should not have access to fertilizers because we have decided you should be an organic farmer. No, that's not our choice; that's her choice.

My third point, David, relates to what I have just said. None of us at this table or in this room have the ethical right to force a particular technology upon anybody, but neither do we have the ethical right to block access to it because we don't take the consequences. The poor farmer in West Africa doesn't have any time for philosophical arguments as to whether it should be organic farming or fertilizers or GM food. She is trying to feed her children. Let's help her by giving her access to all of the

options, and she can then choose which parts of the solutions that she would like to have.

Similarly, for the poor urban person, the consumer, worker, who spends 50 to 70 percent of her income on food, who is anemic as she does not have access to enough iron in her diet, whose children are going blind because they do not have access to enough vitamin A. How can we sit here and say this part of the solution is unacceptable because we don't like genetic modification? We have no right to say that. Let's make the choices available to the people who have to take the consequences. Let them choose and please don't stop the science that is needed to develop the cures for the diseases that I may someday suffer from, and let's not do that for them either. Thank you.

REV. BECKMANN:

Per said he would like responses from anybody who disagrees. If everybody agrees, we can go home. Dr. Ho.

DR. HO:

I agree with completely with what he says. This is why we are here, to give information as widely as possible to everyone. I would also add that there is already recently developed drought-resistant chick pea which is not developed with genetic engineering. We should also make that available. The Joint Inner Center also developed a broccoli, again by conventional breeding techniques that is supposed to be very good for anti-cancer. It may help you as you get older, as you say. So again -- you see the problem is that we are in danger of narrowing down the solutions when we only say genetic engineering or else nothing, which is not true.

There are plenty of other solutions. Bio-remediation, for example. There is a very good study that came out of one of the University of California colleges that showed, in fact, the ordinary canola plant -- or oil seed rape we call it in England -- is very good at heavy metal bio-remediation. In fact, you do not need genetically engineered crops. You see, this is the point I want to make, is that all the technology that can help us go ahead to make a better sustainable world more equitable world already exists. If we put all our resources into genetic engineering, we won't actually have the other things.

REV. BECKMANN:

Dr. Shiva.

DR. SHIVA:

I agree with Dr. Andersen that politics and technology are always tied together. The point is that we have two groups and two complexes of politics and technology guided by very different values wanting to reach objectives of sustainability and justice, with one clearly in the hands of the more powerful one complex and the other is the discourse of those who are not part of the powerful combination. Now, you talked about the drought-resistant variety being denied to that Western African woman as if drought-resistant varieties were on the table from genetic engineering. There is not a single product (technical difficulty) engineering. On the other hand, two years ago when Icresad (phonetic) did its participatory breeding research in Rajastan and it brought the Icresad bred varieties which is the dry land arid zone CGIR system and asked farmers to bring their own varieties, and they went through variety after variety of selection, and the farmers always chose their own because of drought resistance being the main criteria in a drought-prone area.

The issue of drought is intimately linked to land-use, and the very herbicides, those broad spectrum Roundups that wipe out every bit of bio-mass also deplete the capacity of your soil to hold moisture and absorb water. Organic matter depletion is part of that package, organic matter buildup is part of the package of building up drought resistance in your soil and in your plant. Tenfold increase in water conservation takes place with addition of humus and organic matter. That is precisely what your very fake Roundup Ready system deprives the soil of.

Finally, the issue of organic for that poor woman with five children on a farm. It is not a philosophical issue for her. It's a survival issue, and it is precisely because under conditions of poverty we cannot criminally impose on people capital intensive systems of costly seed, costly pesticides, costly herbicides, when for every one of these, farmers have systems that they are evolving in partnership with scientists at every point. Better seeds in partnership, much better, much safer pest control systems of their own and in partnership, and much better weed control systems. To turn that into philosophy rather than that survival option, to not recognize that by saving on wastage of that precious scarce resources, you are literally making more food available to those five babies of hers. I think we need to start talking about the capital intensity of these systems, and I disagree totally with our earlier presenters when they talked about this being scale neutral. Seed itself might be scale neutral because it's a tiny

little thing, but when it comes with a package of herbicides, comes with a package of pesticides, it's not scale neutral because capital is not scale neutral.

Poor farmers have small farms, rich farmers have big farms. The data around the world now, including from World Bank development report is showing unfortunately all that idea, that capital intensive technologies increase productivity, is not at all true. The smaller the farm, the lower the capital intensity of the inputs, the higher the output of food. That data is now available across the world, and lowering external input costs is not a philosophical issue. It's a survival issue for the poor people. Any technology that increases costs of production and any technology that makes the farmer dependent on higher purchase inputs is a technology that will increase poverty and, therefore, increase hunger.

DR. PRAKASH:

I agree with Dr. Shiva in terms of technology input. Again, we are comparing apples and oranges here. When you use herbicide resistance as an example to deride the technology and to vilify the technology, and then talk in the Third World context, this has nothing to do with it. What we're talking about is the product that is going to be delivered from the local institutions, from the local research laboratories with cooperation from the International Research Institute on food crops of importance to the developing countries. And we're talking about issue such as golden rice, the rice that has been designed for instance in the Philippines against the bacterial blight, and it has nothing to do with -- it has nothing to do with the capital intensity because this rice, like all the previous rice varieties, is going to be made freely available to the farmers, and so I think the issue is moot.

DR. SHIVA:

Dr. Prakash, about ten universities have partnerships with Monsanto on deploying Roundup right now in India. So don't talk about it being a theoretical issue. It is real.

REV. BECKMANN:

Why don't we go ahead to Arthur Getz who is an associate at the World Resources Institute?

MR. GETZ:

Good morning, I would like to thank Tony Hall's office for convening this. This is a remarkable moment because from my

understanding, this is the first time that biotechnology and hunger questions have been juxtaposed. We have had prior sessions on biotechnology on its own. I think today we have witnessed a tremendous amount of to and fro on the issue of, are you for or are you against biotechnology. I think the question really ought to remain focused on what are the bigger picture challenges? What are the challenges around hunger?

I think there is a set of questions one would have to ask about all technologies that we are aiming to propose for small producers in many times very marginal lands and working under very difficult conditions. So I want to make a couple of points and then direct some questions to our presenters. The first is, what is the potential for the incremental adoption of the technology that is being introduced? Are we asking the farmer, as has been suggested already, to take the technology that is (technical difficulty), and what is the degree to which farm involvement in the design of that product is reflected in that package? There is a sort of polarity between presuming that the package itself will solve the problem and really not understanding where the farmer is and what the farmer will turn that seed or any of the technologies to productive use in the context that they are operating within.

How do we approach hunger as a production problem within that setting when the setting is really very risk averse, where the risks of crop failure are survival questions, where there is a real premium on a rapid return on the investment, where there is a very strong aversion to purchased inputs? So how do we emphasize minimal use of purchased inputs, especially in areas where farmers are quite distant from roads and other infrastructure, where input markets are functioning very poorly? Is the technology of one size fits all or something that is locally adaptive? This is a more important question with respect to farmers' knowledge. And we have heard a little bit about traditional strategies today and very controversial, both sides' positions. Making effective use of niches, of microclimates, of the variability of the conditions in a farmer's field, are places where the farmer is coming from. If the package doesn't respond to that knowledge of the farmer, perhaps we won't see the kind of results we really expect.

So one of the trends that I see as a welcome trend in the promotion of agricultural technologies in international settings is that there is more of a focus on these knowledge systems, meeting the farmer halfway, and looking at strategies that cost much less for the farmer. For example, instead of suggesting terracing strategies, using vegetative barriers to control

erosion. They all get at diagnosing what are some of the underlying natural resource problems, the management problems the farmer has, and then co-evolving strategies with the farmer to develop tools and techniques to address these problems. By having the participation between the researcher and the farmer from the lab and from the field, those two knowledge systems coming together. The unfortunate thing is in the grand scheme of things the way that research funding is allocated, we are seeing an overall trend as Dr. Andersen has suggested in declining support for public sector research. We need to see within that an increase in public sector research support, an increase toward this specific area of meeting farmers' knowledge systems, meeting those needs from an understanding of what the underlying natural resource challenges are.

My questions to the presenters are fairly general. We have heard some remarks about the biodiversity impacts of biotechnology. I would like to hear a little bit more in both directions. We heard from Dr. McGloughlin a little bit about how sparing wild lands or maybe even in some of her writing we have seen some suggestion that biodiversity will be enhanced with the introduction of biotechnologies. We have also seen in Dr. Mae-Wan Ho's writings and suggestions today that caring capacity and the relationship to biodiversity are very tightly linked. So I would like to see a tighter discussion around what is the future interest among both private sector and the public sector in protecting biodiversity, particularly agro-biodiversity, and how they see trends in the use of this technology either enhancing or threatening those genetic resources. I would like actually to have Dr. Prakash and Dr. Vandana Shiva address this. I enjoy contrast.

DR. PRAKASH:

Biodiversity is very important. Biodiversity is the foundation on which all agricultural improvements are based, and it is very important. Again, in this respect, I do agree with Dr. Shiva that our crop biodiversity, the agro-biodiversity, has come down as a consequence of the use of the high yielding varieties, and that is what is referred to as the monoculture and the very narrowing of genetic diversity is a matter of concern to me. What I want to say is that (technical difficulty) it is going to be much better for two reasons. One, the way conventional plant breeding works is like, for instance, IR 24 was one variety that the Rice Research Institute would have developed for all rice growing regions, and no wonder with this magic variety that encompassed all the rice growing regions, there was a very narrowing of the genetic base, and it got out of hand. With

biotechnology, we could take the existing varieties and even those varieties that have been gone out of fashion because they are susceptible to a disease or a pest, we could very quickly introduce one or two genes and bring back that biodiversity.

Beyond that, I also want to point out that there is all this talk about biodiversity in the environment. There is tremendous technological infusion into preserving biodiversity today, the cryo preservation where we keep all the varieties. I also want to point out one very interesting comment made by David, in nature that we cannot keep biodiversity by imposing our Third World farmers to keep growing those varieties that are not profitable for them. What he said is that they are not the museum keepers for these varieties. So the state and the local institution, the universities have a much larger role to play here.

DR. SHIVA:

First, it is not true that industrial breeding, whether earlier in the green revolution or now with genetic engineering, increases land use efficiency to release wilderness areas to conserve biodiversity better. Precisely by displacing diversity on the farm, it actually increases land pressure. The studies now all over the world showing that poly-cultures of land, monocultures and sorghum monocultures use much more land to produce the same amount of yield than they would in a poly-culture. The land equivalent ratio has been shown, which is what would the two grown separately, how much land would they take to grow the amount that is grown on an acre when they are grown mixed? For (unintelligible) ground it is 1.26, for maize and bean it is 1.38; for sorghum it is 1.53; for maize and pea it is 1.85; and for maize and sweet potato it is 2.08. Basically, one hectare of a poly-culture is producing what 1.62 hectares of a mono culture would produce. And I think it is absolutely critical that each time we are told about yield increases removing pressure on land, we should ask the question, and what is that land not producing now that will need to be grown somewhere else; displacing wilderness, displacing biodiversity or depriving people of nutrition which is precisely what happened in India with the green revolution where all seeds and protein crops like the parsleys and legumes disappeared to increase acreage on the rice and wheat.

We have very severe, not just vitamin A and iron deficiency anemia, we have very severe protein malnutrition, because the legumes which are a staple of everyone including the poor, have in this period become a luxury of the rich. Which is why when we

preserve our legumes, we just go and conserve all varieties of dahl (phonetic), our kidney beans 160 varieties. Farmers have a tremendous market because of green revolution, poverty and scarcity created in these crops has increased the value of these crops, and what was called low value earlier has become very high value because of this terrible instability that has been introduced.

Finally, it is not at all the case that genetic engineering very quickly breeds anything. It doesn't do any breeding faster than conventional breeding. The breeding component is still the same breed. The vitamin A rice everyone recognizes, the developmental work will still take the kind of time that it took for breeding of any rice variety. Introducing the gene might be quick, but the breeding of crops with particular traits and developing them into viable crops still is dependent on conventional breeding. And that quickness is a total myth and I don't think we should ever address it, especially in the context of conservation. It is turning out around the world, conservation carried out by farmers which connects to production and sustainable production in which poly-cultures with higher productivity produce more food, conserve more biodiversity, and conserve more soil is the best win/win solution.

Following up my book on the green revolution, a Scientific American paper had analyzed that in a poly-culture 5 units of input produce 100 units of food. In an industrial monoculture 300 units of input are needed to produce the same 100 units of food. We can see that in industrial factory farming, but enough attention hasn't been paid to crop production which also is highly inefficient in terms of energy and resource use. If you really take those costs into account, they were never taken into account. That is why I say the myths of productivity which have justified the destruction of biodiversity just are totally false. (technical difficulty) biodiversity better also produces more food for the poor, and the reason we need to conserve biodiversity is both for conservation reasons and for food security reasons.

REV. BECKMANN:

I just want to insert kind of a dumb question which I hope somebody will answer. That is, I'm just not clear to what extent are genetically engineered crops actually being used any place in the developing world? There was a reference to soybeans. Are we just on the cusp of it? Dr. McGloughlin, it's just a dumb question, but I'm not clear.

DR. McGLOUGHLIN:

At this point in time, the main "developing country" that is using genetically modified crops is, in fact, China, and they have been very rapidly adopted in that country. They are probably going to greatly help in increasing not only the productivity, but making China one of the dominant economic powerhouses of the world. They are focusing specifically on introducing genetic engineering to increase productivity.

I couldn't agree with Dr. Shiva's notion that through genetic engineering you do not speed up breeding, because when you insert these genes using traditional breeding, you have to take years, up to 15 years of cross breeding and back crossing to get rid of all the traits you don't want. Using genetic engineering, it’s very precise, very predictable, because you're taking single genes and you're introducing those very quickly into sustainable genomic background.

The other thing is using traditional agricultural slash and burn systems, you are definitely reducing biodiversity. You are increasing leaching of soil nutrients, and you're definitely increasing erosion systems. The notion that was brought up with the broccoli that was produced in the John Innes Institute, this in fact was produced using genomics. You would not have that broccoli without the tools of biodiversity. Likewise, we have a gene introduced in rice at UC Davis, the actual source of that genetic material was in Indian wild rice, and we have demanded that when this particular gene is licensed that a large proportion of the licensing fees goes back to the country from which that genome came, from which those genetic resources came. That money goes back there to help with sustainable agriculture, to help with fellowships for these students. We, in fact, have a center for genetic conservation based on biotechnology.

REV. BECKMANN:

I don't think I asked all that, but it was really interesting. Peggy Lemaux is a professor of plant biology at the University of California, Berkeley.

DR. LEMAUX:

Actually, I'm not a professor. And as such, my job at the University is to interact with the public on issues like this. I have been taking notes during all these talks and jotting down little questions that I have. I could spend my time addressing, these but I kind of threw my notes out. In the end, to me, in a way this morning has been unsettling to me, because it is a bit

like watching a tennis match where you go boing, boing, yes, no, right, wrong. It is not a black and white issue; it's a gray issue. In my heart, I am a consensus builder. I don't believe there is going to be unbridled use of biotechnology across the world to address everything, nor do I think that is the right way to go, nor do I think it's going to solve all the problems. In the same -- be the case where we are not going to have biotechnology, and that there aren't places that it can be used very effectively.

Do I think the public sector has a role in this? Very definitely. I think we do, and I think we have a responsibility as public sector scientists to be involved in this not only technically but to be involved in the debate, and to ask questions as to how to move forward. I think there are some tools that as public sector biotechnologists trying to address issues in developing countries, I think there are the tools that we need. Certainly funds, that has already been mentioned. I think more than money we need a structure that will provide us the opportunity as scientists in a developed country to really find out what those issues are, and where does it makes sense to use these technologies, where does it make sense to use organic approaches? Where does it make sense to use genetic engineering? Where does it make sense to use other technologies? I think we need a forum to have a productive discussion.

I think public debate in this area, I have been involved in it for 10 years off and on. I think it is a very valuable thing. I think it is unsettling to me to sit here and listen to the back-and-forth, but I think it does serve a role because I think it sensitizes us and, hopefully, a lot of other people about what is the debate and what are the problems, and are there world food problems? I think sitting here probably none of us in this room, maybe there are a few exceptions, have really experienced hunger, true hunger. I think having these discussions and bringing these up sensitizes me and, hopefully, a lot of other people about what the issues are and how can we go forward and how can we solve these problems?

So the question that I want to pose, and I really want to pose it to all the people who have spoken this morning, is how can we move forward? How can we create a productive debate about this and figure out where we go from here and how to get there? Thank you.

REV. BECKMANN:

Do you want everybody to speak to it?

DR. LEMAUX:

This is an issue that I think if we're going to do anything with what we have done today, we have to figure this out. So I really would like each person to take just a minute or so to address that. How do we go forward?

DR. SHIVA:

I think one very clear-cut criteria for going forward is to always posit alternatives at the time of any technology decision and any technology choice. So when a particular genetic engineering option is being offered, to always look, and is there another way and then allow both farmers, consumers, and society at large to make its choices on the basis of real options being available. The reason there has needed to be the tremendous intensity of bringing up the alternatives that were excluded or made invisible was because biotechnology was offered as the only option for the future. It is interesting that in these five years, most people who promote biotech are starting to say, well, it's one of the options.

I think it is crucial that every time we talk of it as an option, we lay out the other options at the same time so people can make very clear, informed, ecological choices, political choices, economic choices about cost and benefit and very often ethical and religious choices about what kinds of food do they want, what kind of information do they think is (technical difficulty) there will have to be a minimum at every point to lay out. You talk with them and their rights, lay out the series of biodiversity sources for vitamin A. What kind of cultivation systems would the two be part of? And I think part of the dialogue would lead to this, and that is why it is good we are having this dialogue.

DR. PRAKASH:

I agree in terms of all the choices, and I don't think any responsible scientists, at least that I have worked with, sees biotechnology as the only solution, and we have always believed that this is an important tool in the whole range of things that we have. As far as what I think we really need to be doing is, let's get it right and let's accept, first of all, from the critics that this is a technology that doesn't bring any unique risks. This is a technology that compares with all the tools and techniques we have been using, and then start examining in the Third World where we could put our limited resources and start prioritizing it along with the other options that we have.

I think there are a lot of hurdles that are ahead, the resources, the expertise, and the network that is needed. It is not a trivial task, but on the other hand, it is not insurmountable. I do believe here we can use the energy and the vision of the individuals that currently do not feel comfortable with the biotechnology, but we could indulge in a dialogue and learn from each of them and move on. I think all of us are very sincere here in this room that we do recognize the problem of hunger, and I think all of us are sincere in believing that there are solutions out there. Thank you.

DR. McGLOUGHLIN:

As I said in my presentation, I absolutely believe that biotechnology is not the panacea to all the world's ills. We need to optimize all tools so that we can optimize the interaction of the various things that work best in a particular environment. However, we need to make this science based. We cannot throw out the science. We cannot create false barriers based on pseudo science or beliefs that are not compatible with using the best tools we have that are optimum in any particular situation. We need to focus on science based values that will allow us to reap the incredible capability and potential we have with all types of agriculture, and biotechnology is a very strong component of this agricultural tool case. Thank you.

DR. HO:

Yes, I think this was a very useful challenge to do, to say, well, what now? I think that personally I do not rule out biotechnology. It has some valid uses, especially under well-contained conditions, not at the moment genetically engineered crops and releasing them to the environment, because again I do not find it helpful to demonize those of us who do not agree that the risk assessments are not complete. We are not convinced. It does not offer unique risks, and we are not convinced it is safe. Now let's have more transparency. Let's have more research in this area and let us have more dialogue, more debates in public.

Now I also think that, at this point, a moratorium is very appropriate. It creates more time to do this kind of research. I also think that we should create a culture where it doesn't matter who is paying for the science. The scientist should be free to say, to report accurately what he or she has found without being vilified and victimized. I also think it is very important for science to be socially accountable. It does not occur in a social vacuum. And these points are very important in

the debate. Everybody has been asked to be accountable, even corporations are being asked to be accountable, so why not science?

REV. BECKMANN:

What I was hearing Peggy also ask, is there a need for a new or a strengthened institution or a forum that will make a framework, an institutional framework in which these debates will be joined, so that people in poor countries don't feel like they are just getting it shoved down their throat, you know, that precisely these assessments of possible benefits and risks can get discussed. Is there a need for a new institution?

DR. SHIVA:

For 10 years nearly now, the biosafety protocol has been a forum Third World companies have shaped and evolved to discuss the costs and the benefits, and make the decisions on that basis with the right to pull information. That it took the leadership of the South to bring that protocol to conclusion just shows that it was in the interest of the South to have a very open platform to assess safety risks and benefits, and that it was really this wonderful country that tried to prevent the biosafety protocol from coming into being, shows how servile our governments and our scientists are becoming to the corporate interest in the biotechnology field. I think it's posing a real danger to democracy at all levels. And I would say we have the platform, let's strengthen it. I would like everyone of you here who is working with a congressman to try and create a lobby here to get the U.S. to ratify the CBD and to become committed to the biosafety protocol as the forum under the UN to push this discussion.

REV. BECKMANN:

Our final challenger is Michael Pollan, a contributing writer for the New York Times. I think this is the first time in history that a contributing writer for the New York Times is at the end of the program.

MR. POLLAN:

Well, I don't know about you, but I am thoroughly confused. I am not an expert in this field. I have a sort of different status than everybody here. I came to this subject as an amateur, as a gardener who wanted to plant one of these crops which I did a couple of years ago. I grew some biotech, some GM potatoes in my otherwise organic garden, to explore what the implications were.

And what the implications of that experiment were for me and this discussion for me is that uncertainty is a big theme here. It is remarkable that this debate is going on when first it doesn't sound to me -- and I'd like to leave one of the questions in the air -- I'm actually going to ask several questions and leave them out there and people can pick up what they want because I've been left with more questions than answers, and that's fine.

Have the benefits of this technology been proven that we are already trying to decide whether to proceed with? That seems like a real question. Have the risks been proven? That seems also like a real question. I would like to ask on both sides, do you feel the benefits of biotechnology as what we know has been proven to your satisfaction? And on the other side, do you feel the risks have been proven and are substantial enough to outweigh these? That's one question I'd throw out.

The other thing is I would like to talk briefly about politics in this temple of politics, and that's something we haven't done very much. But, of course, the whole idea of discussing biotechnology and world hunger together, we should not lose sight of. And I do not say this to question anybody's motives in this room, although there are other people's motives that I would quickly question. Why are we talking about these two things together? And the answer to that question is political. This is an industry that is in a certain amount of trouble in this country internationally, that has had a very strong reaction. The problem I found as someone deciding whether I wanted to eat a biotech potato I had grown is, well, why should I? What are the advantages to me as a consumer?

Now I'm going to briefly take a very narrow First World consumerist point of view. And I could not find any good reason to eat this potato. It offered me nothing. It was a potato, a Bt potato. It offered, perhaps, the farmer something. It certainly offered Monsanto, the company that developed it, quite a bit. But given on the one side, a series of risks that were in some ways unproven, suggestive, but with enough uncertainty, and I was trying to do what corporations normally ask me to do, which is weigh in my consumer decision the benefits and risks. The benefit to the consumer isn't there. The risks, the uncertainties, are there. When an industry is selling a technology to us and they cannot make a case to us of proven benefits, they have to come up with other arguments. The Third World hunger argument has been advanced by the industry. There is a suggestion out there that by being critical of this technology, you are blocking the access of the Third World to

something that may be useful to it. Let me assume it is useful to the Third World or is potentially useful. Do I, do we as Americans, have a moral obligation to the Third World that entails accepting this technology? I think that's a real question we have to deal with.

Congressman Hall said at the beginning if this is about money, I am not interested; if it's about feeding kids, I am. Unfortunately, those two issues cannot be separated. It is about both. We have to be very alert to the politics of this debate. And the reason that before (inaudible) golden rice is the first crop that has come forward specifically designed to solve a Third World problem. It too is full of uncertainty; it's not ready to be commercialized. It's not even ready to be given away yet, but we are being asked to make our decisions as Americans with this in view. And I think that's a question we all have to answer.

I also want to resist the suggestion that is out there that being a critic of this technology, even being a consumer who does not want to use it, or someone who wants to label it, as Congressman Kucinich said, is, therefore, against it. Like everything in a democracy, science requires criticism. And I don't know that anybody on this panel wants to block the science. If they do, I think it's very important to hear about that. One of the questions I would ask to the supporters is, granted that there are many important questions to be answered about the safety and benefits of this technology, would you be troubled if the political outcry against it doomed it? I would ask people on that side too, is there a specific application of this technology that you could support?

DR. McGLOUGHLIN:

To answer Mr. Pollan's question on the issue of risks. If you were to take his concern to its natural conclusion, we absolutely today should have a moratorium today on eating all plants. Plants cannot run away to protect themselves. Plants produce mutagens, carcinogens, toxins. He took potatoes as an example. Potatoes should have a label over every single potato when you go to the produce aisle at your local supermarket. It should say, these products contain toxic genes from deadly nightshade. That's absolutely true. Do you think that's beneficial to the consumer? I have asked consumers and got, gosh, I would never ever eat a potato again. Of course, we have been eating potatoes for hundreds of years and I specifically have a horrible history with respect to potatoes. However, these glycoalkalides (phonetic) that are present in potatoes through

many years of breeding have been reduced. However, some years ago, a potato was being considered for introduction that came from the University of Pennsylvania that had fantastic chipping characteristics and was very resistant to insect pests. But when it got down to the market line -- and remember this was produced using traditional breeding, not through genetic engineering -- those glycoalkalides called salmine (phonetic) were quite high.

Because the checks and balances are in place to be able to put out the issues of potential concerns with respect to allergenicity, toxicity, and reduction in nutrition value, all of those types of tests are done. In fact, these particular products are more thoroughly tested than any other product on your plate. These tests, unfortunately at this point in time, are not obvious to the consumer. The consumer doesn't see the amount of testing that is being done. I think that absolutely is one of the issues that needs to be addressed. I think if you talk to any of the companies, they will tell you that they would be happy to make available to individuals, to anyone who wants to find out, the amount of biochemical, physiological feeding tests that are done to ensure the safety of these crop products. This is true of any type of situation we are in. We have to balance the risks and benefits. We have to make a determination on which side of that particular graph that our decision is going to fall. And without question from me at this point in time, if you balance the risks and benefit, without question it falls humongously on the side of benefit. Thank you.

DR. HO:

I agree with you that uncertainty is the hallmark and uncertainty is actually the hallmark of any active knowledge system such as science. Otherwise, it is like religious fundamentalism. So the real role of science is to deal with this uncertainty and, therefore, we have something called the precautionary principle. I know you will laugh at it because you have been rubbishing the precautionary principle, which is now accepted in international law. It is enshrined in the biosafety protocol. The reason is that if we get this wrong, we cannot call it back. Therefore, there is no proven benefit yet as far as I'm concerned, and I think I agree with Michael that all the benefits are potential at this point.

Now there are valid uses. For example, under well-contained conditions, you can genetic engineer vaccines, drugs and so on. You can use the technology in order to assist conventional breeding. This is called marker assisted breeding. You can use the technology to find out more about the organisms themselves,

what they actually do to understand the organisms better. Those are all valid uses of the technology but again I'm not the only person who goes around saying there are new risks. In fact, the FDA's old scientific advisers have actually said that, that this is a new technology involving new risks and all this came out because there is a large coalition of scientists and public interest organizations who actually are taking the FDA to court for improper testing, safety testing, and ignoring their own scientific advices on this issue.

I might say there is a bit of a double standard here when it comes to patenting. You say this is novel enough that -- this is so novel that we actually have to patent this. But when it comes to safety, they are trying hard to say it is just like conventional breeding and, you know, I think there is a bit of double standard here and I am not happy about that. So let me say that I have no vested interest in this. I mean this is my punishment. I really hate to do this because it takes me away from my family, from my extended family, from my granddaughter whom I haven't seen, you know, she is nearly five. And I really would rather not be doing this.

If I have any vested interest, it is, yes, the hunger problem, yes, it is the survival of our planet. I think it is as serious as that. So please do not dismiss people who are saying there are unique risks. I mean, I have said enough in my talk to try and tell you why, and maybe you can read my book. Thank you.

REV. BECKMANN:

We have now got some time for questions from all of you. I would like to start again with congressional staff, if there are congressional staff that want to ask questions. Okay, are there other folks -- why don't you identify yourself?

UNKNOWN SPEAKER:

(inaudible) My question is, is there any law regulating these things? It seems that there is nothing. Is there anything like a law involved?

REV. BECKMANN:

Who would like to speak to that? It doesn't have to be one of the presenters if one of the challengers wants to answer his question.

DR. SHIVA:

It's the biotechnology protocol.

REV. BECKMANN:

He asked, is there a law or an international regulation for all this.

DR. McGLOUGHLIN:

Codex Alimentarias.

DR. HANSEN:

There is also the bio-safety protocol, but also within the Codex Alimentarias, there is an ad hoc task force on biotechnology that is trying to come up with what would be considered, what the proper regulatory framework should be for genetically engineered foods. That's a global process that is happening right now. It is a voluntary process, but in the GATT Agreements, the Codex is written in as an a priori considered scientific standard. So the debate about food safety and that is going on in the Codex Alimentarias right now. In fact, next week there will be the first meeting of the working group of the ad hoc task force on biotechnology, which will be meeting in Tokyo.

REV. BECKMANN:

Identify yourself.

UNKNOWN SPEAKER:

(inaudible) Ms. Shiva, you specifically downplayed the importance of golden rice, based upon the example of women farmers in Bengal and the wide variety of green leafy vegetables that they utilize in their traditional diet. I actually spoke with a couple of nutritionists at UNICEF on vitamin A Global Initiative, and they told me that the bio availability of vitamin A in those green leafy vegetables is actually quite low, and they seriously question whether it would be physically possible to meet vitamin A needs based solely on eating these native green leafy vegetables, and that vitamin A rice and supplementation are very important. What do you have to say to these UNICEF scientists and nutritionists and their question about the green leafy vegetables?

DR. SHIVA:

First, the green leafy vegetables are not the only source of vitamin A. There are tremendous fruit varieties that are also sources of vitamin A. It is now recognized by every nutritionist that the areas where we are getting vitamin A deficiency, iron deficiency, calcium deficiency, are in regions where the impact

of the green revolution has wiped out the biodiversity sources.

The reason I addressed the hype on vitamin A rice is because when it was presented, it was as if all these children who are going blind will go blind if this rice is not produced. That is not true. The increase in vitamin A deficiency is a result of agricultural systems that destroy biodiversity and easy access to wide variety of sources of food with the balanced nutrition. Now that I think is something we can't get away with. We also know UNICEF is pushing micronutrients, as if we didn't have capsules children would never have micronutrient deficiency met. We know UNICEF and WHO and FAO have a history of functioning with a little bit of nudging from where power lies; we experience that. And I go by the nutritional analysis of our National Institute of Nutrition, (technical difficulty) nutrition in the various states, and you just have to see that data that they are laying out and you just have to map the depletion of biodiversity, the expansion of industrial agriculture and chemicals in agriculture, especially herbicides, that's absolutely 1 to 1 with the deficiencies of the kind that we're talking about in vitamin A.

I think it is time for us to recognize that the poorest of women can have a home garden. All we have to do is once again allow them to be major actors on this issue of nutrition and food and food rights for their children. I think any system that lets four companies and six scientists be the educators of nutritional literacy in the world will create tremendous threats to nutritional security.

REV. BECKMANN:

Identify yourself.

UNKNOWN SPEAKER:

I'm Michael Zayre (phonetic) from Senator Tim Hutchinson's office. My question is to both Dr. McGloughlin and Dr. Shiva. Since there is little evidence, scientific anyway, to suggest that genetically modified foods pose any particular danger to consumers, how do you respond to the claims that many of the EU countries have embraced the precautionary principle in the green movement as a means of limiting trade, protecting their highly subsidized farmers?

DR. McGLOUGHLIN:

Dr. Shiva's response reminds me of one particular EU country, and that is France where Marie Antoinette suggested the peasants

eat cake if they didn't have access to bread. And I think the EU's present stand is in keeping with this notion because, in fact, the EU -- and I think I have a relative level of experience from that particular culture of the world -- if you look over the last 10 years, their attitude towards genetically modified foods has specifically coincided with massive distrust in the regulatory process there because with good reason actually; situations such as mad cow disease, dioxins in soft drinks, et cetera, all have led them to distrust the regulatory authorities in their country. They do not have the same type of regulatory authority as we have here, specifically I'm talking about the FDA.

And if you looked at the stores in London before mad cow disease that was in 1994, Zeneca had a version of the genetically modified tomato that allowed this tomato to grow to full ripeness on the vine. It had much higher solids. They were making paste from this tomato. It was being sold in bigger tins. It cost a lot less. It said on it, made from genetically modified tomatoes, and it was flying off the shelves because it was so popular. There was a choice. Now you don't have that choice. I asked specifically individuals who were opposed to biotechnology in the UK and in Ireland, and what they said to me is, right now the only people who we see are making specific monetary benefit from this are Midwest farmers, and we're not going to let them do that. I said, if I were able to convince you on every single point regarding the safety of biotechnology and the safety from an environmental and health point of view, would you be interested, and they said, no. Nothing you're going to say is going to convince us, because right now it's of interest to us to be able to keep this out. However, every single country is actually working on the production of biotech crops because they see this as a transition period within the EU.

MR. POLLAN:

I want to address both your question and your answer to the question on the question of FDA regulation. You know, I went to the FDA to ask them indeed did they regulate this potato I was growing. If you ask the FDA this question, and they've been in asked in court, no, they do not right now regulate genetically engineered food; it is a voluntary system. So it's a bit of a canard that the Europeans distrust their regulators and we trust ours. We trust ours, but whether we have any basis for that trust is another question. The FDA is issuing its first regulatory rule this summer or fall on biotech, and that is eight years after it has been introduced.

REV. BECKMANN:

I'm going to take five minutes for closing remarks, but I think we ought to end on time. It's really tough to summarize or bring any kind of -- I'm sure my conclusions won't be your conclusions. One thing that I was struck by is that I think that everybody, all the panelists at least, agree that biotech is not the solution to world hunger, but I think they also agree that it is one possible tool that could be helpful in reducing hunger. They have very different assessments of the potential benefits and risks. They all agree, as Michael pointed out, that, in fact, there is a lot of uncertainty that nobody knows for sure. And I think they all agree that there is massive neglect of others tools that could clearly help hungry people. Tested technologies, say, like primary schools or clean water, or things in agriculture that are available right now that we're neglecting.

I am also struck that biotech -- the biotech debate related to world hunger -- is taking place in a context of tremendous imbalance of power and money. So most of the biotech development so far, the research, the marketing, even the controversy about it, has had nothing to do with hungry people in poor countries. There are other purposes that are -- other interests that are much more powerful, so it may be that this could really help hungry people, but so far most of the discussion, most of the action has been about other things. And it is true that the companies that have developed biotech, that have taken the lead, that have done a lot of the research have other interests that they haven't done much yet to do anything for hungry people. The scientific -- even the scientific community, you know, for lay people it's maybe a bad thing, but I think scientists are not -- there's an interest in science progressing.

So when there are questions about the ethics of science, people who are not scientists don't entirely trust the scientific judgments about whether to let science move forward, rip ahead in a particular area. And even the environmental debate about biotech, again the interests being served so far are primarily the health and environmental concerns of people in the industrial countries, not the concerns of the poor Ghana farmer who is trying to feed her kids. Now I am struck that at that end of the scale, that woman is tremendously vulnerable. I can't figure this thing out. How is she going to try to figure out -- you know, what should she use. So she is vulnerable and certainly her knowledge base is vulnerable, and so I mean she just doesn't -- she's going to depend on some other people to tell her to advise her on what to use.

So there is this massive imbalance of power and money, and it takes place in the context of equally massive public policy disinterest in that woman, starting right here in the U.S. Congress where, for the most part, the main issue is not that anybody is against helping hungry people, but is it worth five minutes on the floor of the Senate ever? Probably not. Just massive disinterest in this place in what is good for hungry people.

So I think it is really good that we have this discussion and that we have it here. I think if the U.S. Congress would show a little bit more interest in what is going to happen to that woman in Ghana, that that would in fact allow the U.S. government to show more interest, and that we have seen over and over again that when the U.S. government shows a little bit more interest that that brings along other industrial country governments, many other developing country governments. And that just if the Congress would show some interest, put some money, a little bit of money into reducing hunger around the world, that would help to correct this massive imbalance of power in which a debate like this gets contorted and distorted.

The other thing, I want to close again just by thanking people. Thanks to all of you for taking your morning to listen in on and participate in this really important debate, especially thanks to those who stood patiently. Thanks to the speakers who have shown tremendous expertise and concern and civility, too, and have kept to the clock pretty much on time. And finally we are grateful to the organizers, especially Tony Hall, for convening this session. I think it has been very helpful. So thanks all around. Let's give ourselves some applause. [Applause]