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# Can biotechnology help fight world hunger?

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Key Words: GM crops, CaMV promoter, horizontal gene transfer, world hunger, organic revolution in science.

**1.** It's a great honor to be invited to speak here. I'm a scientist who loves science and believes science and technology *can* help build a better world and combat world hunger. But it must be the right kind of science and technology, and it must be decided by people themselves. There is no alternative to the democratic process of seriously informing and empowering people. And I congratulate Congressman Tony Hall for putting on this special forum.

**2.** I am among the 327 scientists from 38 countries who have signed an Open Letter to all Governments demanding a moratorium on GM crops because we have reasons to believe they are not safe [1]. We are also calling for support of sustainable agricultural methods that are already working successfully around the world.There is genuine disagreement within the scientific community. The public are not served by portraying the debate as science versus anti-science.

**3.** Let me begin with recent report from Germany that GM genes in GM pollen have transferred to the bacteria and yeasts in the gut of baby bees [2].

**4.** This kind of horizontal gene transfer involves the direct uptake of foreign genetic material. It has been found to happen also in the field. After GM sugar beet was harvested, the GM genetic material persisted in the soil for at least two years and was taken up by soil bacteria [3].

**5.** Not only microorganisms, but animal cells, including human cells can readily take up the GM constructs and the foreign genes often end up in the cell's own genetic material, its genome [4].

**6.** Not so long ago, the pro-biotech scientists were insisting horizontal gene transfer couldn't happen. Now, they are saying it happens all the time, so no need to worry.

**7.** So the crucial question is whether GM genetic material is like ordinary genetic material. The answer is no. There is a world of difference between GM genetic material and natural genetic material

**8.** Natural genetic material in non-GM food is broken down to provide energy and building-blocks for growth and repair. And in the rare event that the foreign genetic material gets into a cell's genome, other mechanisms can still put the foreign genes out of action or eliminate it. These are all part of the biological barrier that keeps species distinct, so gene exchange across species is held in check. And that has been so for billions of years of evolution.

**9.** GM-constructs are designed to invade genomes and to overcome natural species barriers. Because of their highly mixed orgins, GM constructs tend to be unstable as well as invasive, and may therefore be more likely to spread by horizontal gene transfer [5].

**10.** GM constructs consist of genetic material of dangerous bacteria, viruses and other genetic parasites from widely different origins. They are combined in new ways that have never existed, and put into genomes that they have never been part of. They include antibiotic resistance genes that make bacterial infections very difficult to treat. And, you never just put a gene in by itself. It needs a gene switch or a promoter to work. Typically an aggressive promoter from a virus is used to make the gene over-express continuously -- something which never happens in healthy organisms.

**11.** One viral promoter in practically all GM crops out there, including the so-called second generation GM plants such as the 'golden rice' [6] is from the cauliflower mosaic virus, CaMV for short. This CaMV promoter has a recombination hotspot -- a site where it is prone to break and join up with other genetic material [7]. It is promiscuous in function [8]. Plant genetic engineers thought it works in all plants and plant-like species, but not in animals. Just last week, we discovered in the scientific

literature more than 10 years old that this same CaMV promoter works extremely well also in frog eggs [9] and extracts of human cells [10]. It is already known to be able to substitute for promoters of other viruses to give infectious viruses.

**12.** What will happen when these dangerous GM constructs spread? Remember, GM constructs are made from genetic material of viruses and bacteria and are designed to cross species barriers and to invade genomes. In the process, there's the obvious potential that they may recombine with viruses and bacteria to create new strains that cause diseases. The antibiotic resistance genes may also spread to bacteria associated with serious diseases such as meningitis and tuberculosis. GM constructs that invade genomes may recombine with, and wake up dormant viruses that have now been found in all genomes (reviewed in 8).

**13.** GM crops are turning out to be useless as well as unsafe. The bacterial bt-toxins, engineered into many crops, are poisonous for beneficial and endangered species such as lacewings, the Monarch butterfly as well as the black swallowtail [11]. Bt crops encourage new resistant pests to evolve. Stink Bugs in North Carolina and Georgia are eating up the bt-cotton crops [12] and have to be sprayed with deadly pesticides. A study in the University of Nebraska shows that GM Roundup Ready soya yielded 6-11% less than non-GM soya [13], confirming an earlier Univ. of Wisconsin study which also found that the GM soya required 2 to 5 times more herbicides.

**14.** The way to fight world hunger is definitely not GM crops. World population figures have been wildly exaggerated. The figure of 10 billion has been bandied about. In fact, figures have had to be revised downwards several times in the late 1990s. By mid-1998, the UN's estimate was that world population will peak at 7.7 billion in 2040, then go into long term decline to 3.6 billion by 2150, less than two-third of today's number [14].

**15.** Population arguments are based on the ecological concept of carrying capacity. Ecologists are increasingly finding that the more biodiverse the ecosystem, the greater the carrying capacity [15], and hence the more people and wild-life it can support. Biodiverse systems are also more stable and resilient. The same principles have guided traditional indigenous farming systems, and are now being re-applied in holistic approaches that integrate indigenous and western scientific knowledge [16]. Some 12.5 million hectares around the world are already farmed in this way. The yields have doubled and tripled and are still increasing, at the same time reversing some of the worst environmental, social and health impacts of the green revolution.

**16.** World market for GM crops has collapsed because people all over the world are rejecting them and opting for organic sustainable agriculture [17]. An organic revolution is rising from the grass-roots and also sweeping across the disciplines within western science. From quantum physics to the ecology of complexity and the new genetics, the message is the same: nature is dynamic, interconnected and interdependent [18]. Proponents of GM technology are stuck in the mechanistic era, it is that above all that makes the technology both futile and dangerous. It is just not innovative enough!

**17.** In conclusion, GM crops are not safe, not needed and fundamentally unsound. Far from helping to fight world hunger, they are standing in the way of the necessary global shift to sustainable organic agriculture that can really provide food security and health around the world.

## Notes and References


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12. "Research Shows Roundup Ready Soybeans Yield Less". News Release from IARN News Service, University of Nebraska ianrnews@unlnotes.edu

13. See Biodemocracy News #27, www.purefood.org

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15. See Tilman, D., Wedin, D. and Knops, J. (1996). Productivity and sustainability influenced by biodiversity in grassland ecosystems. *Nature* 379, 718-720.

16. See Altieri, M., Rosset, P. and Trupp, L.A. (1998). *The Potential of Agroecology to Combat Hunger in the Developing World*, Institute for Food and Development Policy Report, Oakland, California; also Rosset, P. personal communication.

17. Over the past four years, US corn exports to the EU have fallen from $360 million a year to near zero, while soya exports have fallen from $2.6 billion annually to $1 billion -- and expected to fall even further as major food processors, supermarkets, and fast-food chains ban GM soya or soya derivatives in animal feeds. Canada's canola exports to Europe similarly fell from $500 million a year to near zero. From Biodemocracy News #27, www.purefood.org.

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