

Where do the real dangers of genetic engineering lie?

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Scare stories about genetic engineering may divert our attention from areas where we do need to be on our guard against cynical exploiters

To listen to some people, you'd think genetically modified foods were radioactive. But genetic engineering is not, of itself, either bad or good. It depends what you engineer. Doubtless a malevolent geneticist could stick a poison gene into a potato. If we insert a gene for making oil of peppermint, we'll end up with peppermint flavoured potatoes. It's up to us.

There's nothing new about genetic modification. That's precisely what Darwinian evolution is and it's Darwinian evolution that put us all here. All plants and animals including humans, are genetically modified versions of ancestors. Darwinian modifications are not designed; they evolve by natural selection - the survival of the fittest - which may or may not be good from our point of view. Mosquitoes are genetically modified by natural selection to eat humans, which is good for them and bad for us. Silkworms are genetically modified by natural selection to make silk, which is good for them and also good for us because we steal the stuff.

Most genes are placed where they are by natural evolution. We can achieve a little further adjustment by artifice, and here we at least have the opportunity to tailor changes that are good for us. We can selectively breed - a kind of artificial version of Darwinian selection which we've been practising for thousands of years. And we can genetically engineer. This is a technique that we're only just beginning to learn, and like all novelty it arouses fear.

Genetically engineered plants have been sensation-ally called Frankenstein plants. But traditionally-bred domestic peas are 10 times the volume of their wild ancestors. Does this make them Frankenstein peas? The wild ancestors of corn cobs were half an inch long. Today a domestic cob may be one and a half feet long. Yet nobody accuses our forebears of "playing God" when they bred them. Are spaniels and whippets Frankenstein wolves?

PR E S U M A B L Y selective breeding seems less sinister because it is a little older than genetic engineering. But both techniques are extremely young compared with the long history of Darwinian genetic modification that produced wild plants and animals in the first place. I am reminded of the old lady who refused to enter an aeroplane, on the grounds that if God had meant us to fly He'd never have given us the railway.

Both natural selection (which gave us the maize plant in the first place) and artificial selection (which lengthened its cobs thirty-fold) depend upon random genetic error - mutation - and recombination, followed by non-random survival. The difference is that in natural selection the fittest automatically survive. In artificial selection we choose the survivors, and we may also arrange cunning hybridization regimes. In genetic engineering we additionally exercise control over the mutations themselves. We do this either by directly doctoring the genes, or by importing them from another species, sometimes a very distant species. This is what "transgenic" means.

And now, here's a potential problem. Natural selection favours genes that have had plenty of time to get adjusted to the other genes that are also being favoured in the species - the gene pool becomes a balanced set of mutually compatible genes (I explain this in a chapter called The Selfish Cooperator in my forthcoming book, *Unweaving the Rainbow*). One of the problems with artificial selection (partly because domestication is so recent) is that the balance may be upset. Pekineses, bred to satisfy questionable human whims, have consequent difficulties with their breathing. Bulldogs have trouble being born. Transgenic importation of genes might raise even worse problems of this kind, because the genes come from a more distantly alien genetic climate, and the

translocation is even more recent. This is a danger we must think about.

Genetic engineering is a more powerful way to modify life than traditional artificial selection, so the potential for danger is greater as well as the potential for good. Environmental dangers are likely to outweigh nutritional ones, mainly because knock-on environmental effects are so complicated and hard to predict. But some risks can be foreseen. Suppose there is an indiscriminate poison which is cheaper to produce than sophisticated selective weedkillers, but which cannot be used because it kills the crop along with the weeds. Now suppose a gene is introduced which makes wheat, say, completely immune to this particular herbicide.

FARMERS who sow the transgenic wheat can scatter the otherwise deadly poison with impunity, thereby increasing their profits but with potentially disastrous effects on the environment. If the same company patents both the poison and its genetic antidote, the monopolistic combination would be a nice little earner for the company, while the rest of us would see it as a menace. On the other hand, enlightened genetic engineers might achieve an exactly opposite effect, positively benefiting the environment by reducing the quantity of weedkiller required. There is a choice.

Part of what we have to fear from genetic engineering is a paradox - it is too good at what it does. As ever, science's formidable power makes correspondingly formidable demands on society's wisdom. The more powerful the science, the greater the potential for evil as well as good. And the more important it is that we make the right choices over how we use it. A major difficulty is political - deciding who is the "we" in that sentence. If decisions over genetic engineering are left to the marketplace alone, the long-term interests of the environment are unlikely to be well served. But that is true about so many aspects of life.

Hysterical damnors of genetic engineering in all its forms are tactically inept, like the boy who cried wolf. They distract attention from the real dangers that might follow from abusing the technology, and they therefore play into the hands of cynical corporations eager to profit from such abuse.

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