The corporations that are introducing genetically modified crops into the global ecosystem want you to think of genetic engineering as a well-understood science similar to laparascopic surgery. Indeed, the phrase "genetic engineering" gives the impression that moving genes from one organism to another is as straightforward as designing a rocket or a TV set. This is not the case.

Basically, a plant’s genome (all of its genes, taken together) is a black box. Genetic engineering takes a gene from one black box and forces it into a second black box (the recipient plant), hoping that the gene will "fit." Most of the time, the experiment fails.[1] Once in a few thousand tries, the foreign gene embeds itself in the recipient plant’s genome and the newly-modified plant gains the desired trait. But that is all the technicians know. They have no idea where in the receiving plant’s genome the new gene has found a home. This fundamental ignorance, combined with the speed and scale at which modified organisms are being released into the global ecosystem, raises a host of questions of safety for the future of agriculture, for the environment, and for human health.

** To begin with, genes don’t necessarily control a single trait. A gene may control several different traits in a plant. Without careful study, plants with undesirable characteristics may be released into the global ecosystem. And biotechnology is not like a chemical spill that can be mopped up -- once you release a new gene sequence into nature, your grandchildren are going to be living with it because there’s no taking it back.

** How a gene affects a plant depends upon the environment. The same gene can have different effects, depending on the environment in which the new plant is growing.[2] What appears predictable and safe after a few years of observation of a small test plot may turn out to have quite different consequences when introduced into millions of acres of croplands in the U.S. and elsewhere, where conditions vary widely.

** Does the new gene destabilize the entire plant genome in some unforeseen way, leading one day to problems in that crop? Only time will tell.

** Genes can travel to nearby, related plants on their own. This is called gene flow. In 1996 gene flow was discovered to be much more common than previously thought.[3] According to SCIENCE magazine, many ecologists say it is only a matter of time before an engineered gene makes the leap to a weedy species, this creating a new weed or invigorating an old one. "It will probably happen in far less than 1% of the products," warns ecological geneticist Norm Ellstrand of the University of California at Riverside, "but within 10 years we will have a moderate-to-large scale ecological or economic catastrophe, because there will be so many genetically modified products being released."[3] Ellstrand predicts. It is worth noting that U.S. farmers already spend $4.3 billion purchasing 628 million pounds of herbicides (active ingredients only) to control weeds.[4,pg.32]

The Congressional Office of Technology Assessment (OTA) recommended that all genetically modified plants should be considered non-indigenous exotic species, with the power to disrupt ecosystems. [4,pg.29] Non-indigenous, introduced species have provided great benefits to humanity (most of U.S. agriculture relies on introduced species), but we also should learn from kudzu, purple loosestrife, the gypsy moth, the fire ant, and the boll weevil that can be extremely disruptive and very expensive to control (if indeed they can be controlled at all).

** A public health disaster was narrowly averted in 1996 when a group of researchers tried to improve soybeans by giving them a gene from the Brazil nut.[5] The goal was to improve the nutritional value of soybeans by forcing them to produce more methionine, an essential amino acid. The gene from the Brazil nut was successfully transferred to soybeans. After this had been accomplished, but before the soybeans were sold commercially, independent researchers tested the soybeans to see if it would cause allergic reactions in people. Many people are allergic to nuts, particularly Brazil nuts. In some people, allergic reaction to Brazil nuts is swift and fatal.

A series of laboratory tests on humans confirmed that the genetically modified soybeans did provoke Brazil-nut allergy in humans. They could not feed the genetically modified soybeans to people for fear of killing them, but through scratch tests on skin, they confirmed unequivocally that people allergic to Brazil nuts were allergic to the modified soybeans. In discussing their findings in the NEW ENGLAND JOURNAL OF MEDICINE, the researchers pointed out that tests on laboratory animals will not necessarily discover allergic reactions to genetically modified organisms. Only tests on humans will suffice.

U.S. Food and Drug Administration (FDA) only requires testing for allergic reactions if a gene is being taken from a source that is already known to cause allergic reactions in humans. Many genes are being taken now from bacteria and other life-forms whose allergenicity is entirely unknown, so federal regulations require no allergy testing in these cases. This reduces regulatory costs for the corporations, but leaves the public unprotected.

** Crops are being genetically modified chiefly as a way to sell more pesticides. [See REHW #637.] In some cases, the modified crops change the pesticides themselves, giving them new toxicity. The herbicide bromoxynil falls into this category.[1,pg.41] Bromoxynil is already recognized by U.S. EPA [Environmental Protection Agency] as a possible carcinogen and as a teratogen (i.e., it causes birth defects). Calgene (now owned by Monsanto) developed a strain of cotton plants (called BXN Cotton) that can withstand direct spraying with bromoxynil. Unfortunately, the bromoxynil-resistant gene in cotton modifies the bromoxynil, turning it into a chemical byproduct called DBHA, which is at least as toxic as bromoxynil itself.

Although humans do not eat cotton, traditional silage for cattle contains up to 50% cotton slash, gin mill leavings, and cotton debris. Both bromoxynil and DBHA are fat-soluble, so they can accumulate in the fat of animals. Therefore, it is likely that DBHA will make its way into the human food chain through meat. Furthermore, cotton seed oil is widely used as a direct human food product and as a cooking additive. In licensing bromoxynil for use on Monsanto’s genetically modified BXN Cotton, EPA conducted a risk assessment that assumed bromoxynil and DBHA had no way to enter the human food chain. Lastly, cotton dust -- the cause of brown lung disease -- will now carry the added hazard of bromoxynil and DBHA, another danger that EPA has disregarded.

Thus genetic engineering -- which is being promoted as a technology that will reduce the perils of pesticides -- will in some instances increase them.

In rats and in rabbits, bromoxynil causes serious birth defects, including changes in the bones of the spine and skull, and hydrocephaly ("water on the brain"). These birth defects appear in offspring at doses of bromoxynil that are not toxic to the mother. Despite these findings, and despite a law (the Food Quality Protection Act of 1996) that explicitly gives EPA the power to reduce exposure standards to protect infants, EPA in 1997 declined to require a special safety factor to protect children from bromoxynil.

Lastly, when EPA added up the cancer-causing potential of bromoxynil, they found it to be 2.7 per million, and they promptly declared this to be "well within" the one-in-a-million regulatory limit.[1,pg.46] Is 2.7 less than one? By all appearances, EPA is more interested in protecting Monsanto’s investment in this new technology than in protecting public health.
** Because genetically-engineered soybeans will be doused with increased quantities of herbicides, such as Roundup (glyphosate), soybeans and soy products will carry increased chemical residues. Infants who must be reared on soy milk, because they cannot tolerate lactose in regular milk, will be at special hazard.

** Crops that are genetically modified to resist herbicides detoxify the herbicides by producing proteins, which will be incorporated into our food with unknown results.[1,pg.143]

** When crops are genetically modified to incorporate the naturally-occurring Bt toxin into their cells (see REHW #636), those Bt toxins will be incorporated into foods made from those crops. What will be the effect of these toxins and gene products on the bacteria and other organisms (the so-called microflora) that live in the human digestive tract? Time will tell.

** The "life sciences" companies have big plans for turning agricultural crops into "factories" for producing pharmaceuticals and specialty chemicals in open fields. They plan to manufacture vaccines, drugs, detergents, enzymes and other chemicals by putting the right genes into the right plants.

The net effect of all this will be to expose soil insects and microorganisms, foraging and burrowing animals, seed-eating birds, and a myriad of other non-target organisms to these chemicals and to the gene products that make them. The Union of Concerned Scientists says, "Herbivores will consume the chemicals as they feed on plants. Soil microbes, insects, and worms will be exposed as they degrade plant debris. Aquatic organisms will confront the drugs and chemicals washed into streams, lakes, and rivers from fields."[4,pg.6]

** Most fundamentally, genetically-engineered crops substitute human wisdom for the wisdom of nature. As genetically-engineered crops are planted on tens of millions of acres, the diversity of our agricultural systems is being further diminished. Do we know enough to select the "right" combination of genes to assure the stable, long-term yield of our agricultural systems? Our recent experiences with PCBs, CFCs, DDT, Agent Orange, and global warming should give us pause. Genetic engineering is by far the most powerful technology humans have ever discovered, and it is being deployed by the same corporations that, historically, have produced one large-scale calamity after another. Is there any good reason to think things will be different this time?

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