Developments in Biotechnology

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First of all, thanks for inviting me. I'm going to talk about life sciences. I particularly like Washington University not only because it is a very good university with a great faculty and good students, but also because I'm a trustee. I have the pleasure of being the father of an alumnus of the business school, so I know it's a good school.

St. Louis is recreating itself as the Silicon Valley of biotechnology. A bio belt where we are trying — through technological advancement — to create companies to create a science that will help the whole world. We started on that a number of years ago and are making good progress. As a matter of fact, today more than 390 life science enterprises operate in St. Louis, employing more than 22,000 people and growing. St. Louis has a number of institutions, both private and public, that really drive this effort very successfully. Washington University is obviously a great center of innovation and new technology discovery that can be translated into start-up companies — such as The Danforth Center and the Knight Center for Emerging Technologies. We have good incubators and we are narrowing the process of developing the commercial extension of that so the businesses that are created here will stay in St. Louis and cause St. Louis to become a center of entrepreneurial activity in the life sciences area. That's the objective. And I must say I'm very pleased that Bill Danforth is here because that was originally his vision, his idea. I must say I never would have believed that in such a short period of time that we would have made so much progress. I believe the region will greatly benefit

from this effort — not only the region but also the world in general. We need to find technologies that are going to improve food production, as I will show you in a minute. We need to improve the quality of the food and the nutritional value of the food. We need to come up with better health, try to preempt disease (not just cure it), but try to preempt it [before it] happens. We here in St. Louis are going to be a very strong contributor to that.

Monsanto is obviously part of all of this, so this morning I thought I would give you a quick overview of Monsanto as it is today. Since Monsanto has evolved quite a bit, I'll give you a little overview of what's there in biotechnology — from a plant perspective, not from a human health perspective. I am going to show you what's there today, but I'll also talk a little bit about the pipeline because we see this technology evolving very rapidly and there are absolutely tremendous products in the pipeline. I am giving you a little scope of those products that we see coming. Then I am also going to address the issue of biotech acceptance because what we have found is that is the major challenge. We can very effectively deal with our competitors, but biotech acceptance is the challenge for this technology. I'll try to explain where that came from and what we are doing about it. Then we can open it up for questions, and maybe you have some suggestions for me.

First, Monsanto. You know that Monsanto originally, many years ago, was a company that started in chemicals, and then we moved on to agriculture and also joined with Searle in human health pharmaceuticals. Eventually, we spun-off the chemical component as Solutia and merged with Pharmacia. Now Monsanto is again an independent company, 100% public, and we are totally focused on agriculture. And you

can see in agriculture that there has been a lot of consolidation — there are only about six companies of any magnitude that are left. Beyer and Syngenta are the biggest ones; Monsanto is the third in size. We have a pretty good combination of chemicals, seed, and biotechnology, and we have had the highest profitability of the group.

We have Round Up. Round up is the largest product in our industry. It's, as you can see — what you can see are the ten largest products in our industry — it's like five times bigger than the second largest product, so this is a very significant product. We also have the premier position in seed, as you can see in this global picture. We are number one if you combine our retail business together with our wholesale business. We are bigger than Pioneer on a global basis. They are bigger in corn retail, but overall we are now the largest seed company through a number of acquisitions and internal developments. The reason that we are in seed is that you need seed in order to develop the biotech traits that we are developing. And so, seed is really the vehicle for the technology that we are developing through genomics and biotechnology. We are very unique in that we are the only company that is offering total solutions to farmers. We sell the seed with the biotech trait and then Round Up. For example in soybeans, we sell Round Up Ready Soybeans and then Round Up on the top. In cotton and corn we do the same thing. So we go to the farmer and we say "We have a total solution," and we sell a total solution. We are the only company who can do that because we are the only company that has strong chemical, biotech, and seed divisions.

The other thing is that we see a significant shift from chemicals to seeds and biotechnology. On the left-hand side you can see that although the total gross profit in Ag is not growing, the part that we are interested in—seed and biotechnology—is

projected to grow from $4.3 to $6.1 billion. That's where we're investing. You can see we spend about 83% of our resource dollars, which is about $500 million, in biotech and seeds. The rest of the industry is still very much focused on chemicals, so we are unique in that perspective.

The other thing that we have done very well is that we have established a range of capabilities from gene sequencing, gene structure, gene function to gene expression, all the way to germ plasma. We have done that through internal development of the technology. But, also we have done a number of collaborations, and we are continuing a number of collaborations with other companies -- the ones in blue. So our technology is based on what we can do internally, but also externally. The reason why we do that is this technology is evolving very rapidly, and whenever you have technology that is evolving very rapidly, you always have to go with the best technology. You don't always have it, so we spend about a third of our research dollars on collaborations with other companies that have advanced the technology and we have built-up a capability which is really unequalled in our industry. I dare to say that we are four to five years ahead of any other company. Now, on the one side that's good because we are the leader in the technology. We are the leader in commercial development of biotechnology with over 90% market share. On the other side, we get all the critique. We have to carry the whole biotech acceptance effort greatly by ourselves.

And so, longer term if you look at where is Monsanto going to go, we see our major strength as what I'd call a 'discovery engine,' based on biotechnology, genomics, and breeding, that is going to develop products not only that improve agricultural production, but also products that will improve food, improve feed and also will improve

animal production. We have BSE and we are also, through genomics, developing animals that are more feed efficient and have better quality meat as well. So what we are interested in is not only what we traditionally have been, which is Ag production, but especially, how we can make the output better. And we are going to be over time more and more involved — where the growth is going to come — in downstream applications of the research that we are doing through the genomics and biotechnology and breeding. So we are working with food companies. We have a joint venture with Cargill called "Renaissance on the Feed Side." And, we are also working in the animals. That's really where the growth is going to come from and that's where Monsanto is moving. So, that's Monsanto.

A few words about biotechnology. We were the first ones to start working on biotechnology, some twenty-five years ago. We were the first ones to bring products to the market. Now let me show you how fast this technology has grown. It has grown faster than any other product that ever has been introduced in agriculture. And so in six years, we grew from nothing to 130 million acres in thirteen countries. Many many farmers around the world have had the benefit. The reason that it has grown so rapidly is that the farmers like it—it really works for them. And let me give you just a couple of examples, and then I'm going to get into the new stuff.

The best known example is Round Up Ready Soybeans. Through biotechnology we have made plants tolerant to Round Up. Round Up is a herbicide that is very safe and environmentally friendly. It will control broad leafs and grasses and perennials all in one treatment. So by making the crop resistant, you can spray Round Up over the top of the crop [and] kill everything there in a single application. Where before the farmer had to

use a broadleaf herbicide, a grass herbicide, a perennial herbicide, he can do it now all in one single treatment. That makes his whole application a lot more cost-efficient and convenient. The farmers just love it. Today, in 2002, 84% of the soybeans in the U.S. are biotech soybeans, Round Up Ready Soybeans.

So, and you can see the satisfaction, which we measure on a regular basis is 97%. Round Up, which is probably the best chemical ever invented in agriculture gets 85, 86% satisfaction levels. Round Up Ready Soybeans [get] 97%, which is very unique. You can't find, probably in any industry, products with that kind of satisfaction. That's why it's grown so rapidly despite all the controversy that exists in Europe. Another one is Score. We do the same thing. Again it's a terrific satisfaction level that we have — the farmers love it. They would love to grow it on all of their acres; [but] they are concerned about the export because some of the corn gets exported to Europe.

Another area we're in is controlling insects and here's just one example in cotton. Where we control insects, where before a farmer would spray an average of ten to fourteen times with an insecticide, we have put a gene into a cotton plant so that the cotton develops its own insecticide and you don't have to spray. So, again, it reduces greatly the cost — the cost of insecticides in cotton were over $100 an acre. Today, we charge $28 an acre for this technology. And so he gets better results, more convenience, and it avoids using all these pesticides — that means less pesticides in the water, soil, and so on.

The one that we are just about to launch — we hope to get the registration to bring it to the market this spring — is a corn plant that kills rootworm. This is a pest and you can see there is an insect and it eats the roots of the plant and the plant falls over. It

has a tremendous negative impact on the crop. We have, again through biotechnology, placed a gene into corn so that it develops its own insecticide against rootworm. You can see, with Yield Guard it's more effective than the current insecticides and it's certainly more effective than not doing anything. So it is a terrific product that the farmers want to use. It's going to be a tremendous success once it's in the marketplace. So this is the first wave of technology and it's really technology that has been developed to make farming more effective [and] more productive.

The big promise from biotechnology is — oh, and these are some of the benefits that we are getting. The major benefit really is a reduction in herbicides and in pesticides so you make, if you will, farming more effective, more productive, but also more sustainable because you use less stuff to produce, you have less microtoxins, you have less pesticides in the water, and so on. So there are consumer benefits, but what is really going to become much more interesting for the consumer is the second wave of technology, which is going to have direct consumer benefits. So, again, through plant genomics and biotechnology and breeding, we are going to develop better foods. Foods that have higher levels of vitamins, improved proteins, changed carbohydrates. Basically, we can engineer plants, we can engineer crops—we call them designer crops—to do just about anything we want. And I'm going to give you just a few examples of what I mean by that.

So, one of the things that we are working on in one of our most promising products is Omega-3. Omega-3 is a fatty acid that you find in salmon. It is very good for the heart and you can see, the tests will show, the cardiovascular risk drops significantly as you consume more of this EPADHA, which is this Omega-3 fatty acid. And that's

why eating salmon is good or, you know, fish is good. It gives you the good cholesterol, so it's good for your health. However, in order to be able to bring that to the market, we have developed a gene that you put in corn or in soybeans so that when you eat your cornflakes, you would get your Omega-3. And basically what happens is that salmon—the reason that salmon are high in Omega-3 is that they eat algae and that is where the Omega-3 precursor is. And we have taken the gene out of algae and put it into corn and soybeans.

Now, if you eat beef, you consume Omega-6, which is bad and can lead to heart problems. And that's one reason why salmon is healthier than beef. So the things that we envision that we are going to be doing with this product is not only deliver it in cornflakes and soybean oil, but also deliver it in feed to animals, so that we can have chicken and beef with the same health qualities as salmon. And we actually already have done that and we indeed find that when we feed chicken this corn that is high in Omega-3, that the breast meat and the chicken meat is high in Omega-3. And so in the future, you will be able to eat your steak with the same health qualities as salmon.

Another issue you may have read about that is a significant problem is that when you hydrogenate oil in order to make it firm into margarine and spreads, you develop trans-fatty acids. And more and more is known about these trans-fatty acids, that they lead to cardiovascular problems. The same thing is true with saturated fat and so again what we have now developed is crops that will totally eliminate trans-fatty acids and saturated fat. And so in the future, you will be able to get spreads, margarines, and oils that don't contain any trans-fatty acids or saturated fat.

The other one is, we can not only take bad things out and, for example if you think about peanuts—we are not working, but some people are working on peanuts—take the allergenic effect out of peanuts. So, you can take bad things out, saturated fat; you can put good things in, Omega-3. The other one is we know that stanils reduce cholesterol and so we can—we have put a gene into a crop where now you have high production of stanils in a plant so that you have a natural decrease in cholesterol by eating those foods. You wouldn't use that if you are really—if you have a very high level of cholesterol, then you take a pill. But there are a lot of people that are just on the border and by eating these products they can lower their cholesterol. Again, this has been developed in our lab.

Another one that you are probably familiar with is vitamin A. If you think about, around the world, one of the problems is that in certain areas they don't have enough vitamins in their food and as a result, for example if you lack vitamin A, that results in night blindness and eventually total blindness. We can build in crops the capability for plants to have, to develop high levels of vitamin A, so that you totally eliminate that problem. There is a professor from Switzerland who has done it in rice and its called Golden Rice. We did it in Golden Mustard, and we are working in Africa with Golden Corn to bring crops that will be high in vitamin A and that will eliminate that.

The other one that we are working on is iron. About 2 billion people in the world have a shortage of iron in their nutrition, and we can elevate the level of iron that is digestible iron that is into crops. So, we can add things to crops to make them healthier.

The other thing that we are working on, and we are one of the leaders, there are about three companies that—there are more, there're about a dozen companies that work

on this, but about three companies that have a significant lead on it. That is, using plants to make pharmaceutical products. And when I say pharmaceutical products I mean monochrome and antibodies and therapeutic proteins. They are very difficult to make through manufacturing and the only way that they are made at this point in time is through animal cells—they call it Cho-Chinese hamster ovaries. It's very expensive; we can make that very cost efficiently in manufacturing plants. All we do is put the gene and the product, in this case we work on corn, produces this monochromal or therapeutic protein that you extract from the plant and you can do it at a fraction of the cost -- like a tenth of the cost that it would cost if you do it through the normal animal process. So now you can make pharmaceuticals available to developing countries at significantly lower cost. We are not working on vaccines, but other companies are doing work on vaccines. And so it is a means to bring products to the market at a cost that would be very affordable, or more affordable if you will, to developing countries. We would obviously sell it at full price in those countries that can afford it, but you could bring it to developing markets at much lower prices.

We are currently working on six compounds with pharmaceutical companies that we are developing for them. We hope that by the end of 2003 we will have twelve. So this is a very rapidly growing opportunity that is going to become, or has the potential to become, quite significant for us. And it would give us an avenue to be back into the pharmaceuticals if we so desired.

Another aspect, and I'm just giving you a few examples, is biofuels. We are so dependent on Mideastern oil, so we have a program in place that has a couple of steps. The first step we are taking, that's already in place, is that we are working with farmers to

where we have developed through our genomics screening, we have taken those varieties that are higher in carbohydrates that can lead to biofuels that can lead to fuel. And so we are making alcohol production, or in the case of soybeans biodiesel production, much more effective by going after these varieties that are higher in carbohydrates and so this is not bioengineering, this is simply through screening -- genomics screening of the current varieties that you move to varieties that are higher in carbohydrates and they increase alcohol production, and decrease the cost of alcohol production quite significantly.

The second phase is going to be where we, now through bioengineering, significantly increase the carbohydrate content and so you grow basically corn for fuel. And it's going to be very effective in that.

The third phase, and that's the most interesting phase, is where you develop the enzymes that basically crack biomass into fermentable sugars. If we can do that, we can produce all the fuel that the United States needs inexpensively, utilizing biomass. This is still quite a ways out, but this is a very interesting area and its one that the United States Government is very interested in.

But, as I said, this is going to happen in phases. The first phase is basically in place. We are working with a number of farmers who are now putting up these ethanol plants to deliver varieties around the plant that are going to be high in carbohydrates, that are going to be very effective. In the longer term, we will have a totally different approach.

Another example is our joint venture with Cargil, working to improve feed efficiency because eventually the proteins that we eat come from animals. And so, if you will, we improve the productivity of plant production, but eventually in order to also have

improved protein production you have to improve the animal because you have to put the plants through the animal to produce protein. And so animal productivity has not gotten the same attention that we have given to plants. We are approaching it from two different perspectives. We are doing animal genomics to understand what makes—why is one cow producing twice as much milk as another cow? Once we understand that, we can do breeding that is guided at making sure that those genes are present in the offspring. So you can, through genomics, improve the productivity of the animals. If you want better meat, if you appreciate less fat, you can change the characteristics of the animals through genomics.

The second thing that you do, and you do that in combination, is how can we improve the productivity of the feed and the feed efficiency? And so, for example, tryptophane is an amino acid—an essential amino acid in the feed. We have now built a gene into the crop to produce high levels of tryptophan. Eventually what we are looking for is that we are going to be able to grow grain that is specifically geared for each one of the different animals so that you have corn for chicken or corn that has all the essential elements. And, by the way, we have a program with Norman Borlaug.

In many places in Africa they eat corn, and that's all they eat. Obviously corn by itself provides carbohydrates but it does not provide all of the essential amino acids. So we can do the same thing, we can build vitamins into the corn, we can build tryptophan which is also essential for human growth and so you can deliver, basically, corn that has all the essential elements for good nutrition. So, you eat corn and you have your meat and potatoes all in and the vitamins from vegetables. You can build it all into one thing. So those are, when I talk about designer crops, we can really through biotechnology and

genomics and breeding make a plan and do exactly what we want. We can make it grow protein on the carbohydrates or whatever.

But the other thing that we now have learned is—and the thing that is very exciting and this came from genomics—is drought resistance. Drought is something if you think about Africa today, you know, fourteen million people are at risk of starvation and the reason is that they had a two year drought that devastated their crops. So drought is one of the big problems in the world. We have developed a drought-resistance gene and we were going to—arabidopsys, which is kind of the mouse of plants where you do all your tests and then if it works there, you put it into a regular crop, in this case it's rice. And so, you can see on top it's arabidopsys, though the left-hand side, the control, got—both had only 50% of the normal water needs that they have. You can see the crop with the gene that made it resistant is growing, the rice the same thing, while the other one is drying up. So drought resistance is certainly something that we are going to be able to bring to the market.

Another one that is very interesting in the same field is fertilizer efficiency. So we have developed plants that have the capability of growing more root hairs. Root hairs are what take up the fertilizer from the soil. They are so much more efficient in taking up fertilizer that you can apply half the rate of fertilizer and still have the same yield. Eventually we hope to develop, but this is quite a while out, plants that would develop their own fertilizer, just like we have plants today that develop their own insecticide or herbicide.

So, these are just a few examples and Monsanto is not the only company that works on this. There are other companies too. And what you are seeing now is that this

technology is developing at an exponential rate because as we learn more through genomics—as we have mapped the genomes of plants, as we start understanding the function of the genes in plants, we see an acceleration, exponentially, of what we can do. And so we are going to see over the next few years a very rapid evolution of what can be done and the benefits of the products that we can bring are becoming more interesting for consumers, while the ones we have today are interesting for the farmer. The future will be the consumer.

Now the problem that we have, you know this is a very promising technology and as you can see, the number of people around the world is growing very rapidly and they're growing especially in developing countries. At the same time, the spendible income is increasing and people eat more meat and so what you have is a congruence of more people eating better that requires producing a lot more food. I mean, we did some modeling, making assumptions on how many people there are going to be by 2020 and how many calories they are going to eat and what is needed. Our best case is that by 2020 we need to produce 76% more food than we are today. So, you need to become more productive and biotechnology is certainly one of the means to do that.

So why is it when you see all these products that you can bring that have benefits -- when you can see that this technology can help to feed the world -- that people are so negative towards it? I'm going to say we caused it to some extent ourselves because we, when we started marketing these products in '96, did market them just like we were marketing chemicals. We said, hey, we got a good product, we are going to do marketing to our customer, the farmer and that's it. Well, what we found was that there were a whole number of stakeholders that have been involved in this. And it was not just a

farmer issue, it was you know, people that say, 'well you are playing God, this is something—you are changing life, you shouldn't be involved, you know is this going to be safe in my food?' In developing countries, when I met people, they said, 'you are going to control our food supply with your technology and we can't just trust one company, you know, to control our food supply.'

And so there was a question of globalization that came into it. And so we had not foreseen all these reactions because we were a company that was producing chemicals, selling to farmers. What we learned was that society's expectations are really changing and government and regulators are losing influence. So when they say the product is safe, it does not necessarily mean that the public accepts that. And on top of that, the NGOs are gaining tremendous—there are more NGOs, but they are also much better organized through the internet and they are much more effective in getting their messages out and they are very opposed to globalization and technology. And, if you don't have the public opinion on your side it makes everything difficult because the government will not support you as strongly when the people are negative. The regulators become slower in approving, because they know that the public is negative and so, you need to get the public opinion at your side or it makes everything much more difficult. And gaining approval is only the first step. It just gets you into the marketplace. You really need to get public acceptance to make progress, and society has a tremendous impact on that.

And so that's why in 2000 when I realized that you this was a different kettle of fish, I started going out and meeting with these NGOs and stakeholders and talking to them and trying to find out how we could help them to support this technology, which I believe the world needs. And that's when we came out with new Monsanto (sic) that

says, okay we need to be much more open, we need to undertake dialogue, we have to be a transparent company, we have to demonstrate that these products are safe by making our data freely available. Before we wouldn't do that because we had competitive consequences. We also said, okay we need to respect other people's opinions, we really have to work with them to see if we can avoid some of the issues that they have and that's why we committed that we wouldn't put any animal genes or human genes into plants because several people don't want that. We also committed that we would share this technology with developing countries and that we would design our products to benefit the environment, the farmers, but society in general—make a difference for the world. And so we really changed as a corporation quite significantly because we realized that the Old World was no longer valid and the old approaches would no longer work.

Unfortunately, a lot of the damage was done by the time that we changed, but we are making progress and basically, we work with retailers and food companies to educate and inform them about these products so that they fully understand because they are the first ones who get questioned. We work with scientists around the world so that they can speak for this technology because they see the benefits, and we provide them with all the information. I have stakeholder dialogue—we meet with NGOs, we meet environmental NGOs, we meet with developing country NGOs to see how we can work together to help them to achieve their objects. We meet, obviously with governments and regulators and so on.

It's encouraging that, you know, if you think U.S. people are more and more aware about biotechnology, they are aware about the benefits and they consider that they are going to benefit from it. And so we see in the U.S. we have a very strong base of

supporters and in general the U.S. is quite positive towards biotechnology. I'm going to say Asia is getting more and more positive; Latin America is getting more and more positive. The one that we really still have problems with is Europe and so I'm spending quite a bit of my time on Europe because Europe has a big impact on what happens in the rest of the world. And, for example, when you see what happened in Africa, where U.S. food aide was refused in Zambia, for example because it may contain biotechnology. The reason why is that the Europeans had scared the Africans so much towards this technology that you know they refused to use it. So we are working and hopefully Europe is going to come along as well because I believe that this technology is going to benefit not only farmers, but also consumers with these healthier products that we can produce and really it is going to be one of the tools that helps to feed more people in the world healthier diets. I'm going to stop here and open it up for questions.

Question 1: You mentioned that Europe, where the Green movement is so strong. Are you doing anything to work with, in my opinion some of the best minds, which are in Russia in terms of agricultural test sites and things where it will be cost effective putting some good people to work and then getting, again transparent, very credible data?

Answer: Yeah we are…Eastern Europe has seen the need for biotechnology because again, they need to improve their productivity and so they have a very scientific approach. You see, where we succeed is when the decisions are made based on science because all the science—we literally have hundreds of tests—can demonstrate that the

products are safe, can demonstrate the products offer benefits. And so Asia realizes that for them that with a rapidly growing population that they need productivity improvement and so that's why China has moved into biotech. India has—last week, as a matter of fact, the Philippines has approved the first biotech product. So all of Asia is now utilizing biotechnology to improve productivity. So where people make judgements based on science, where they have good scientists, we win. It's where it is based on these other emotional issues that we really as an organization are still learning how to deal with that. It is a very very tough. We you know, when all of this started before 2000, we had a few people who knew how to deal with public opinion and with NGOs and so on. Now, we have a whole group of people that gradually is coming on stream. And frankly, this is something that with any new development we all better learn that the world has changed and we have to be much more open to society, that we have to find out the different interests that people have and deal with it beforehand because once it has turned negative, it's very hard to turn back.

Question 2: Could you talk just a little about the infrastructure that's going to be needed to segregate as you get corn—looks like corn, but that's designed for alcohol or (sic). How are we going to keep these things segregated, there almost becoming the quality of pharmaceuticals in some respects?

Answer: Well, obviously, you have extremes. If you take plants made to produce pharmaceuticals you have to not only segregate them, the output that you have to segregate from the rest, but you have to make sure that these plants don't get into food and so that becomes really extreme. That's why (*Audience: The media's so ready to jump on it, I mean as we've seen the possibility for errors that have nothing to do with what you mentioned).* Yeah and so that's also why from industry perspective, for example, PNPs, we have led the industry in setting up standards that would prevent these events that happened with Prodigy who had that problem. They did not follow the guidelines that they had signed. Otherwise that would not have happened and that's why this has not become a big issue in the media. It was there for three, four days and it disappeared because USDA got immediately involved, they said, 'Hey, they did not follow the guidelines, we are going to punish them and the rest of the industry is behaving as it will, as it should.' So what we are working with Cargil, and that's why we have a joint venture is how do you set up the logistics to do that? And so we will in the future, because that's the only way you get the value if you bring Omega-3 or you bring this biofuel efficient crops, you have to be able to separate them. And so what you will have is a commodity channel which is basically undifferentiated and then the specialty channels and that will work as long as you can charge a premium, if it brings sufficient value that you can separate. We have set-up the systems, and you can do it quite inexpensively once you work on it.

Question 3: Could you talk a little about protecting the intellectual property developed? I guess I'm wondering about your views on the efficiency of our patent system generally

or globally and how much leeway do you have over great ideas that you can't control (sic) over the public domain.

Answer: We have really good patent law in the U.S. and Europe, it's a little bit less in Latin America, and in Asia and in some places it's good, in other places it's non-existent and so from that—that's the first element that you have to deal with. One of the issues that we have come to is it's not just that we can't protect our patents that we don't make any money from it, but also it impacts the global competitors. So, for example, we have a patent for Round Up Ready Soybeans in the U.S. We charge the U.S. farmer $10/acre for this technology. Argentina does not have patent. Over 90% of the soybeans in Argentina are Round Up Ready beans for which they pay zero because there's no patent. So the Argentine farmer has a cheaper cost of production because they don't—and so now we have a problem that U.S. farmer says 'we are disadvantaged, we like your technology, but we're disadvantaged.' So it has not only the implication that we don't make any money from the technology in Argentina, but it disturbs the global market. The other thing is whenever you have a new technology, the same thing happened in software and information technology, everybody files for patents and it takes a while before the extendable patents are known and there are lots of conflicts. And so, Syngenta is suing us, we are suing them and so on and so on. All of this is gradually working itself out where you start cross licensing and where you know you find ways and so I'm not too concerned with that aspect. These lawsuits are going to go on for awhile, but eventually they're settled; they're settled already between us and the farm and that's going to make progress. So, and the third thing that I would want to, there are arguments that we should

not have patents in developing countries so that those people can immediately benefit from the technology without—while they cannot afford paying for it. Our answer to that is no, we want to keep patent because there are commercial crops that compete with the rest of the world, but we are willing to share our technology with developing countries in those crops that don't have global commercial interests and so we share the technology with those countries.

Question 4: What year do you expect your Omega-3-containing soybeans to be commercialized?

Answer: Yeah, I would say this is four to five years off. So, we got them in the lab, we can produce the Omega-3 to do the testing in the animals. We are now producing the toxicology tests and everything. So, between the invention and, this again people think that we develop these products and just put them in the marketplace, and between the invention and discovery and the time you get it in the market, is six to seven years. That's how long it takes to do all, literally hundreds of tests you have to do to prove that these products are safe.

Question 5: A lot of the objection to biotechnology revolves around the transgenic technology. How committed is Monsanto to that, after that channel versus developing mita-genesis where you inherit traits in plants?

Answer: So, first of all, let me say mita-genesis is really the same technically. So, what you do is you use chemicals or you use radiation to cause mitagens to develop that would have specific properties. So, what you do is you have a lot less control because if you do that through irradiation or chemicals you not only have changed one gene as we do with bioengineering, which is very precise, but you have literally changed thousands of other genes that you don't test for, ok? So the product that you have is most probably less safe than the product through bioengineering. Second thing is if you have, let us say, an insect resistant cotton through mita-genesis, why is it insect resistant? Because through mita-genesis you have developed a gene in that plant that causes that gene, and that gene produces a protein that's toxic to insects and that can you know, out-cross just like—So, first of all there is no difference. But we realize that you know, bioengineering is more controversial than genomics and that is, I believe, a more natural way. And so, we are betting on both sides—we are doing genomics and we are doing biotechnology. What you do with genomics is you start understanding the function of a gene within a plant and you over-express that gene within the plant, but it is the plant's gene. And, for example, I showed you this drought resistance. That is not a transgene, that was a gene in the plant that was over-expressed and so there are a genomics and they call that 'soft' biotechnology versus transgene, which are called 'hard' biotechnology. We are doing both. Hard biotechnology is more efficient, faster, and more precise.

Question 6: I'm a great believer in the principle there is no free lunch, that nature is a balanced system in what people now put—we're getting a great deal of output here. Do you have any insights on any impact the ambient input factors within our environment to

get this increased output, such as if your not using drought resistant plants to the ones that are enhanced, do they require more moisture or something like that? Or, is there any off-set?

Answer: So there are obviously, whenever you have a new technology there are certain risks that go along with it. And so the risk that we see is not food safety, we have done literally thousands and thousands of tests. Proteins are put into your digestive system, digests them and breaks them down and there is no consequence. The environment is—the risk that you have is what they call 'out-crossing' where pollen from a plant that has been transformed out-crosses with a wild plant or with a weed and transfers that capability to that weed so that you would have theoretically the possibility of creating a super-weed that now is you know more capable of competing. Again, very extensive tests have been done that have proven that those plants have no—don't survive over time and that they don't seem to have the benefit and that they disappear and those tests have been done in the UK very extensively. So, at this point in time we have not—we have theoretical risks, but we have not experienced after six years and 130-million acres, not a single person has gotten any negative effect from it, not a single incident that we have created an environmental problem that persists.

Question 7: The soil nutrients remain the same in effect as the various different plants grow.

Answer: Yes.

Question 8: Along those same lines, could you talk specifically about what's driving the concerns of Western Europe?

Answer: It is a very complex issue. It is not a single factor, there is, number one, an impact of trade protection because the—in Europe they have a what they call 'the cap' which is you know an agricultural subsidy program because the European farmer is not as efficient as a U.S. farmer or Brazilian farmer and so they can't really compete and therefore the government in Europe spends enormous amounts of money subsidizing agriculture. And so any time that other countries improve their productivity and if they don't utilize that, they have to increase their subsidies and so there is one element of trade protection where they say, hey we need to keep this out because they have an unfair competitive advantage, technological advantage. There is a cultural element. In Europe food is part of the culture and so when they, it's not just McDonalds, it's the way that we eat that they don't like and so they find that doing something from a biotech prospective somehow makes the food less natural and so culturally it is a very difficult situation. The third element is that NGOs like Greenpeace, who has very little credibility in this country, have enormous credibility in Europe. And the NGOs have been very reactive and very efficient creating doubt in people's minds. And fourthly the media—we complain about our media not always being balanced, but let me tell you, ours are very balanced compared to the Europeans. And so, when they find an issue, you know they like scandals, they really drive that and so the media was every day and every day and eventually it impacts people's minds.

Question 9: Concerning the incorporation of pharmaceuticals in the corn, does that represent a substantial potential for the farming community or is it a fairly small, specialized thing?

Answer: So, over time this is going to develop a significant opportunity, but not just the PNPs or the plant made pharmaceuticals because that is a small acreage. It's going to be very valuable for those farmers who produce something, but it's going to be a small acreage, so it's going to be a small number. However, you think about Omega-3. That will be tens of millions of acres so more farmers are going to benefit from that. If you think about biofuels, so growing crops specifically for higher production of alcohol, there the farmer, and so the farmers are looking at this as a way to add value to if you add triptophane and other essential amino acids to make better feed, again that will have an opportunity for a farmer to make a higher return. And so the farmers look at it as all this is going to eventually create and we call it, the 'de-commoditizing commodities' so you are going to have more specialized crop production for which you can charge a higher price because it will have a higher value.