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Ban GMOs *Now*

Dr. Mae-Wan Ho *warns that further indulgence in GMOs will severely damage our chances of surviving the food crisis and global warming; organic agriculture and localised food systems are the way forward*

Invited lecture at conference on TRADITIONAL SEEDS OUR NATIONAL TREASURE AND HERITAGE -Traditional and Organic Agriculture instead of GMO, 17 May 2008, Bewelder, Warsaw, Poland

The Brave New World of GM Science

In 1994, I met some of the most remarkable leaders in the Third World: Tewolde Berhan Gebre Egziabher (Institute of Sustainable Development, Addis Ababa, Ethiopia), Martin Khor (Third World Network, Penang, Malaysia), and Vandana Shiva (Navdanya, New Delhi, India), who persuaded me to look into genetically modified organisms (GMOs), especially GM crops, which they rightly saw as a special threat to small family farmers. The biotech industry was promising miracle GM crops that would boost yield to feed the world, improve nutrition, and clean up and protect the environment. Monsanto's Flavr Savr tomato, the first GM crop, had just been commercialised, though it turned out to be a complete flop, and was withdrawn several years later..

The biotech industry's aggressive campaign of disinformation and manipulation of science did nothing to obscure the signs that the dream would soon turn into nightmare; and I said so in my book first published in 1997/1998 [1] Genetic Engineering Dream or Nightmare*, the Brave New World of Bad Science and Big Business*, which became an international bestseller, translated into many languages, and recently reprinted with an extended introduction to coincide with its translation into Indonesian. Everything predicted in that book has happened. It also explained why the science behind GM is obsolete; a story elaborated further in Living with the Fluid Genome [2] published in 2003.

Genetic modification based on an obsolete theory and hence ineffective and dangerous

Genetic engineering of plants and animals began in the mid 1970s in the belief that the genome (the totality of all the genetic material of a species) is constant and static, and that the characteristics of organism are simply hardwired in their genome. But geneticists soon discovered that the genome is remarkably dynamic and 'fluid', and constantly in conversation with the environment. This determines which genes are turned on, when, where, by how much and for how long. Moreover, the genetic material itself could also be marked or changed according to experience, and the influence passed on to the next generation.

The best thing about the human genome project is to finally explode the myth of genetic determinism, revealing the layers of molecular complexity that transmit, interpret *and* rewrite the genetic texts [3] (Life Beyond the Central Dogma series, *SiS* 24). These processes are precisely orchestrated and finely tuned by the organism as a whole, in a highly coordinated molecular 'dance of life' that's necessary for survival.

In contrast, genetic engineering in the laboratory is crude, imprecise and invasive. The rogue genes inserted into a genome to make a GMO could land anywhere; typically in a rearranged or defective form, scrambling and mutating the host genome, and have the tendency to move or rearrange further once inserted, basically because they do not know the dance of life. That's ultimately why genetic modification doesn't work and is also dangerous.

Independent science against GM

In 1999, I co-founded the Institute of Science in Society (ISIS) with my husband and long-time collaborator Peter Saunders, Professor of Mathematics at King's College, London, to work for science, society and sustainability and to reclaim science for the public good. We are fortunate to have the support of wonderful fellow scientists, especially Prof. Joe Cummins, who joined ISIS from the start and continues to play the leading role in monitoring GM science. (Joe Cummins has been honoured with the ISIS Distinguished Fellow Award 2008.)

In 2003, dozens of scientists from around the world joined us in ISIS to form the Independent Science Panel, and produced a report, The Case for A GM-Free Sustainable World [4], documenting all the problems and hazards of GM crops as well as the successes and benefits of non-GM sustainable agriculture. The report was republished within a year, translated into many languages and widely

circulated. We presented the report to the European Parliament in 2004 [5] (Keep GM Out of Europe, *SiS* 24), with the help of Jill Evans MEP.

In 2007, we updated the ISP report with a dossier containing more than 160 fully referenced articles from the archives of ISIS' magazine *Science in Society*, spelling out the scandals of serious hazards ignored, scientific fraud, the regulatory sham and violation of farmers' rights [6] (GM Science Exposed: Hazards Ignored, Fraud, Regulatory Sham, Violation of Farmers Rights). Duped farmers in India are driven to suicide in hundreds of thousands. GM science is a crime against humanity.

In a scientific review paper [7] (GM Food Nightmare Unfolding in the Regulatory Sham), we documented how national and international regulators and advisory bodies such as the European Food Safety Authority have been ignoring the precautionary principle (which is accepted by the European Commission), abusing science, sidestepping the law, and helping to promote GM technology in the face of evidence piling up against the safety of GM food and feed.

We presented our dossier and review paper to the European Parliament in June 2007, once again to press for a GM-Free Europe and a GM-free world, thanks to the sponsorship of Polish MEP Mr. Janusz Wojciechowski and his office. Our panel consisted of key scientists from six countries including Poland, and friends of independent scientists, including MEPs Dr. Caroline Lucas and Jill Evans.

The case for a GM-free world has grown much stronger since 2004, not only because so much more evidence has stacked up against GM crops; but especially because accelerating global warming, the depletion of water and fossil fuels, and the current food crisis make it that much more urgent to shift comprehensively to sustainable food *and energy* systems as proposed in ISIS/TWN's energy report Which Energy? [8]. There is neither the time nor resources to waste on GM.

We'd had 30 years of GMOs and more than enough damage done, as detailed in the ISP Report [4], in our GM Science dossier [6], and more recent evidence has been piling up.

Thirty years of GMOs are more than enough

• ***No increase in yields***; on the contrary GM soya decreased yields by up to 20 percent compared with non-GM soya [4], and up to 100

percent failures of Bt cotton have been recorded in India [6]. New studies confirmed these findings. Research from the University of Kansas found a 10 percent yield drag for Roundup Ready soya [9] that required extra manganese applied to the soil to make up the yield deficit. A team of scientists from the USDA and the University of Georgia found growing GM cotton in the US could result in a drop in income by up to 40 percent [10, 11] (Transgenic Cotton Offers No Advantage, *SiS* 38)

• ***No reduction in pesticides use***; on the contrary, USDA data showed that GM crops increase pesticide use by 50 million pounds from 1996 to 2003 in the United States [4]. New data paint an even grimmer picture: the use of glyphosate on major crops went up more than 15-fold between 1994 and 2005, along with increases in other herbicides [12] in order to cope with rising glyphosate resistant superweeds [6]. Roundup tolerant canola volunteers are top among the worries of Canadian farmers [13, 14] (Study Based on Farmers' Experience Exposes Risks of GM Crops, *SiS* 38)

• ***Roundup herbicide is lethal to frogs and toxic to human placental and embryonic cells*** [6]. Roundup is used in more than 80 percent of all GM crops planted in the world

• ***GM crops harm wildlife***, as revealed by UK's farm scale evaluations [6], and more recently in a study led by Loyola University, Chicago, Illinois in the United Stated, which found that wastes from Bt corn impaired the growth of a common aquatic insect [15, 16] (Bt Crops Threaten Aquatic Ecosystems, *SiS* 36)

• ***Bt resistance pests and Roundup tolerant superweeds render the two major GM crop traits practically useless*** [6]. A recent review concluded that [17] "evolved glyphosate-resistant weeds are a major risk for the continued success of glyphosate and transgenic glyphosate-resistant crops." And the evolution of Bt resistant bollworms worldwide have now been confirmed and documented in more than a dozen fields in Mississippi and Arkansas between 2003 and 2006 [18]

• ***Vast areas of forests, pampas and cerrados lost to GM soya in Latin America***, 15 m hectares in Argentina alone [6]; and this has worsened considerably with the demand for biofuels (see later)

• ***Epidemic of suicides in the cotton belt of India*** involving 100 000 farmers between 1993-2003, and a further 16 000 farmers a year have died since Bt cotton was introduced [6]

• ***Transgene contamination unavoidable***, scientists find GM pollination of non-GM crops and wild relatives 21 kilometres away [19]

• ***GM food and feed linked to deaths and sicknesses*** both in the fields in India and in lab tests around the world (more below)

GM food and feed *inherently* hazardous to health [7]

Here are some highlights from our GM Science dossier [6] on the hazards of GM food and feed. Dr. Irina Ermakova of the Russian Academy of Sciences showed how GM soya made female rats give birth to severely stunted and abnormal litters, with more than half dying in three weeks, and those remaining are sterile. Hundreds of villagers and cotton handlers in India suffer allergy-like symptoms, thousands of sheep died after grazing on the Bt cotton residues, goat and cows as well were reported in 2007 and 2008 [20] (Mass Protests against GM Crops in India , *SiS* 38). A harmless bean protein transferred to pea when tested on mice cause severe inflammation in the lungs and provoked generalised food sensitivities. Dozens of villagers in the south of the Philippines fell ill when neighbouring GM maize fields came into flower in 2003, five have died and some remain ill to this day. A dozen cows died having eaten GM maize in Hesse Germany and more in the herd had to be slaughtered from mysterious illnesses. Arpad Pusztai and his colleagues in the UK found GM potatoes with snowdrop lectin damaged every organ system of young rats; the stomach lining grew twice as thick as controls. Chickens fed GM maize Chardon LL were twice as likely to die as controls. And finally, GM maize Mon 863 was claimed to be as safe as non-GM maize by the company, and accepted as such by European Food Safety Authority. But independent scientists of CriiGen in France re-analysed the data and found signs of liver and kidney toxicity.

Different animals and human beings exposed to a variety of transgenic crops with different traits either fall ill or die. The evidence compels us to consider the possibility that the hazards of GMOs may be inherent to the technology, as I suggested more than ten years ago [1].

Litter from female rat fed GM soya (bottom) compared with control

(from Dr. Erina Ermakova)

Table 1. Summary of Exposure of Animals and Human Beings to GMOs

Species	GM species	Transgene trait	Effect
Rat	Soya	Roundup Ready	Stunting, death, sterility
Humans	Cotton	Cry1Ac/Cry1Ab	Allergy symptoms
Sheep	"	"	Death, liver toxicity

Cows	"	"	"
Goats	"	"	"
Mice	Pea	Alpha-amylase Inhibitor	Lung Inflammation, General food sensitivity
Mice	Soya	Roundup Ready	Liver, pancreas and testis affected
Humans	Maize	Cry1Ab	Illnesses and death
Rats	Maize	Cry3Bb	Liver and kidney toxicity
Cows	Maize	Cry1Ab/Cry1Ac	Death and illnesses
Rats	Potato	Snowdrop lectin	Damage in every organ system. Stomach lining twice as thick as controls
Mice	Potato	Cry1A	Gut lining thickened
Rats	Tomato	Delay ripening	Holes in the stomach
Chickens	Maize	Glufosinate tolerance	Deaths

US courts rule GM crop field-tests and releases illegal

The message that GM crops are unsafe appears to have got through to the judiciary system in the United States. There have been three court rulings against the US Department of Agriculture (USDA) for failing to carry out proper environmental impact assessment, making the original releases illegal [21] (Approval of GM Crops Illegal, US Federal Courts Rule, *SiS* 34). These are the first rulings against GMOs in the top producing country in the world, which has been also promoting GMOs aggressively.

The first case was on drug-producing GM crops in Hawaii. The court said that the USDA violated the Endangered Species Act as well as the National Environmental Policy Act.

The second court case not only ruled GM herbicide-tolerant creeping

bentgrass illegal, but also that the USDA must halt approval of all new field trials until more rigorous environmental reviews are conducted.

The third decision was passed on Monsanto's Roundup Ready alfalfa for having been commercial released illegally without an Environment Impact Statement.

An avalanche of bans and rulings strikes GM crops worldwide

There have been numerous bans and restrictions imposed on GM crops in recent years, which say a lot about the inadequacies of regulatory regimes worldwide (see Box 1).

Box 1

Rulings and bans on GMOs between May 2007 and May 2008

- **US** GM alfalfa ban made permanent [22]

- **US** Federal Court of Appeals ruled against GM bentgrass again [23]

- **Four counties in California** have bans or moratorium on GM crops and the first state bill to protect Californian farmers against lawsuits that intimate and harass them when their field are contaminated passed through the Agriculture committee in January 2008 [24]

- **Montville USA** became the first town outside California to ban GM crops [25]

- **South Australia** extended its GM ban [26]

- **Romania** joined EU members in banning GM crop Mon 810 [27], the others are France, Hungary, Italy, Austria, Greece, and Poland

- **13 out of 20 counties in Croatia** have declared themselves GM-Free [28]

- **Greece** renewed its ban on GM maize seeds [29]

- **Germany** imposed much stricter regulations on GM maize [30]

• **Scotland** backs GM ban in Europe [31]

• **France** banned GM maize Mon 810 in February 2008 and passed GMO law in April to guard against contamination by GMO, making it compulsory for farmers to "respect agricultural structures, local ecosystems and non-GMO commercial and production industries" [32, 33]

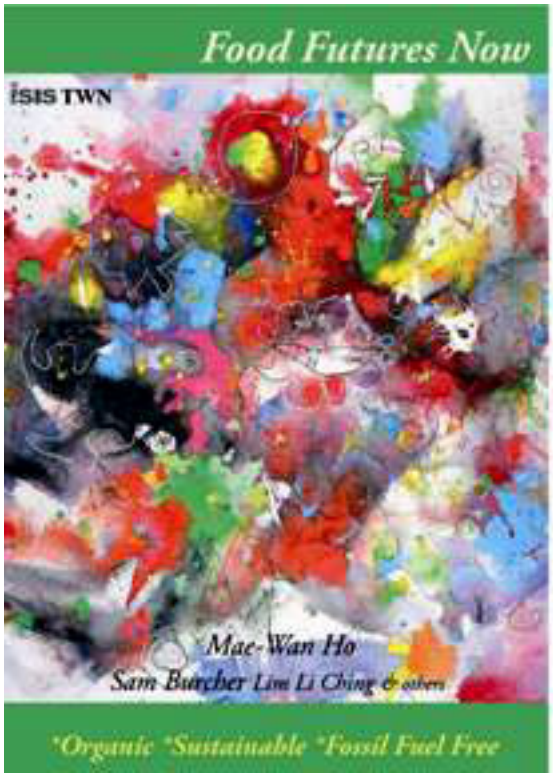
• **Wales** is set to ban GM crops [34]

• **More than 230 regions, over 4 000 municipalities and other local entities** and tens of thousands of farmers and food producers in Europe have declared themselves GMO-free so far [35]

EU Commissioner for the Environment Stavros Dimas has expressed serious reservations concerning GMOs [36] (GM-Free Europe Beginning?, *SiS* 36), which is unprecedented in the history of the European Commission. On 7 May 2008, the European Commission delayed a decision on allowing farmers to grow more GM crops, and asked European Food Safety Authority to reconsider its previous review, which it had admitted was inadequate, as it was unable to take indirect and long term impacts into account [37].

No case for GM crops, small scale organic farming is the way ahead

Meanwhile, on 15 April 2008, 400 scientists of the International Assessment of Agricultural Science and Technology for Development (IAASTD) released its 2 500-page report [38] that took 4 years to complete. It is a thorough examination of global agriculture on a scale comparable to the Intergovernment Panel on Climate Change. Its conclusions are remarkably similar to our own report Food Futures Now *Organic *Sustainable *Fossil Fuel Free [39] launched in UK Parliament a week later.



Only Organic Agriculture Can Feed the World

Organic agriculture and localised food and energy systems can potentially compensate for all ghg emissions due to human activities

&

Free us from fossil fuels

The IAASTD calls for a fundamental change in farming practice to counteract soaring food prices, hunger, poverty and environmental disasters, it says GM crops are controversial with respect to safety for health and the environment, and will not play a substantial role in addressing climate change, loss of biodiversity, hunger and poverty. Small scale farmers and agro-ecological methods are the way forward, and indigenous and local knowledge are as important as formal scientific knowledge. It warns that growing crops for biofuels could worsen food shortages and price rises [40] ("GM-Free Organic Agriculture to Feed the World", *SiS* 38)

The Director is Prof. Robert Watson, Chief Scientist at the World Bank and also UK's Department for the Environment, Food and Rural Affairs. He says, "Are transgenics the simple answer to hunger and poverty? I would argue no." And "Small organic farms are the way ahead" (BBC Radio 4 Today Programme, 19 April 2008).

Our *Food Futures Now* report goes a step further. We argue that *only* organic agriculture can truly feed the world. More than that, organic agriculture and localised food and energy systems can potentially compensate for all ghg emissions due to human activities and free us from fossil fuels, and we need to implement this urgently.

The UN has declared 2008 the year of the Global Food Crisis, and it has been the top news story everyday for months now as the crisis deepens. Food prices increased by an average of 40 percent last year; a string of food riots and protests spread around the world

including the UK, and more than 25 000 farmers killed themselves in India.

Most commentators agree that the immediate cause of the food crisis is the divestment of food grains into producing biofuels. *BusinessWeek* identified Monsanto as a "prime beneficiary". Its stock correlated closely with the price of oil (better than ExxonMobile), and hardly correlated with the price of corn, basically because no one will eat its GM corn. Nevertheless the pro-GM lobby are out in force, using the food crisis to promote GM crops.

I can only repeat what I said earlier. GM crops are one big failed experiment based on an obsolete scientific theory, and this failure has been evident since 2004 [41] (Puncturing the GM Myths, *SiS* 22). Apart from yielding less and requiring more pesticides, anecdotal evidence since 2005 from farmers around the world indicates that GM crops also require more water [42]. Industrial Green Revolution agriculture is now generally acknowledged to be a major driver of climate change as well as being vulnerable to climate change because of its heavy dependence on fossil energies and water, and its susceptibility to pests, diseases and climate extremes [38, 39, 43]. GM crops have all the worst features of industrial Green Revolution varieties exaggerated, including susceptibility to diseases and climate extremes on account of genetic uniformity [44]] (Beware the New "Doubly Green Revolution", *SiS* 37); and not least, there are outstanding safety concerns (as described above). Growing GM crops for biofuels does not make them safe, as they will contaminate our food crops all the same.

Any further indulgence in GMOs will surely damage our chances of surviving global warming. We must get on with the urgent business of building organic, sustainable food and energy systems right now.

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The Institute of Science in Society, PO Box 51885, London NW2 9DH
telephone: **[44 20 8452 2729] [44 20 7272 5636]**

General Enquiries sam@i-sis.org.uk - Website/Mailing List press-release@i-sis.org.uk - ISIS Director m.w.ho@i-sis.org.uk