Suppression & Denial over Horizontal Gene Transfer

BBC drama, Fields of Gold, portraying the health risks of GM crops was subjected to astonishing attack and vilification orchestrated from within the heart of the scientific establishment. Why? Because it dares mention the forbidden H word. The drama suggests that antibiotic resistant genes could jump species from crops to animals and humans, leading to an outbreak of a "superbug". This is horizontal gene transfer, genes going across species barriers, a taboo subject among proponents of GM crops. But it does happen, says ***Dr. Mae-Wan Ho****.*

"Horizontal gene transfer" doesn't quite trip off the tongue as easily as "feeding the world" in the debate on GM crops. But when it comes to balancing cost versus benefit, the former definitely tips the scale in potential hazards against any potential benefit that GM crops can offer. It is not as if people are starving because they haven't got GM crops, whereas horizontal gene transfer can kill. And there is much more evidence to suggest that horizontal gene transfer from GM crops can happen than there is that GM crops can feed the world.

Genetic modification is nothing but assisted horizontal gene transfer. And it can happen even when not assisted. There is such a lot of selective citing of negative evidence, even denial and explaining away of positive findings that some of us have taken the trouble to collect the positive, incriminating evidence together [1-6].

For example, laboratory experiments have shown that DNA isolated from a range of GM crops can transfer an antibiotic resistance marker gene to soil bacteria [7]. In the only field study carried out so far, transgenic DNA was found to persist in the soil two years after the GM crop has been harvested. Parts of the transgenic DNA were found in some batch cultures of bacteria from the soil, even though the actual strain of bacteria cannot be isolated, which is not surprising, as less than 1% of the bacteria can be cultured [8]. Microcosm experiments further showed that transgenic DNA added to soil, was taken up by soil bacteria. Other studies suggest that gene transfer may occur via GM pollen and dust to bacteria in the mouth and respiratory tract of animals including human beings [9,10]. These and other findings have simply been ignored and dismissed by a 'cautious'(!) interpretation that eschews any and all positive results.

Can animal cells take up transgenic DNA? A research team in the Institute of Genetics, University of Cologne, Koln, Germany, was the first to draw attention to the fate of DNA in ingested food. They fed mice DNA, either from the bacteria virus M13, or the cloned gene for the green fluorescent protein inserted into a plasmid. They found that large fragments of the DNA can be traced from the intestinal contents, via the gut wall, the Peyer's patches and white blood cells, to the spleen and the liver. When fed to pregnant mice, the DNA passed via the placenta to fetuses and newborn animals.

In a recent experiment [11], the team compared the fate of soybean DNA from soybean leaves, with transgenic plasmid DNA containing green fluorescent protein linked to viral promoters from the human cytomegalovirus (HCMV), the Simian virus (SV40) or Rous Sarcoma virus (RSV). Soybean DNA was tracked by probing for the presence of the plant-specific, nucleus-encoded ribulose-1,5-biphosphate carboxylase (Rubisco) gene.

They found that the plant gene, or fragments of it, can be recovered in the intestine from 2h up to 49 h after feeding, and in the caecum, for up to 121 h after ingestion. Thus, plant-associated naturally fed DNA is much more stable in the intestinal tract than naked DNA. In a total of 37 soybean leaf-fed mice, the DNA from liver and spleen were investigated for the presence of Rubisco DNA. The DNA was found in three organs in two animals.

In experiments where the plasmid containing transgenic GFP- DNA were fed to mice, however, a much higher proportion of the DNA were present in liver, spleen, kidney,

blood, and in the intestinal wall, just 3 to 8 hr. afterwards. The numbers varied from a low of 3 out of 16 to 5 out of eight, the total over 8 experiments was 28 out of 87.

The researcher noted that far greater amounts of transgenic DNA were fed, typically 50 micrograms, equivalent to 10^{13} copies compared with about $6x10^{8}$ copies of the Rubisco gene. But then, according to their findings, plant-associated DNA was much more stable and resistant to breakdown, remaining in the gut far longer.

When injected, into muscle, the green fluorescent protein DNA fragments can be amplified by PCR for up to 17 months afterwards, and from DNA from organs remote from the site of injection up to 24h after injection, and from intestinal contents 6h after injection. This indicates that transgenic DNA can circulate around the body.

Why didn't they do the obvious experiment, which is to feed transgenic plant material to the mice and probe for both a plant gene and the transgene? Perhaps no biotech company will provide the transgenic plant material for such experiments. In fact, this obvious experiment appears to have been avoided altogether, so the denial can continue. Absence of evidence is evidence of absence.

The only comfort one can draw from this latest experiment is that mice continuously fed daily with the transgenic green fluorescent protein DNA for 8 generations did not become transgenic, so there is no germline transmission of DNA from ingested DNA. Your unborn children need not worry, even though you do.

References marked with * are for sale from ISIS. Enquiries: sam@I-sis.org.uk

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