A Special Interview with Dr. Elaine Ingham

By Dr. Joseph Mercola

DM: Dr. Joseph Mercola

EI: Dr. Elaine Ingham

Introduction:

DM: Welcome, everyone. This is Dr. Mercola. You know by reading the website that one of my passions is nutrition and having loads of good, healthy organic vegetables. But the key to getting healthy organic vegetables, of course, is the health of the soil. And we are just delighted to have a research scientist with us today, Dr. Ingham, who is one of the "good guys."

She was an associate professor at Oregon State University and on her way to full-tenure professorship when she did some studies on GMOs. The industry (Monsanto primarily) that funded the large part of the budget for Oregon State University didn't like that. They put lots of barriers in her ways that essentially forced her to resign.

But I'm a firm believer in the inverse paranoid principle that when something bad happens to you, it really is a good thing. Because after she left that position, she went on to develop a company called Soil Foodweb Inc., which is really what I'm absolutely passionate about and really starting to explore now. It's the company that's designed to help you and farmers understand the health of their soil. This company she put up actually analyzes the soil and helps develop compost that's specifically targeted for those plants that you're seeking to grow.

But in addition to that, she's also the chief research scientist at Rodale Institute. She's really one of the leaders in helping people understand [how] to increase the health of their soil, which ultimately has profound influence on our own personal health. So, welcome and thank you very much for joining us today.

EI: Thank you, Dr. Mercola. I'm glad to be here.

DM: You were fired from Oregon State University. Is that true? You were full professor there?

EI: I was associate professor.

DM: Associate professor.

EI: I was on my way to full professor, and then how dare I go up against Monsanto. I was an associate professor at Oregon State University. When I came back, they did not fire me. They made it very, very difficult until eventually I did resign. I just… I wanted to see how long it would take them to make it utterly impossible for me to remain at Oregon State University. I mean…

DM: Okay.

EI: And they did. I saw the handwriting on the wall at Oregon State University, so I started this small business, Soil Foodweb Inc., where I now have laboratories around the world where people send samples to have their biology assessed and where they can get very rapidly information on bacteria, protozoa, and nematodes in their soils.

DM: Okay, perfect.

EI: It's a business. I'm a research scientist; I'm not a business person. So, I kind of let Soil Foodweb Inc. go to the business people.

DM: Okay.

EI: Let them continue that. I really want to be here at Rodale to continue the research showing the dangers of genetically engineered [material], to demonstrate how easy it is to get all of these benefits back into the soil rapidly and easily, and to demonstrate exactly how you do that in a replicated scientific fashion.

So, often when I work with growers, we'll go out and they'll give me a small area. They'll give me half an acre, 10 acres, a small part of their farm. We teach them how to compost. We teach them how to do it correctly, not reduced waste. When we go to all of the municipal composting places, they are not making compost; they are making reduced waste. And it's really horrific stuff. You would never want to put that material in your plant, because it will probably kill your plant.

DM: Okay.

EI: So, properly made compost. We teach them how to do that. They start applying that out on the field, and then they see how much less work they have to do. They don't have to apply pesticide. They don't have to go buy plant fertilizers. They reduce their water bill. Their plants are healthier. They [inaudible 04:18], because their plant material now has maximum nutrient concentration.

The next time I come back and say, "Okay, we now want to compare the yields in the biologically treated area with yields in your conventional area," they just look at me and [say], "But we converted the whole farm to biological, because we were doing so much better. It's less expensive. It's less work." My replicated scientific trials just go down to two's at that point. So, trying to get this done in a replicated scientific fashion, so we can publish the journal articles – that's what we're trying to do here at Rodale.

DM: Perhaps we can start [with the] description of how the plant growth is affected by the health of the soil. Maybe start us with the foundational basics.

EI: When we're looking at plant health, it's really key to have helper organisms, these really beneficial species of bacteria, fungi, protozoa, nematodes (the beneficial nematodes, not the weed feeders), microarthropods, and earthworms. All of those organisms in the soil contribute in a number of different ways. A lot of the work that I've done with my career is to document what those different mechanisms that these organisms in the soil help the plant [with].

If we get a problem like around the root systems, around the surfaces, above ground – the seed, the leaves, or the branches of the plant – these organisms will prevent diseases from being able to even find the plant. The pests won't locate the plant. They won't home-in on the plant. So, disease suppression, pest suppression, and all of those things are part of what the life in the soil does for your plant.

Nutrient cycling is another very big issue if you really understand what life in the soil does for your plant. There is no soil on this planet that lacks the nutrients to grow a plant. This concept that the chemical world is trying to put across – you lack phosphorous, you lack nitrogen, you know, your soil is poor and can't grow a plant – is all based on looking at the soluble, inorganic nutrients partly present in your soil, when in fact the biology or the organisms will take that mineral material that's in your soil and convert it into a plant-available form.

It's very necessary to have these organisms. They will supply your plant with precisely the right balances of all the nutrients as the plant requires. We are not very good at providing exactly what the plant needs and all the different nutrients a plant needs in the proper balances. We're really not good at supplying at. Whereas, of course, if the plant is in control with what's going on in the root system, it can get those microorganisms to supply all the nutrients in the right balances.

When you start to realize that one of the major roles and functions of life in the soil is to provide nutrients to the plants in the proper forms, then we don't need inorganic fertilizers. We certainly don't have to have genetically engineered plants or to utilize inorganic fertilizers if we get this proper biology back in the soil.

If we balance the proper biology, we select against the growth of weeds, so the whole issue with herbicides is done away with. We don't need the herbicides if we can get the proper life back into the soil and select for the growth of the plants that we want to grow and against the growth of the weedy species.

DM: So…

EI: We want to build structure in the soil as wells, so your roots will go as deep as they possibly can go. Get these nutrients cycling going on all of those root systems. We have to get rid of the compaction that's imposed on our soils by tillage and by the large equipment that we're putting across that soil.

Roots can go down six, 10, 20 feet in a single growing season. If root systems are down that deep, then typically we reduce water requirements of the plant. We don't have the insect pests. All of those problems are pretty much done away with, if we can get the proper life back in the soil.

DM: Now, when you talk about life in the soil or biology in the soil, I'm assuming you're referring to the different bacteria that are supporting the growth of the plant. And I'm wondering if you can comment on how one assesses how optimized this bacterial growth or microbial communities.

EI: It's pretty simple if you look at the soil. So, you take a sample of your soil. You dilute it or quantify it with water. Put a drop of that suspension on a microscope slide, and use a pretty

simple microscope. It usually takes us about a day to train people to be able to use that microscope, and then of course, they have to practice.

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But you can look at your soil and determine quite rapidly within five minutes whether you have the proper balance for the plant that you want to grow. If you don't, then you need to be making compost. Use your own waste materials to make compost that will have the proper sets of organisms in the soil, and then you put the compost on.

If you don't like putting solid materials on them, we can turn that compost into a liquid form. It's pretty easy to apply that biology. And it's a liquid. Get those organisms growing and surviving in the soil. It's pretty rapid for us be able to return that life to the soil if your plant's growing in an organic fashion.

DM: Okay. The science of establishing the ideal microbes for a specific plant is well-established. And there's a reference material on how one can identify what those bacterial communities are?

EI: Yes. Bacterial, fungal, protozoan, nematode, and microarthropod communities. There's quite a bit of scientific literature on that. Because, of course, you know, the very first person who looked at the first microorganism, Antonie van Leeuwenhoek, was describing what these organisms look like. So, we've had this knowledge for a good 100 to 150 years.

DM: Great. How would one access…

EI: The ratios of…

DM: How would one access this reference material on how to identify what those optimums are?

EI: You would want to look at a number of different books. My publications go through what those ratios are and what they need to be. I've worked a lot with a lot of the permaculture people. Several publications have those ratios to find out what are the bacteria for the different kinds of plant species. Certainly, a number of my publications go over what those proper balances are.

Going to my CV is probably the easiest way to access all of my publications or going to the Rodale Institute website and looking at my recent list of books. There's a book called *10 Steps to Gardening with Nature* that goes through a lot of these and which shows an explanation of all of the mechanisms why that life in the soil benefits your plant. It's pretty easy to read books; I've had lots of people helping me turn the scientific language into a much more of a general-public-understandable language.

DM: Once you have these optimums identified through your reference works that you've published, do you then specifically modify the compost or the ingredients of the soil? Or just general compost is typically enough to optimize those ratios that you described?

EI: Depending on the formula of starting materials that you put into the compost. There are a number of green plant materials that really select for the growth of bacteria, and then woody materials [are] high in cellulose, high in lignin, high in [inaudible 13:39].

Woody materials – saw dust, paper, cardboard, wood chips, and dry ground leaves that fell from the trees at the end of the growing season – are going to grow fungi. You choose whether you need more fungal or more bacterial. And then design your recipe for your compost according to what is missing in your soil, so you can put back in what is not there.

A number of people, especially commercial growers, they will make a compost that has equal biomass fungi and bacteria. Then when they actually apply it, they will put on more bacterial foods, because that's what they need. Or when they apply it, they will put in more fungal foods, if that's what's needed in a soil. There are a number of approaches for fixing that ratio of fungi, bacteria, protozoa, and nematodes depending on what's the easiest for the grower to do.

DM: Do you ever use a starter culture that's high in concentrations of the bacteria or the fungi that you want to inoculate the compost [with]?

EI: Yeah, we do. And especially if we want to compost very rapidly, we'll use a starter to inoculate the specific sets of organisms that we need to encourage in that compost.

DM: Okay, great. So, once [you've] identified and optimized the soil health through the microbial communities, I'm wondering if you can expand on the relationship between the plant health that's produced and then human health.

EI: We need our plants to have the full set of nutrients that allows the plant to grow in a very healthy fashion, because that's the proper balance for us as human beings. When we look at a lot of the GMO plant material, when we look at conventionally grown plant material, they may be extremely high one nutrient, but lacking in many, many others.

We've done some studies of that in New Zealand, looking at facial eczema in dairy cows. We were able to cure all of the animals from that facial eczema, because it was a nutritional deficiency that was causing that facial eczema. It wasn't really a disease; it wasn't an illness. It was a nutrient deficiency in the grass.

What we saw is when we put the proper balances of the organisms back into the soil, now the plants have the proper balance of selenium, molybdenum, and a number of the micronutrients. The conventional grass had almost no cobalt, no selenium, and really low levels of a number of very important micronutrients.

If the food that human beings are eating doesn't contain the proper set of nutrients, we aren't going to be healthy. We've got to get those nutrients in the proper balances back into the food that we're eating.

I think a lot of what you've been looking at is exactly that problem: our food sources do not contain the micronutrients and don't contain what human beings need. If we can get that proper biology back into the soil, then the plants have the proper balance of nutrients. And then because we are what we eat, human beings can be properly nourished once again.

DM: All right. Well, thank you for describing that foundational premise for the groundwork of the next question, which is what your area of study has been recently, and that's the influence of GMOs on this whole environment. I'm wondering if you can comment on what the GMO

introduction has been doing, and what the projections are for that technology in the next few decades.

EI: When you look at GMOs, you have to understand each specific genetic engineering event. It's hard to make a simple statement about the effect of all GMOs, because each one is a very specific mechanism, and you have to understand that.

When we're really trying to understand each and every different kind of engineered organism, the effects are going to be mediated a little bit differently. But pretty much across the board, we don't know exactly what's going to happen with any engineered event, because we have not studied what happens when that GMO plant is subjected to extremes of weather or extremes of climate. We don't know exactly what's going to happen. That, to me, is one area of major concern with every GMO that has been produced.

When we start looking at the specific kinds of GMOs – for example Bt plants, where the specific genetic material for a single toxin protein has been taken out of the bacteria (Bacillus thuringiensis or Bt) and put into the genetic material of corn, soybean, potatoes, and now a whole bunch of other plants that have come along to the system that Monsanto's trying to get accepted.

When we look at what happens to animals that consume Bt plant material, it ends up with severe ulceration, and it starts at the digestive system. We see massive damage to the liver and to many of the internal organs in the body of those animals when we went to compare the Bt plant material fed to those animals versus non-Bt plant material fed to a herd that started out exactly the same. We're seeing very clear effects.

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A lot of that research had to be done in Australia, for example, because within the United States we're not really – there's no funding for that kind of research work. We're not really allowed to do that research, and,[there's] a lot question why that is. But we don't have that research going on in the United States for the most part. So, looking at what's being done overseas, it's very clear that that particular genetically engineered plant is causing huge problems with the animals that are feeding on that material.

Where in the human studies that ought to be done and ought to be showing whether the same kinds of things are happening in human beings, that is not being done. So, we don't really have the data to let us know whether there's a problem with Bt toxin in every cell of the potatoes that we're eating. Or the corn, if it's Bt corn, we have that toxic protein in every single cell of the corn that you're eating. In the soy, in the soybean, and all the other plants that are coming along, we're going to have that protein toxin in every single cell.

What's the effect on human beings? We can show you what the effect is on animals. And it makes you really wonder if the reason we do have all the digestive problems that we have right now, it might not be due to the fact that so much of the American public is ingesting this toxic protein. And every single cell of the potato, corn, and the soybean – all of it is contaminated with that toxic protein. It's a huge concern when you start to look at the ultimate effect on human health with that genetically engineered organism.

Now, we could turn to another genetically engineered plant, Roundup Ready. That plant material has been engineered to be resistant to the herbicide, glyphosate, the active ingredient in Roundup. Previous to the genetically engineered plant produced by that, we didn't use a lot of Roundup. But with the advent of these Roundup Ready plant species or engineered organisms, we have increased the amount of glyphosate going onto our agricultural lands by a massive amount.

What we've found with another Roundup Ready plant material [is that] when we apply that Roundup to the soil in massive quantities, we're seeing significant reduction in all of the beneficial organisms in the soil. It causes a massive balloon of bacteria in the soils, because glyphosate is a bacterial food. And when you have that massive growth of bacteria in your soil, it takes up all the soluble inorganic nutrients that are present in the soil, which means now your plant is going to be stressed through lack of nutrition.

Then if you're a grower, you're going to have to go buy more fertilizers, so that you can keep your plants alive. If you fall into that trap of utilizing that Roundup Ready material, you're going to be putting on a lot of Roundup. And you'll grow a lot of bacteria, unbalancing the soil, meaning your plant can't get the nutrition that it requires. You're going to have to use more chemical to keep your plants growing. Your plant material becomes even more unbalanced and less healthy for human beings to get the nutrition that they require.

Every single genetically engineered plant has to be really examined very carefully for the effect [that it has] on the whole ecosystem – on the soil, animal health, and human health. We just don't have the studies. They weren't done. They weren't required.

DM: Can you comment on the system that allows that to happen, specifically with respect to Monsanto and Cargill, who are the larger producers of these seeds? I mean, what system is in place that prevents this independent research from going forward, so that we can investigate this issue more carefully?

EI: It's really a situation where the control of USDA-Animal and Plant Health Inspection Service really is the focus of the problem. Back when they were writing the regulatory language for testing genetically engineered organisms on the basis of very few species of bacteria being examined, a little bit of testing was done on the basis of just a few bacterial species not causing an ecological effect. The USDA decided that the regulatory language is basically: "Genetically engineered organisms are of no greater risk than the parent."

When a graduate student of mine was looking at a particular genetically engineered bacterium that grows in soil… Something that the USDA and the EPA had not yet tested was an organism that actually grows in soil. All of the test organisms they were using were non-soil organisms.

When we took that bacterium and put it into the root systems of plants, compared their genetically engineered bacterium against the parent that has no additional bacteria in that soil, we showed very clearly that the genetically engineered Klebsiella planticola caused total death to all of the plants that we put into the system – the test plants and when using weed as the test plant in that system.

The results from that testing clearly shows that the genetically engineered organisms can be of a great deal of risk, higher than the parent organism.

We need to do a much better job of testing these genetically engineered versions of plants, microorganisms, or whatever we're talking about. They need to be better tested. And that the regulatory language "genetically engineered organisms are of no greater risk than the parent" is clearly incorrect. It's invalid. We need to go back and think better of a valid regulatory statement by the USDA. So, why don't they change it? Well, who's controlling the USDA?

DM: Well, who is controlling the USDA? Maybe you can enlighten us or remind us who is.

EI: When you start looking at the USDA-APHIS, the Animal and Plant Health Inspection Service, it's a rotating system where they bring somebody on board from the industry, from Monsanto, or from the chemical biotech industry. They serve their time out, and then they go right back into service in Monsanto, Golden Harvest, Syngenta, or any one of the biotech companies. That's been documented over and over again.

For those people who might really want to look at that history, you might want to go talk to the folks at the Edmonds Institute out of Washington State, because they very well documented it. You know, how much of the turnaround there is. You come from the industry. You're on the USDA panel, promoting every company that you came from in, and then you go back to that company.

We really have to, you know… The U.S. public needs to wake up and pay attention to what's really controlling the regulations on these genetically engineered organisms. It's not scientifically valid what's in the regulatory literature. We need to stop that rotating door into the regulatory agencies, so that people coming from the industry are not writing the regulatory language.

We need people who are not in any way influenced by the Big Business – the biotech companies. They need to be the people looking at the science at hand and writing that regulatory language. Right now that is definitely not the case.

DM: Yeah, it would seem there should be some type of laws against these revolving doors between the industry and the regulatory agencies. But for whatever reason – most likely corporate corruption and penetration into the government – these rules and regulations don't exist. I'm not certain how making more people aware of that would change that, but I guess it's a start. Ultimately, it needs to be done through the legislatures, to pass these laws. But right now it's not there.

I'm wondering if you can also comment on any concerns you might have from the research that Monsanto and Cargill had done and submitted to the FDA to obtain approval for these GM organisms and seeds?

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EI: When you start looking at the ability of scientists to bias research, it's actually very, very easy to set up an experiment to show exactly what you want to show. You do things with the control, so that it looks like your test organism isn't causing any problems relative to the control that you set up. It's quite easy to bias the research and show essentially what you want to show.

That means that when you rely on the industry that wants to develop a product and make lots of money… You can look at Monsanto. It has a five-billion-dollar profit on an annual basis or, you know, even more than that on an annual basis. They [inaudible 31:13]. When we're relying on that company to do the research necessary to show that there is or is not a problem, they bias that research. Beyond the shadow of a doubt, they bias that research.

So, our regulatory system cannot be relying on the company itself to regulate itself. It's setting the fox to guard the hen house.

When does the American public wake up to that particular fact? When does the general public around the world wake up to that fact? But so much of the world relies on the U.S. to do the research. I've worked with the United Nations committees a number of times, and every place else in the world looks at the U.S. as having so much money. We have the money to do the science.

So, if the U.S. is saying, "Don't worry, be happy. Trust us not to try to sell something that will kill you," really, we've really got to go back. We've got to look back at the tobacco industry. How many years did the tobacco industry say, "Oh, we would never sell something to the public that will kill them," when, in fact, all they were interested in was the profit. They were greedy. And they, out loud, lied about their results. They altered the experiments that they were doing, so that it didn't look like there was a problem.

When we go to the pesticide industry, exactly the same thing happened there, where all these pesticides were approved based on research that came from those chemical companies. Today, we go back, and were banning those chemicals, because they are so dangerous to human health. Why don't we learn our lesson, as the public, that we can't rely on this kind of research? We have to have totally independent research systems.

Well, going back to when my graduate student was doing the work on Klebsiella planticola. When we saw what that bacterium was doing to plants, we're reasonably… In fact, when genetically engineered organism has been released out into the world, the logical concept requires in releasing that bacteria is that we would lose terrestrial plants. That's how dangerous that genetically engineered organism was or actually is, if that soil bacterium grows in the root systems of all plants.

It was now engineered to produce alcohol. The idea being that we would stop field-burning, because you would break up all of the residues from your farm instead of burning them. Burning would break a lot [inaudible 34:05] in the farm. Let that go anaerobic and produce the alcohol, because the Klebsiella planticola grows on all of that plant material in the root system of every plant and produces alcohol.

You would take the residues left from that alcohol prevention and you would spread them back out on the field. You would be spraying, living, and growing engineered Klebsiella planticola that would now produce alcohol in the root systems of your next crop, and kill your crop. If that escapes (and of course, it would) from the field that it was put on, it would start producing the alcohol in the root systems of all terrestrial plants. And terrestrial plants cannot tolerate that effect.

So, genetically engineered organisms, thank goodness, we actually did the research on that, which showed how dangerous it was. The USDA didn't want to believe the results. They wanted to question the methods and the methodology.

When I returned to Oregon State University after I presented these data at the United Nations meeting, the people at the university – because, well, Monsanto contributes a serious amount of money to the budget at Oregon State University and at every university in the country (land-grant universities in general); so much of their research budget comes from these biotech industries – in the choice of keeping a single professor that's showing the dangers of genetically engineered organisms…

But that's the way our universities work. They're big businesses. They can't tolerate loss of the money coming from the biotech industries. So, of course, they gave to that pressure. I am no longer a professor at Oregon State University, because I dared to bring to light this information about the dangers of genetically engineered organisms.

DM: Okay. Well, thank you for sharing that and providing that perspective. I'm wondering what your recommendations are that the average person watching this can do to make sure that they have access to non-GMO foods.

EI: What they need to do is – well, I can only think of three things that a person in the general public could do.

First of all, you probably want to eat organic food. Of all the places, of all the ways to make sure that you're not receiving these toxic loads, that you're not supporting through your food dollars these industries that are really trying to pull the wool over your eyes, we need to eat organic food.

Because we don't allow GMO materials, we don't allow GMO seeds, and we don't allow genetically engineered organisms to be used in organic production. They're one of the best ways to assure that you're not getting genetically engineered material. You're not harming the environment by supporting that industry. If you don't support the industry by buying their food, then they will learn that that's not the right direction. So, eating organic food, that's probably the easiest way to get out or help reduce that support of the GMO industry.

The second thing that people really need to do is to require labeling on that food. You really want to know whether you're eating potatoes that have a protein toxin in every cell of that potato material that you're eating. You want to know when your corn is being contaminated with that genetically engineered protein. You want to know your soy or when anything you're eating has some of that genetically engineered material in it.

And then thirdly, you can start growing vegetables. Improve your soil. Get the life back into the soil, so that your food that you're growing yourself has the proper ratio and has the amount of nutrition balanced correctly by getting all that life back into your soil and growing your own food.

DM: Terrific. Thank you for that. To encourage people to adopt these recommendations, I'm wondering if you could comment on any disasters that have already occurred with GM foods.

EI: There's been, you know. It's like the Klebsiella planticola story. It's a disaster that was very close to being a disaster. We were within two weeks of that genetically engineered organism being released out into a [inaudible 39:30] grassland situation. It's pretty, pretty frightening how close we came to that total disaster.

When we look at Roundup Ready plant material, that's a disaster in the making right there, because everywhere we're using the Roundup Ready plant material, we're applying a chemical that is removing nutrients from the soil, so our plants are not getting the nutrition that they require. There's a human health effect.

With the Bt, there is clearly research going on that's showing that it's harming the digestive systems of pigs, cows, horses, and other livestock.

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If it's causing that kind of damage to their digestive system, what's it doing to human beings? It's got to be causing the same type of damage. But we know nothing about it, because we don't know when we're actually eating a genetically engineered material that has those toxins in it. I'm not sure if you're thinking of other examples, but probably those examples are pretty good ones.

DM: Okay. You know, there are many people – mostly with a strong science background – who have bought into what you and I suspect or believe to be the lie of Biotech, that the benefits of these technology far outweighs any potential concerns of risk. The primary benefit, of course, being to feed the world – and probably being the most significant one.

But I'm wondering… You know, I'm a big fan of technology. I love what it produces and the potential it has to improve human existence. I'm wondering if there are any potential applications that you can perceive of biotech and genetically engineered food that might actually be safe.

EI: Because you have to look at each individual engineering event, understand exactly what it's done to the plant, and how it's actually going to be interpreted under a number of different conditions, it's hard to make generalizations.

I'm sure with proper testing, if we actually tested the genetically engineered plant material for its effect on the life in the soil, the effect on nutrient cycling, on water uptake, on the structure of the soil... If we actually did the proper testing, we'd be able to exclude those genetically engineered materials that are going to cause real problems environmentally or in human health. But we have to have that proper testing occur.

Often we hear, especially for Monsanto, that "We're not going to be able to feed the world by 2025. We have to be making these genetically engineered plants, so that we can feed the world. We have to continue with the Green Revolution." But we realize that the only reason that the Green Revolution worked is because we've already done so much to destroy the soil. We've wiped out most of the beneficial organisms in our soils, so our plants were stressed. They weren't growing well. The nutritional value of our food resources is already going downhill.

The way to avoid the whole Green Revolution, pesticides, inorganic fertilizers, and this whole chemical addiction that agriculture's been on for the last 75 years would have been to put the proper biology back into the soil.

When Monsanto says that "We have to have genetically engineered organisms to feed the world," that is just ridiculous. Because we're going to run out of clean water long before we run out of food on this planet. We're already fighting water wars in many parts of the world, because there's just no clean water for people to drink. How can you grow plants if all of your water is extremely salty, as all kinds of contaminants in it? And that lack of clean water is being caused by the kind of conventional agriculture that we've been doing for the last 70 years.

I always have to kind of giggle when we call it "conventional agriculture," because it's conventional only in terms of the last 70 years, not the last 5,000 or more years that human beings have been cultivating plants. So, really, when you want to talk about conventional agriculture, organic is conventional. It's just that the chemical way of doing it is something… Some advertising person in the chemical world figured out we can call it "conventional," so that he would feel better about it, I guess.

It's really that we need to get back to organic agriculture, where we put the biology back into the soil and get the normal nutrients. If we get root systems growing deep the way they're supposed to grow in all of our crop plants and if we get the proper biology back into the soil, we don't have any Bt, we don't have loss of nutrients, and we don't have loss of nutrients to feed our plants. They're supplied at the proper rate for our plants if we get that proper biology back into the soil.

So, really, what's going to solve the problem is getting the proper life back in the soil, not continuing to destroy our soils through overuse of toxic chemicals.

DM: Yes, I agree. As I said, I'm a big fan of technology and the concept of exponential growth in technology, which is somewhat challenging for most people to understand. Because we tend to think linearly, we don't really fully appreciate exponential growth.

My guess, from what I've been reviewing, is that hopefully we'll have the water issues solved in the not-too-distant future. Because we'd have developed advances in energy, which would allow us to essentially distill seawater as a source of freshwater. That will be part of the problem.

But until that time, we really do need to be diligent and exert these precautionary principles, because of these revolving doors that really limit the introduction of the proper restrictions and the federal regulatory agencies' inability to implement them because of that revolving door essentially) that the science can't be done, as you've really alluded to. We need to be very careful.

I'm wondering if you could comment on an area that's commonly confused when people think of, at least the average person who has not studied this somewhat, the difference between genetically engineered food and the time-honored tradition of hybridization, which, in my view, most people confuse with genetically engineered food. They think this is just a better version of that. It's speeded up. And it's just, you know, this is science improved, so this should be better. Why not do it?

So, if you could help expand and comment on that to help eliminate this area of confusion for so many people.

EI: Yeah. When looking at normal breeding techniques, we are not going outside of that species. You can't breed one species with another species. By definition: when we're doing normal genetic manipulation using breeding methods, it's all going to be done within the normal, natural restrictions of reproductive abilities of organisms. You can't go outside of the species. You're not going to get genetic material from a different species to cross with whatever it is you want to have that crossed with.

When we're dealing with genetic engineering, we are taking genetic material quite often from entirely different kingdoms of organisms. When we're removing that genetic material, that's something that could not ever possibly breed with the plant or the organism that you're interested in.

When you take that really foreign genetic material and then insert it, or when you actually take a gun and blast individual cells with the genetic material that we want to stick into this other organism. And we're crossing our fingers and hoping that it's going to insert itself, and it's going to begin blowing that gun in the right place. We may blast these genetic sequences into a million cells. Cross our fingers and hope that it won't … that we want.

It's an expensive process to do all of that. It takes a lot of time, a lot of patience, and checking for whether that genetic material got put into the place that we're hoping that it went, so we could express the character that we want.

But then we don't know what other things we disrupted. When you said that you read all the current work on how DNA expresses any traits, you come to understand that it's extremely complex and lots of different translations from that DNA occur.

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If you inject this unique sequence into a random place on the DNA, most of the time, the organism can't live. But on those rare occasions where it can and it starts to express, there's going to be 10 different protein changes. And we don't know what all those proteins are, how they got modified, or what metabolic processes are going to be disrupted because that new genetic material is in there.

What happens when this plant or organism encounters freezing temperatures? It may express some genetic material in an extremely frightening way. It could be extremely toxic under certain environmental conditions. But we don't know any of that.

So, when we're trying to take genetic material from totally and completely different kingdoms of organisms, that's what we're dealing when we do genetic engineering. And it is just a real kind of like [inaudible 51:12]. It's pretty frightening to think about what we could possibly be doing when we allow these things to be released out into the real world on the basis of "genetically engineered organisms are of no greater risk than the parent." We very clearly have research that shows that that's an absolute lie.

DM: Okay, great. Well, thank you for that. In closing, I'm wondering if you'd like to provide any summary of comments, and then also any specific recommendations for your resources that you've compiled that people can seek for further information.

EI: I probably want to conclude that as these genetically engineered organisms are currently made or produced, there really is no such thing as a "safe GMO." We do not understand really what we're doing. We don't need GMOs definitely. There is no need to be producing these kinds of dangerous organisms that we really don't know what they're going to be doing ultimately, which is exchanging with other organisms in the environment.

In the Roundup Ready weeds that we have in many parts of the United States, it's a great deal of concern. We are already probably going to lose Roundup as an herbicide; that very possibly could be a good thing. But we are not paying attention to the ecosystem damages that could be occurring from those sorts of things.

We certainly don't need GMOs to feed the world. We need to go back to a less environmentally damaging way of doing agriculture. We need to get off the chemical addiction and return to putting the proper biology back into the soil.

The key to global climate change, to better nutrition in our plants, to human nutrition, and to human health is recognizing that we have destroyed the life in our agricultural soils, and most of the soils that are impacted by human beings. We have not understood the damage that we're doing in the last 20 to 30 years.

In the last 30 years, we have started to recognize and to understand what the damage is and how to easily – very easily – fix this. It's not going to take billions of dollars to remedy the problems that we have with our soils – erosions, cementation – and water quality could be brought back very rapidly if we could just put the proper biology back in the soil.

DM: Any resources you could recommend for people who wanted more information from the materials you've compiled?

EI: A lot of work that I've done with the GMO is available from the Edmonds Institute in Washington State. Beth Burrows is the person that you would probably want to contact to get those materials. Certainly, the Rodale Institute. You can go and find my list of publications. I'm currently the chief scientist at Rodale Institute. Most of this material is on their website. You can find my list of publications.

The book called *10 Steps to Gardening with Nature* by Carole Ann Rollins and myself is available from the Rodale Institute. It's a really good basic summary. There's also a very good book written by Jeff Lowenfels called *Teaming with Microbes*. "Teaming" as in it's a team affair. So, [there's] kind of a play on words on that one. That's an excellent resource for a lot of this kind of information as well.

[END]