

A GM-Free World

Leading Geneticist Exposes the Bad Science of Biotech



Mae-Wan Ho, Ph.D.

Mae-Wan Ho obtained her B.S. degree in biology in 1964 and her Ph.D. in biochemical genetics in 1967 from Hong Kong University. She was a postdoctoral fellow in biochemical genetics from 1968 to 1972 at the University of California in San Diego, during which time she won a competitive fellowship of the U.S. National Genetics Foundation. She then became a senior research fellow in Queen Elizabeth College in the United Kingdom, and after that a lecturer in genetics and a reader in biology in the London Open University. In 1999, Ho founded the London-based ISIS — the Institute of Science in Society — to promote her views and those of like-minded scientists. Dr. Ho retired in June 2000 and remains a visiting reader in biology at the Open

University and a visiting biophysics professor in Catania University, Sicily. Today, she has close to 300 publications, including 47 experimental works.

Dr. Ho has been one of the most influential figures of the last decade in the debate within the scientific community regarding the use of genetically modified organisms. She is a highly consulted scientific figure with many theories relating to her powerful anti-GM stance. She is also a well-known critic of neo-Darwinism and reductionist thought in biology and physics.

ACRES U.S.A. We would like to get your insight and your experience on this genetic engineering, which is kind of a mystery to most people — and I'm afraid in the United States they don't take it quite as seriously as they do in Europe. So what is your take on this technology?

MAE-WAN HO. Well, I'm a scientist. In fact, I was a geneticist and a molecular geneticist, and I got involved in the genetic engineering debate because I was so disgusted with the quality of the information that was going out to our policymakers, in the first place, and then the public, because I was involved as a scientific advisor to the Third World Network. I was at a conference organized by the Third World Network when they said, "We're really worried about genetic engineering, and we haven't got anybody to look at this problem for us." So that was how I got involved.

ACRES U.S.A. What is genetic engineering, from the layman's point of view?

HO. Genetic engineering refers to a whole set of techniques in the laboratory in which you take the genetic material from different organisms, from bacteria,

from viruses, you join them up together to make new combinations, and then you use laboratory techniques to produce a lot of copies of this new joined-up, engineered genetic material which is completely unnatural. From there, you again use laboratory techniques to introduce these strange combinations of genes into organisms, into the cells of say, maize, or the embryos of cows or sheep or anything, any organism, in order to make genetically modified cells. In the case of plants, you can then regenerate these cells into a whole plant, and you can breed from that and start a sort of transgenic line out of this initial cell that has taken up the foreign genetic material. In the case of cows and sheep, you inject these strange, foreign genes into the embryo or the egg and you hope that some of the egg cells, the genome of the egg cell, have taken up this foreign construct — then it can again be grown into a transgenic animal.

ACRES U.S.A. You said "hope?"

HO. Yes, because this technique is known to be totally unreliable and uncontrollable. You see, even though the genetic engineer can pretty precisely chop up and join up the genetic material in the laboratory, once you try to put it into a cell, then it's completely out of control — it cannot be controlled in the genome, where this foreign piece of DNA ends up. What's more, it can become completely scrambled when it actually lands in the genome. So, depending on where and in what form this foreign construct has landed, then you end up with something totally different. This is why even if you start with the same cells, the same construct, the same kind of genetic material joined together, you can end up with completely different organisms. Basically, each transformed cell is actually the cell that has taken up the foreign genetic material.

ACRES U.S.A. Wes Jackson of the Land Institute tells us that if you had a working manual for the corn plant down to the DNA and the rest of it, it would probably fill the shelves of a major library. If it's that complicated, do we know what we're doing when we're doing this?

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HO. Oh no, we don't know at all, and they admit it. It's only recently that they have gone back and said, "Hey, let's look at where this genetic material has landed and whether, after it has landed, it tends to stay there." What they found is that it's horribly complicated, because they know that when the foreign genetic material "lands" in a cell, it tends to scramble the genome at the site, and then it scrambles itself as well! Some of the scrambling is so bad that they can't even identify the resulting genome sequence. They can't tell where the material has landed. This is why a lot of these lines are unstable, but the proprietary company will claim that they have characterized a transgenic line — they have analyzed the foreign insert

and say, "It is like this: A, B, C, D, E, F," the gene order. When, however, government scientists, European government scientists — mainly French and Belgian, so far — have looked at it again, they found that it's not like that the company's description at all, that the gene order is more like "E, B, F, D," and the other bits have disappeared! Furthermore, it hasn't landed in chromosome #7, next to a certain gene, it actually is in chromosome #5. This is in effect what they have found. French scientists, for example, analyzed five transgenic lines for a transgenic insert, and in five out of five lines they showed that it had changed.

ACRES U.S.A. What is the net effect on human cells and protoplasm when you eat food that's created that way?

HO. That is a major area of contention. The companies keep saying that this genetically modified DNA is no different from natural DNA. "DNA is DNA is DNA." Some pro-GM scientists even say that this is the ultimate organic molecule. There are a lot of indications that this genetically modified DNA is completely new, it has never existed in billions of years of evolution, it's cobbled together from different sources, a lot of viral and bacterial DNA is being used to make it, and it is unstable and has a propensity to jump again — it is designed to jump into

GE Is Not Like Conventional Breeding

by Mae-Wan Ho

I should, right away, dispel the myth that genetic engineering is just like conventional breeding techniques. It is not. Genetic engineering bypasses conventional breeding by using artificially constructed vectors to multiply copies of genes, and in many cases, to carry and smuggle genes into cells. Once inside cells, these vectors slot themselves into the host genome. In this way, transgenic organisms are made carrying the desired transgenes. The insertion of foreign genes into the host genome has long been known to have many harmful and fatal effects, including cancer; and this is born out by the low success rate of creating desired transgenic organisms. Typically, a large number of eggs or embryos have to be injected or infected with the vector to obtain a few organisms that successfully express the transgene.

The most common vectors used in genetic engineering biotechnology are a chimeric recombination of natural genetic parasites from different sources, including viruses that cause cancers and other diseases in animals and plants — although their pathogenic functions have been "crippled" — and tagged with one or more antibiotic-resistance "marker" genes, to aid in selecting cells transformed with the vector.

For example, the vector most widely used in plant genetic engineering is derived from a tumour-inducing plasmid carried by the soil bacterium *Agrobacterium tumefaciens*. In animals, vectors are constructed from retroviruses that cause cancers and other diseases. A vector currently used in fish has a framework from the Moloney marine leukemic virus, which causes leukemia in mice but can infect all mammalian cells. It has bits from the Rous Sarcoma virus, causing sarcomas in chickens, and from the vesicular stomatitis virus, causing oral lesions in cattle, horses, pigs and humans.

Such mosaic vectors are particularly hazardous. Unlike natural parasitic genetic elements, which have various degrees of host specificity, vectors used in genetic engineering, partly by design and partly on account of their mosaic character, have the ability to overcome species barriers and to infect a wide range of species.

Another obstacle to genetic engineering is that all organisms and cells have natural defense mechanisms that enable them to destroy or inactivate foreign genes, and transgene instability is a big problem for the industry. Vectors are now increasingly constructed to overcome the very mechanisms that maintain the integrity of species. The result is that the artificially constructed vectors are especially good at carrying out horizontal gene transfer.

Let me summarize why recombinant DNA technology differs radically from conventional breeding techniques:

1. Genetic engineering recombines genetic material in the laboratory between species that do not interbreed in nature.
2. While conventional breeding methods shuffle different forms (*alleles*) of the same genes, genetic engineering enables completely new (exotic) genes to be introduced, with unpredictable effects on the physiology and biochemistry of the resultant transgenic organism.
3. Gene multiplications and a high proportion of gene transfers are mediated by vectors which have the following undesirable characteristics:

- Many are derived from disease-causing viruses, plasmids and mobile genetic elements — parasitic DNA that has the ability to invade cells and insert itself into the cell's genome, causing genetic damage.

- They are designed to break down species barriers so that they can shuttle genes between a wide range of species. Their wide host range means that they can infect many animals and plants, and in the process pick up genes from viruses of all these species to create new pathogens.

- They routinely carry genes for antibiotic resistance, which is already a big health problem.

- They are increasingly constructed to overcome the recipient species' defense mechanisms that break down or inactivate foreign DNA.

From "The Unholy Alliance," by Mae-Wan Ho. The complete article is available on the ISIS website at <www.i-sis.org.uk>.

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genomes and to overcome species barriers. You know, biological species don't really tend to exchange genes with other species — first of all because there are natural limits to how much they can exchange, since each species has its own space and time in evolutionary history. In the second place, in the laboratory today there is no limit to what you can make. You can even take DNA from organisms that have been dead for hundreds of thousands of years — from a fossil, from a dead fossil — and join it up with organisms that exist today. DNA is actually a very stable molecule. It can actually persist long after the organism is dead. And this, again, is something that people who

are regulators haven't realized — they haven't come to grips with it at all.

ACRES U.S.A. So, what actually happens when we eat these foods?

HO. As I already mentioned, these modified genetic materials were designed to overcome the natural barriers between species. What happens when we eat ordinary vegetables and animal protein is that the DNA is broken down by our enzymes. Then, our cells also have enzymes for breaking them down further, and ultimately they will be nutrition for the cell. Unfortunately, if you design genetically modified DNA to jump into genomes and

to overcome species barriers, then there is a chance that this DNA can avoid enzymatic breakdown and get into other unrelated species. For example, one of the dangers of these organisms is that, as I said previously, they are mainly made up of genetic material belonging to viruses and bacteria. So if these genetic materials meet other viruses and bacteria, they can join up to make new combinations — new viruses and bacteria that cause diseases and resist medical treatment.

ACRES U.S.A. Is that what they mean by the term "recombinant?"

Why GM Free?

1. GM crops failed to deliver promised benefits.

The consistent finding from independent research and on-farm surveys since 1999 is that genetically modified crops have failed to deliver the promised benefits of significantly increasing yields or reducing herbicide and pesticide use. GM crops have cost the United States an estimated \$12 billion in farm subsidies, lost sales and product recalls due to transgenic contamination. Massive failures in insect-resistant Bt cotton of up to 100 percent were reported in India.

Biotech corporations have suffered rapid decline since 2000, and investment advisors forecast no future for the agricultural sector. Meanwhile, worldwide resistance to GM reached a climax when, in 2002, Zambia refused GM maize (corn) in food aid despite the threat of famine.

2. GM crops pose escalating problems on the farm.

The instability of transgenic lines has plagued the industry from the beginning, and this may be responsible for a string of major crop failures. A review in 1994 stated, "While there are some examples of plants which show stable expression of a transgene, these may prove to be the exceptions to the rule. In an informal survey of over 30 companies involved in the commercialization of transgenic crop plants, almost all of the respondents indicated that they had observed some level of transgene inactivation. Many respondents indicated that most cases of transgene inactivation never reach the literature."

Triple-herbicide-tolerant oilseed rape (canola) volunteers that have combined transgenic and nontransgenic traits are now widespread in Canada. Similar multiple herbicide-tolerant volunteers and weeds have emerged in the United States, where glyphosate-tolerant weeds are plaguing GM cotton and soya fields, and atrazine, one of the most toxic herbicides, has had to be used with glufosinate-tolerant GM maize.

Bt biopesticide traits are simultaneously threatening to create superweeds and Bt-resistant pests.

3. Extensive transgenic contamination is unavoidable.

Extensive transgenic contamination has occurred in maize landraces growing

in remote regions in Mexico despite an official moratorium that has been in place since 1998. High levels of contamination have since been found in Canada. In a test of 33 samples of certified canola (oilseed rape) seed stocks, 32 were found to be contaminated.

New research shows that transgenic pollen, wind-blown and deposited elsewhere or fallen directly to the ground, is a major source of transgenic contamination. Contamination is generally acknowledged to be unavoidable, hence there can be no coexistence of transgenic and nontransgenic crops.

4. GM crops are not safe.

Contrary to the claims of proponents, GM crops have not been proven safe. The regulatory framework was fatally flawed from the start. It was based on an antiprecautionary approach designed to expedite product approval at the expense of safety considerations.

The principle of "substantial equivalence," on which risk assessment is based, is intended to be vague and ill-defined, thereby giving companies complete licence in claiming transgenic products "substantially equivalent" to nontransgenic products, and hence "safe."

5. GM food raises serious safety concerns.

There have been very few credible studies on GM food safety. Nevertheless, the available findings already give cause for concern. In the only systematic investigation on GM food ever carried out in the world, "growth-factor-like" effects were found in the stomach and small intestine of young rats that were not fully accounted for by the transgene product, and were hence attributable to the transgenic process or the transgenic construct, and may hence be general to all GM food.

There have been at least two other, more limited, studies that also raised serious safety concerns.

6. Dangerous genetic products are incorporated into crops.

Bt proteins, incorporated into 25 percent of all transgenic crops worldwide,

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HO. Yes, recombinant — that is, a recombination. Horizontal gene transfer and recombination form the major process for generating new viruses and bacteria that cause diseases.

ACRES U.S.A. It sounds an awful lot like what we're attempting to do here is to intermarry unlike species at the molecular level. Is that a correct statement?

HO. Yes, yes, absolutely! And there is no barrier whatsoever now because you can do all these things in the laboratory. The other thing that is immediately worrying is that they also use antibiotic-resistant genes. It's part of the tools of the trade that enable them to select for those cells that have taken up the foreign genes. They put some antibiotic-resistant marker genes next to the foreign genes. Now, these genes can actually pass on — they very often stay in the GM crops that are released into the environment, and the antibiotic-resistant genes — if they get into bacteria that cause disease — would make those infections untreatable.

ACRES U.S.A. Is it a possibility that this procedure has something to do with the prions implicated in Mad Cow disease and things like that?

HO. We don't know, because there have been so few targeted investigations. But this is the other thing: these DNA can also get into *our* cells, and the danger of rogue DNA getting into our cells, or the cells of other mammals, is that they often contain very aggressive virus promoters. It's not easy to get a foreign gene to work in a cell. In order to do that, you really have to give it a very aggressive gene switch — which is called a "promoter" — that says to the cell, "Copy this gene and make a lot of the protein that's involved. Express this gene at a higher level." In order to do that they use the promoter from viruses. A virus, as the name implies, has the ability to hijack the cell to make many copies of itself, and that is essentially the basic technology that enables many foreign genes to become aggressive. They put it next to this kind of aggressive viral promoter. Now, if such an aggressive viral promoter gets into an alien cell, and if this promoter should work in that mammalian

cell, and if this cell is involved in controlling cell division, then it could make this cell multiply out of control — and that's cancer by another name.

ACRES U.S.A. It goes into wild proliferation?

HO. Exactly, and this is not merely a theoretical possibility — you've heard of gene therapy? Gene therapy is the genetic modification of human cells, and it uses techniques and constructs very similar to those used in the genetic modification of plants and animals. In gene therapy there are two major side effects that people worry about. One of them is cancer, because if it gets into the wrong place, it turns on the wrong genes, and you get cancer. The other concern is the regeneration of live viruses, because in order to make this foreign DNA go into the genome, very often they use what is called a "gene carrier" or a "vector," which is itself a virus, a disarmed virus. Disarmed or not, a virus can still pick up genes from our genome or from the cell's genome and turn back into a fully armed virus by recombination. Those are the two major

have been found harmful to a range of nontarget insects. Some of them are also potent immunogens and allergens. A team of scientists has cautioned against releasing Bt crops for human use.

Food crops are increasingly used to produce pharmaceuticals and drugs, including cytokines known to suppress the immune system and induce sickness and central nervous system toxicity; interleukin alpha, reported to cause dementia, neurotoxicity and mood and cognitive side effects; vaccines; and viral sequences such as the "spike" protein gene of the pig corona virus, in the same family as the SARS virus linked to the recent epidemic. The glycoprotein gene *gpl20* of the AIDS virus HIV-1, incorporated into GM maize as a "cheap, edible, oral vaccine," serves as yet another biological time-bomb, as it can interfere with the immune system and recombine with viruses and bacteria to generate new and unpredictable pathogens.

7. Terminator crops spread male sterility.

Crops engineered with "suicide" genes for male sterility have been promoted as a means of "containing," (*i.e.*, preventing the spread of transgenes). In reality, the hybrid crops sold to farmers spread both male sterile suicide genes as well as herbicide-tolerance genes via pollen.

8. Broad-spectrum herbicides are highly toxic to humans and other species.

Glufosinate ammonium and glyphosate are used with the herbicide-tolerant transgenic crops that currently account for 75 percent of all transgenic crops worldwide. Both are

systemic metabolic poisons expected to have a wide range of harmful effects, which have been confirmed.

Glufosinate ammonium is linked to neurological, respiratory, gastrointestinal and hematological toxicities, and birth defects in humans and mammals. It is toxic to butterflies and a number of beneficial insects, also to the larvae of clams and oysters, *Daphnia* and some freshwater fish, especially the rainbow trout. It inhibits beneficial soil bacteria and fungi, especially those that fix nitrogen.

Glyphosate is the most frequent cause of complaints and poisoning in the United Kingdom. Disturbances of many body functions have been reported after exposures at normal-use levels. Glyphosate exposure nearly doubled the risk of late spontaneous abortion, and children born to users of glyphosate had elevated neurobehavioral defects. Glyphosate caused retarded development of the fetal skeleton in laboratory rats. Glyphosate inhibits the synthesis of steroids, and is genotoxic in mammals, fish and frogs. Field-dose exposure of earthworms caused at least 50 percent mortality and significant intestinal damage among surviving worms. Roundup caused cell-division dysfunction that may be linked to human cancers.

The known effects of both glufosinate and glyphosate are sufficiently serious for all further uses of the herbicides to be halted.

9. Genetic engineering creates superviruses.

By far the most insidious dangers of genetic engineering are inherent to the process itself, which greatly enhances the scope and probability of horizontal gene transfer and recombination, the main



acknowledged dangers, or side effects, of gene therapy. Several years ago a group of scientists in France devised a method where they would genetically modify bone marrow cells outside the patient. They took the patient's own cells, genetically modified them, and then selected the "good" transformed cells — the cells that have taken up the foreign genes — and then put them into the patient. It was hailed as a great success that avoids the complications I've just described. Unfortunately, about a year and a half later, two of the nine successes developed leukemia. So this is the other problem that we have to worry about.

ACRES U.S.A. What about research on the effects of these foods?

HO. There have been so few experiments really addressing food safety, transgenic/GM food safety. Proponents will say, "The Americans have been eating it for maybe a decade now, since 1994, and there is no evidence at all that anybody has died from eating GM food." But of

course, nobody has really been looking, and as you have no labeling, you don't even know if you have eaten GM food directly. In any case, most of the GM goes into feeding your animals, so at least you're probably once-removed from direct GM food. However, the Centers for Disease Control's own study, published in 1999, found that incidences of food-borne illness have risen from twofold to tenfold as compared to a 1994 study. That was when the first GM food (a transgenic tomato — "Flavor Saver" tomato) was grown and became available. Of course, that's not evidence that these illnesses were caused by GM food — critics could question whether the earlier study was done using a different methodology — but at least this is something worth investigating. Plus, in Britain, we do have scientists such as Árpád Pusztai, he was a senior food scientist in Scotland, and he and his colleagues were supported by the government to do food safety research. They fed GM potato to some young rats, and much to their surprise — because he was actually a supporter of GM foods, or

at least he wasn't hostile — they found that this GM potato affected every organ system of these young rats. They recently released some photographs of the stomach lining and intestinal lining, and it was most dramatic because it increased the thickness of the lining up to two times.

ACRES U.S.A. What's the significance of that?

HO. We don't fully know what the significance is, but in the colon, for example, colon cancer is preceded by a state in which the lining increases in thickness — it's kind of an overgrowth. There are other experiments that have found similar effects, and there are a string of incidences that have not been investigated. For example, recently there have been reports of illnesses in some villages, up to 100 villages, in south of the Philippines that are next to fields of GM maize. In the United States, your fields are very big, and people don't usually live nearby, but in the Third World, the fields are very small, and people live right next to them.

route to creating viruses and bacteria that cause disease epidemics. This was highlighted in 2001 by the "accidental" creation of a killer mouse virus in the course of an apparently innocent genetic engineering experiment.

Newer techniques, such as DNA shuffling, are allowing geneticists to create, in a matter of minutes in the laboratory, millions of recombinant viruses that have never existed in billions of years of evolution.

Disease-causing viruses and bacteria and their genetic material are the predominant materials and tools for genetic engineering, as much as for the intentional creation of bioweapons.

10. Transgenic DNA in food is taken up by bacteria in the human gut.

There is already experimental evidence that transgenic DNA from plants has been taken up by bacteria in the soil and in the gut of human volunteers. Antibiotic-resistant marker genes can spread from transgenic food to pathogenic bacteria, making infections very difficult to treat.

11. Transgenic DNA could trigger cancer.

Transgenic DNA is known to survive digestion in the gut and to jump into the genome of mammalian cells, raising the possibility for triggering cancer.

The possibility cannot be excluded that feeding GM products such as maize to animals also carries risks, not just for the animals but also for human beings consuming the animal products.

12. CaMV 35S promoter increases horizontal gene transfer.

Evidence suggests that transgenic constructs with the CaMV 35S promoter might be especially unstable and prone

to horizontal gene transfer and recombination, with all the attendant hazards: gene mutations due to random insertion, cancer, reactivation of dormant viruses, and generation of new viruses. This promoter is present in most GM crops being grown commercially today.

13. A history of misrepresentation and suppression of scientific evidence.

There has been a history of misrepresentation and suppression of scientific evidence, especially on horizontal gene transfer. Key experiments failed to be performed, or were performed badly and then misrepresented. Many experiments were not followed up, including investigations on whether the CaMV 35S promoter is responsible for the "growth-factor-like" effects observed in young rats fed GM potatoes.

In conclusion, GM crops have failed to deliver the promised benefits and are posing escalating problems on the farm. Transgenic contamination is now widely acknowledged to be unavoidable, and hence there can be no coexistence of GM and non-GM agriculture. Most important of all, GM crops have not been proven safe. On the contrary, sufficient evidence has emerged to raise serious safety concerns that, if ignored, could result in irreversible damage to health and the environment. GM crops should be firmly rejected now.

From the "Executive Summary" in GMO Free: Exposing the Hazards of Biotechnology to Ensure the Integrity of Our Food Supply, by Mae-Wan Ho, Ph.D., and Lim LiChing, published by Vital Health Publishing (see contact information above).

So in the Philippines, a Norwegian scientist who's actually a virologist was asked to go and investigate these illnesses. He took samples of blood from 39 of the villagers and found antibodies to the foreign gene expressed in the GM maize grown nearby — and this apparently happened again this growing season. There's another case in Essel, Germany, in which 12 dairy cows died between 2001 and 2002 after eating transgenic maize — another transgenic maize, not the type that was growing in the Philippines. That case hasn't been investigated to this day, but this maize has since been withdrawn by Syngenta — it's Bt176.

ACRES U.S.A. We hear many reports from farmers here who have experienced problems with livestock on GM feeds.

HO. Yes, in the United States there has been a lot of anecdotal evidence that came from farmers and others who noticed that animals tend to avoid GM crops if they have the choice. And experiments on livestock and other laboratory animals showed that if they were forced to eat GM, if they had no choice, then they failed to thrive or they died. Just recently, Monsanto has apparently been asked to release results that they have designated confidential business information showing that the some rats that were fed GM food and yet another strain of GM maize developed abnormalities of the kidneys in the males, signs of anemia in the females, and so on. The results simply were not released to the public.

ACRES U.S.A. The question we have here is whether this technology is safe, but we don't have answers because the question hasn't really been asked. We've got hundreds of products on the shelves at our grocery stores that are transgenic, and people are not allowed to find out about it, nor do we have information on the results or the consequences.

HO. That's right, and you also have lots of secret field trials. People don't even know there is this next generation of GM crops in which they're growing really dangerous pharmaceuticals. They are kept in secret, and you know this really can't continue — I think some of your NGOs have been putting pressure on the FDA to tighten the controls on these things, these crops.

ACRES U.S.A. But the pressure is pretty much eclipsed by the amount of money that the Monsanto-types throw into the political arena.

HO. But the interesting thing is that these companies have really withdrawn in a big way from Europe because they know there is no money here. So, for example, in the United Kingdom we started with 159 field trials in year 2001, and today we are down to one field trial.

ACRES U.S.A. For what product?

HO. It's a GM sweet pea being grown on the grounds of the John Innes Centre, which is a research institute. Nevertheless, even though the European Food Safety Authority and the European Commission have approved various products, both Syngenta and Bayer CropScience have withdrawn from commercializing an approved GM crop.

ACRES U.S.A. This is in spite of the fact that the *Codex Alimentarius* has approved these things?

HO. No, it's not the *Codex Alimentarius*, it's the European Commission. I have to say that the European Commission in the case of the Bt11 — which is the most recent one — has gone over the debate among the scientific experts. The experts couldn't agree that it was safe, so the European Commission came in and said, "Well, we will approve it anyway." This is Syngenta's Bt11, but after they'd done it, Syngenta announced that they weren't going to commercialize because there was too much consumer resistance and there's no market.

ACRES U.S.A. How do you account for consumer resistance being so strong in Europe and so lax in the United States?

HO. Well, I think we have a very good situation in Europe in which scientists work together with civil society. The scientists are very good at providing information to support the grassroots action, and we also have governments working together. It really is a very cooperative process, just getting information out to the public at one end and challenging the regulators at the top at the other. All this has to go on in a very coordinated way, and I think somehow without planning we manage that. So, even though our government is quite pro-GM, we haven't got any yet in Britain, which is a good thing.

ACRES U.S.A. But the government has been quite pro-GM.

HO. Yes, Tony Blair. So this is really a chance for democracy as well as for science. The scientific information is the

baseline — you've got to have the politics, the economics, everything — but the baseline is: have you got your scientific evidence right? And if you can't get it right, you have no basis as a scientist for making a rational decision. To make rational decisions you want to know if this technology is reliable, you want to know if it actually lives up to its promise — are there problems, is it safe? — before you even ask questions about whether it is ethical, economical, and so on.

ACRES U.S.A. On the basis of what we know so far, where is this anti-GM thing going?

HO. We have two dozen scientists across the disciplines, we launched ourselves as an independent science panel last May, and we produced a report called *The Case for a GM-Free, Sustainable World*, in which we propose that there should be a global ban or withdrawal of all GM crops. We're not against research — the technology should go back into the laboratory for some proper research, but under carefully contained conditions. Meanwhile, there should be a global, comprehensive shift to all kinds of non-GM sustainable agriculture, because in our report, we not only collected all the evidence of the problems and hazards of GM crops, but we also gathered data on the proven successes of all forms of sustainable agriculture.

ACRES U.S.A. Is that report available?

HO. Yes. It is being published by Vital Health in the United States. As scientists again, we would say take into account all kinds of scientific evidence, and if you really look at all the evidence carefully you know that GM hasn't lived up to its promise. All the benefits are still "potential." In fact, a lot of small family farmers who have taken up GM are now completely devastated, especially in Argentina, which is the second largest producer in the world after the United States. You know there is now a very, very strong global uprising against the introduction of GM crops that was brought to a head a couple of years ago, when Zambia refused to accept GM maize as food aid from the United States and opted instead to purchase surplus food from other parts of their country, and now it is doing so well that it is exporting food surpluses to Angola. That has inspired a lot

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of Third World countries. So the message, basically, is that there is no future in GM crops. Now they are trying to use GM crops to grow pharmaceuticals, and that's even more dangerous, because some of these pharmaceuticals are immune-suppressive, and some of them are very serious allergens that can kill people. The message to the producers is just to put a stop to this — this is madness!

ACRES U.S.A. People like former President Carter and I think even Norman Borlaug and some of these other people have argued that what we're doing with genetically modified crops is no different than what the farmers have been doing all along in selecting and breeding and things like that. How would you respond to that?

HO. It's completely untrue because, as I said before, what you're doing is joining together bits of DNA, and there is no barrier whatsoever on what you can join. You're short-circuiting nature altogether, you cross all species barriers, you make artificial constructs that never existed in billions of years of evolution, and you use special methods to introduce these constructs into the genomes of organisms.

ACRES U.S.A. Then that is a bogus argument?

HO. Yes. In fact, GM technology bypasses natural reproduction altogether. You don't even need reproduction, you see. So to say that this is no different from natural breeding methods is really bending science. It's either being ignorant or just bending science altogether, and that just won't do.

ACRES U.S.A. Substituting self-interest for science.

HO. It is particularly disappointing for people who are scientists themselves that: a) they haven't actually bothered to inform themselves better, and b) that they are accepting bogus arguments of that kind. You know, science is no different from any other form of knowledge. You have to ask, "Is this good science, or bad science? Are you just fooling me?" Scientific evidence is just like any other form of evidence — you have to use your common sense. If you approach it skeptically, in many cases you find out that these people are just having you on.

ACRES U.S.A. Well, we've heard the Japanese say that they weren't in favor of genetically modified foods, and they were going to watch what happened to the American children for about a generation or two before they made up their mind. Would you comment on that?

HO. That's terrible, isn't it? Unfortunately, I understand what they mean, but I think that it would be more ethical to say that if GM food is not good for Japanese, then it's not good for American children. It's not good enough for Zambia, it's not good enough for Australia — Australia has now more or less put an indefinite hold on growing GM crops. It's not good enough for the British because the British have succeeded in putting it off, then it's not good enough for people in the United States, and it's urgent for us to stop all of this globally.

The Case for a GM-Free, Sustainable World, is available as a free PDF download at the Independent Science Panel website, <www.indsp.org>, or in book form from Vital Health Publishing, Inc., P.O. Box 152, Ridgefield, Connecticut 06877, e-mail <info@vitalhealthbooks.com>, website <www.vitalhealthbooks.com/index.html>.

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