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- The Organic Revolution in Science and Implications for Science and Spirituality
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- i-sis news #5

From BSE to GMOs - What Have We Learned?

Institute of Science in Society
In working with the Millennium Debate

Most of the world's 70 million acres of genetically modified crops are being fed to animals or processed into animal feed products. Furthermore, the biotech industry depends upon this market for its future viability. In the UK, the BSE crises has already taught us the lesson of how a change in the composition of animal feed can have a devastating effect on both animal and human health.

In this booklet, Dr Harash Narang, a clinical virologist and BSE expert, adds his voice to the public debate on GMOs. He is especially concerned about the use of specific genes in transgenic crops, namely antibiotic resistance marker genes, insecticide and herbicide-tolerance genes.

The aim of this booklet is to inform the public about some of the major failings in the government's handling of the BSE crises, and to demonstrate that a similar scenario is now being repeated with GMOs. Dr Narang combines his experience with BSE, with his concerns over food GM foods, to convey an important message to all members of the public.

Dr Harash Narang and BSE

By Angela Ryan

At the height of the BSE crises, Dr Harash Narang held a crucial position as a government scientist at the Public Health Service Laboratories (PHSL). In 1989, with over 25 years of research on spongiform disease behind him, he and his colleague, Dr Robert Perry, a neuropathologist, provided hard evidence linking mad cow disease (BSE) with Creutzfeldt-Jakob Disease (CJD) in humans.

Dr Narang went on to devise a brain test for use in abattoirs, and then a live urine test for sub-clinical spongiform ecephalopathy -- to diagnose BSE in cattle and CJD in humans. This meant that infected cattle could be detected and prevented from entering the food chain.

The authorities in Ireland adopted the approach of slaughtering the whole herd in which any clinical case of BSE was detected. Breeding from affected animals was also stopped so that the infectious agent did not pass from one generation to the next. These practices succeeded in keeping the total number of BSE cases in Ireland to below 100.

Advice to adopt the same approach was also available in Britain to the relevant authority, the Ministry of Agriculture Fisheries and Food (MAFF), but it was ignored, and breeding from affected animals continued in Britain. Out of the170, 000 animals confirmed with BSE in Britain, 40, 000 of them were born after the feed ban was introduced in 1988.

The then Ministers of Agriculture, John Gummer and John MacGregor, chose not to develop and use the diagnostic test, perhaps because it would have revealed how widespread the disease had become. An effective diagnostic test would have contained the disease and thereby prevented further infections. Dr Narang continued to push for its implementation and to gather further evidence on new variant CJD. He was the first scientist to use the urine test to identify CJD cases in young persons, which had been missed by the neurologists.

Meanwhile, other scientists were persuaded to add their voices to the BSE/CJD link such as neuropathologist Helen Grant, Professor Richard Lacy, Stephen Dealler and Marja Hovi, but all to no avail. The Government continued to insist there was no link between BSE and CJD.

Dr Narang was portrayed as a ‘loose cannon’ and eventually suspended from his post of clinical virologist at PHSL in 1992, under dubious circumstances. He was made redundant in 1994. Dr Narang was then able to make his findings public and the story appeared in The Mail on Sunday in December 1995. This forced the British Government into a U-turn and it was at this point that they chose to recognise Dr Narang’s findings and to finally admit the direct link between BSE and CJD.

The BSE crisis continues to this day and is in itself a reflection of the uneasy relationships between science and government and between science and industry. BSE continues to pose a problem for the British meat industry abroad and will continue to do so until such time that

the infective agent is eradicated not only from cattle but also from other farm animals such as sheep and birds. However, the British government still fails to recognise the biological nature of the infectious agent responsible for BSE.

Dr Narang has published all his findings in peer reviewed scientific journals on the nature of the infectious agent of BSE. The infectious agent is a slow acting virus that consists of a single stranded (ss) DNA genome which is associated with the prion protein. Furthermore, the agent is transmitted maternally from cow to calf via the ssDNA. Without the implementation of a diagnostic test, maternal transmission has gone unchecked. This means that the infectious agent may still be widespread within British livestock while thousands of perfectly healthy cattle may have been destroyed unnecessarily. Dr Narang has also suggested the need to develop a vaccine against BSE and new variant CJD.

In 1997, the Medical Research Council (MRC) agreed to evaluate Dr Narang's diagnostic test (western blotting/ELISA equipment) and set up a special CJD urine test-committee to oversee his work. The National CJD Surveillance Unit at Edinburgh was asked to provide Dr Narang with 20 blind samples of urine, 10 samples from CJD cases and 10 from non-CJD cases, so as to evaluate the test.

However, the National CJD Surveillance Unit failed to provide the urine samples in the form requested. The test therefore has not been evaluated by the MRC and no CJD diagnostic test is in use to this day, making it impossible to monitor the actual number of CJD cases. Dr Narang has found it increasingly difficult, if not impossible, to get funding for scientific research in this country. He has been forced to pursue his endeavours abroad.

Dr Narang has published two important books on BSE/CJD: 'Death on the Menu", a first hand account of the level of devastation that CJD brought upon the lives of it's victims and their families. And 'The Link', which explains, in detail, the history, incidence, epidemiology and pathology of spongiform ecephalopathy diseases, from scrapie in sheep, to BSE in cows, to CJD in humans . . .

Dr Narang's experience is similar to that of other scientists who acted with integrity and social responsibility. Professor Arpad Pusztai, formerly senior scientist of the publicly funded Rowett Institute was also made redundant and vilified by the mainstream scientific community for making public scientific findings, which were unfavourable to the biotech industry. Thankfully, there is still a substantial community of independent scientists in the world for whom integrity and social responsibility are paramount.

Dr Narang and Professor Pusztai both belong to a group of more than 100 scientists from 23 different countries all over the world who have signed onto a the World Scientists' Statement launched in Cartegena, Columbia, during the UN Convention of Biological Diversity Conference on the International Biosafety Protocol Feb 1999, calling on all governments to:

- Impose an immediate moratorium on further environmental releases of transgenic crops, food and animal-feed products for at least five years.

- Ban patents on living organisms, cell lines and genes.

- Support a comprehensive, independent public enquiry into the future of agriculture and food security for all, taking account of the full range of scientific findings as well as socio-economic and ethical implications.

The British government has lost control over GM crops in animal feed. There is no appropriate regulation governing the safety of GM animal feed and no legal labelling regime. Mr Blair's policy of consumer choice is rendered meaningless due to the failure of excluding GM material from animal feed.

Europe has successfully resisted imports of US hormone treated beef and rBST milk products despite WTO, GATT and EU treaties and agreements. We can therefore call upon our government to resist the import of GM food and GM animal feed products destined for our food chain.

GMOs

Genetically Modified Food and Animal Feed

By Dr Harash Narang

- Marker Genes
- How may this affect humans?
- "Useful Genes"
- Insecticide and Herbicide Tolerance Genes
- Build up of toxic chemicals in the body
- What have we Learned?

Genetic modification has been presented to us as a key solution for solving food shortages and feeding the hungry. Biotechnology companies promote their products as safe, healthy and environmentally friendly. However, such companies compete vigorously with one another, racing to get their GM products onto the market in order to avoid being left behind. Furthermore, the European Union presently funds major research programmes into genetic engineering for it is considered a source of great economic growth. More and more university based research groups now depend on funding from industry that supports their own interests rather than science. This has compromised scientific research as well as the credibility of science and scientists; consequently society is put at risk with regard to health and safety.

Our food should be treated with the utmost respect. It should have a high nutritional value and be free from infection and damaging chemicals. Consumers need to know the basic principles of genetic modification in order to make informed choices regarding GM food. Food is what fuels our bodies and if it is good our bodies will work well but if it is bad, our bodies will suffer.

We are now dependent on a multi-million pound international food industry which has grown ever more powerful with the advent of modern day shopping culture. The GM food industry has its own scientific experts and all these experts speak with one voice and are constantly assuring us that GM food is safe to eat. They will certainly not spend any time, money or effort into research, which may prove otherwise. The fundamental safety issues are not being addressed, but are being swept under the carpet and avoided.

Governments add to this problem by protecting and defending the industry, which makes large donations to their election funds. Lord Sainsbury, Minister for Science, recently donated £2 million to the labour party, in an obvious conflict of interest. Sainsbury has strong connections with the biotechnology industry and is patentee of genetic material used in GM foods. Furthermore, the Sainsbury Laboratory, a forerunner in research into GM foods, receives substantial funding through government grants.

We are told that everything is under control and evidence is being gathered but when scientific findings run contra to biotechnology interests the scientists who present those findings are gagged e.g. the recent Pusztai affair. The political power that the industry commands should not be underestimated. In the absence of adequate labelling, we have been given no choice in the matter of GM food and are being used as guinea pigs in an uncontrolled experiment.

It should be a fundamental human right to know what we are being fed and the effects it will have on our health. We need to understand enough of GM food science so as to grasp the environmental dangers and health risks attached to the products we consume and feed to our livestock.

I am no stranger to GM science. I conducted gene modification experiments from my laboratory as part of an investigation into CJD and BSE. I am very conscious of health and safety, and nothing has ever been used for human or animal consumption or released into the environment from my laboratory. Nevertheless the Public Health Laboratory Service Board ordered me to stop all work on genetic engineering the BSE agent, fearing I might create a ‘super’ bug. I am, therefore, qualified to discuss genetic modification without being guilty of a mere sentimental aversion to the technology.

Traditionally, growers and scientists have used crossbreeding for thousands of years. But today we are introducing genes, which are capable of producing insecticides and herbicide-tolerant chemicals in our food. We are incorporating genes from animal sources into non-meat products.

Under pressure to promote their products, scientists from biotechnology companies claim GM food is safe. But we’ve heard these sorts of assurances before.

We have all already eaten GM food, and increasingly, industry and governments realise that consumer confidence is central to the successful promotion of GM products. That confidence demands credible answers to some simple questions.

- **Is GM Food Safe?**
- **What is being introduced in GM foods?**
- **Would only those who eat the food be affected by the genetic modification?**
- **How would GM crops affect the environment?**

Marker Genes

Genetic modification is a random process and highly imprecise. Fewer that 1 in ever 1000 or even 1 in every 100,000 cells is modified during the process itself. It is therefore necessary to identify those cells which have been modified. This entails a technique, which is crucial, but little commented on. To identify the modified cells, and for this reason only, an extra 'marker gene' is added. This is a passenger gene and it is carried along with the one for improvement, growth, pesticide resistance or whatever desired characteristic one is trying to introduce.

Almost all marker genes used in GM are antibiotic resistance genes and they work by producing a chemical that reacts with antibiotics to protect the GM cells from the harmful effects of the antibiotic. The marker gene will be active only in those cells, which have been genetically modified, and therefore the modified cells can be selected by growing these cells in the presence of the antibiotic. This is how GM cells are sorted from non-GM cells. Therefore all GM products contain a gene that produces the desired trait and something that overcomes the antibiotic, an *anti*-antibiotic.

The biotechnology companies claim that the quantities produced are too small to damage human health. But in laboratory conditions, these modified cells continue to grow when the antibiotic concentration is higher that that used to treat patients. Furthermore, they produce more that enough of the anti-antibiotic product to pass resistance on to neighbouring unmodified cells. Therefore GM food may contain 'anti-antibiotic' chemicals in abundance and these chemicals may also confer resistance on other strains of bacteria that would normally be killed by antibiotics. Furthermore, antibiotic resistance genes have the potential to spread in our environment via horizontal gene transfer to other bacteria. In this process, the genetic material, DNA, is directly transferred to unrelated species, which may result in new strains of antibiotic resistant bacteria.

It is known that DNA from GM material can persist in the environment and is not completely broken down by either processing, decomposition or digestion. Both GM plant materials used in silage and manure from animals fed with GM feed may contain fragments of DNA bearing antibiotic resistance genes. Antibiotic resistance genes may escape from both silage and manure to bacteria in the gut and in the environment. GM animal feed serves to greatly increase the potential for new strains of antibiotic resistant bacteria.

How may this affect humans?

A child who becomes host to such an antibiotic resistant bacteria would be at an increased risk of developing a disease, such as meningitis, and of passing on both infection and drug

resistance to other children, whether or not they had eaten GM food or not. The world already faces the threat of multi-drug resistant bacteria; surely an environment rich in *anti*-antibiotics is one to be avoided.

"Useful Genes"

So far "useful genes" have remained hypothetical, except for those prolonging the shelf life of tomatoes which do not benefit consumers at all. Ordinary potatoes consist mostly of starch. It is claimed that GM potatoes can be produced to contain 20% protein. To the consumer, these two types of potato would be indistinguishable, posing a problem for those who need to know the caloric value of their food. A bigger threat is for those who cannot tolerate high protein diets. But how active is this protein gene?

On a microscopic level, such a protein gene would have to be abnormally active during growth for the potato to have such a protein boost. Of the total weight, 20% is additional protein produced by the inserted gene. But remember, along side the protein gene may be the marker gene producing the *anti*-antibiotic product. How much anti-antibiotic product will be produced compared to the 20% additional protein? This question remains unanswered. Such investigations have not been carried out and we simple don't know.

Insecticide and Herbicide Tolerance Genes

Almost all GM crops now available have been modified to protect them from insects and or herbicides by inserting insecticide and herbicide-tolerance genes. Revealingly, less is known about the insecticide and herbicide-tolerance chemicals, as well as herbicide residues that we can expect to consume from these plants engineered. Such chemicals may not have noticeable effects on adults but for children, the effects may be more serious.

The major insecticides used are Bt toxins isolated from the soil bacterium *Bacillus thuringiensis* . Suspensions of the bacterium have been used by organic farmer as an occasional spray to control pests. The GM plants, however will be producing this insecticide continuously in all parts of the plant, including pollen and nectar. Studies have shown that the monarch butterfly and lacewings are harmed by this toxin as well as bees. Bee honey will also be contaminated, harming the next generation of bees, which will feed on it in the hive. Humans who eat such honey will also be affected.

Furthermore, the Bt toxin is released from transgenic plants directly into the soil, where it cannot be broken down by sunlight, as is the case when organic farmers use bacterial suspension. It cannot be broken down by soil microbes and will therefore build up in the soil and will have harmful effects on soil insects. As the population of butterflies and bees drop sharply this will have a dramatic effect on the rate of pollination. The level of biodiversity will be reduced by the widespread use of such GM crops.

Build up of toxic chemicals in the body

Many chemicals taken in by the body cannot be excreted. Therefore, their concentration will increase over time. Such a build up of insecticide and herbicide residues in our bodies may be enough to produce cancerous effects. There is also evidence to suggest that such

chemicals are excreted in mother's milk, which will not be good for baby.

Herbicide residues in food are already a serious issue. Herbicide-tolerant GM crops are engineered to be tolerant to broad-spectrum herbicides which kill all other species of plants indiscriminately. Insects, birds and mammals, which depend on those plants, will also die out. These herbicides will have drastic effects on biodiversity.

GM companies engineer crops to be tolerant to their own herbicide. Studies on glufosinate, one such herbicide, shows that when ingested by pregnant females it causes birth defects and defeats in behaviour and learning in offspring. Furthermore, fathers exposed to glufosinate also gave birth to children with birth defects while exposure to most other pesticides did not cause such effects. Glyphosate, another broad-spectrum herbicide contained in a formulation commonly known as Roundup Ready, has been linked to non-Hodgkin's lymphoma. Claims by officials that the herbicides used with GM crops have no harmful side effects are false.

What have we Learned?

Fundamental safety assessments regarding GMOs have yet to be carried out, including comprehensive feeding and environmental impact assessments. The present generation of GM crops may indeed have adverse affects on the organisms that consume them. They contain antibiotic resistance marker genes and in addition, some are producing harmful insecticides in high doses in every single cell. Toxic herbicides are used with herbicide-tolerant GM crops and over time, these products will build up in our environment affecting both human and animal health. Any increase in antibiotic resistant bacteria or any additional harm to our already troubled biodiversity or any more build up of carcinogenic chemicals in our bodies, is to be avoided at all costs if we are to secure a sustainable future for coming generations.

In my view, the current generation of GM crops are unacceptable in terms of risks to health and biodiversity. A five year moratorium will give time for vital research to be conducted so as to overcome the above mentioned hazards of GM crops.

I have given you some fundamental principles of genetically modified food science. Based on this knowledge it is up to you to decide whether GM food is safe to eat and whether it is justifiable to continue with the field trials of these GM crops.

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