The future of genetic technology lies in the ethics of the people who are subject to its effects. After experiencing atmospheric testing, New Zealand decided to become nuclear free to safeguard our future generations. Genetic ethics is key to the future survival of humanity.

Through a Glass Darkly: The Genetic Future of Eden

The future of the biosphere and its immortal evolutionary Tree of Life, not only of all species, but the well-being and genetic future of humanity, is going to be irreversibly affected by emerging genetic technologies.

We are already making horizontal gene transfers which would not occur under natural conditions. Little heed is given by the proponents of genetic engineering to the consequences of such actions. Ecosystems have been ravaged by horizontal transfer of genes in the form of introduced species, which have the potential to reduce biodiversity to a few dominant weedy or exotic species. Horizontal transfer of genes is potentially immortal and inheritable, so its effects could become permanent and irreversible. Engineered factors designed to provide resistance to pests may also cause the destruction of many non-target species. Genes can be transferred to other organisms by viruses or spread in pollen and become recombined into wild genomes in which they may continue to reproduce, permanently contaminating the genetic landscape.

Gene manipulation techniques are advancing extremely rapidly. They raise a host of new ethical issues which could either promote the flowering of evolution or reduce both us and biological diversity to an evolutionary wasteland - a brittle engineered nightmare becoming a terminal condition under any minor planetary disruption which disables our techo-agriculture and food supply. The capacity of society to make advance ethical decisions is being seriously undermined by the rapid scale of these initiatives and the fact that large transnational corporations are making major monopolizing plays for world agriculture and seed stock markets to try to out-maneuver the consuming public they should be under covenant to serve. This situation encourages risk, misadventure and terminal failure in a cumulative way which could overshadow the threat of nuclear holocaust.

These issues have to be tackled in a new way through foresight and ethical debate, so that society has the chance to conceive the future these decisions are drawing us into, before they become irreversible. Science is the study of how natural or physical phenomena occur and provides no conclusions as to what sort of world we should create. Economic exploitation with winner-take-all profit as the motive is detrimental to developing social ethics for genetic technology.. Science is as capable of embracing technological fantasies of the future as it is the verdant living world of complexity and diversity. Traditional religious views are likewise struggling to come to terms with biotechnology from an archaic perspective of divine order, human dominion over nature and male reproductive rights in an evolving world of chaos, quantum uncertainty and complexity.

We need to develop a consensual vision among the living people of the planet, who are responsible for the future generations of life, so that we can conceive together a consensus ethics of diversity which will leave room for the future of evolution in the onrush of genetic technology. Without such an initiative, the future of society and the unconceived diversity of this planet may fail. If it does, humanity could become doomed to a cul-de-sac, or to frank extinction.

Genetic technology offers great promises but also great potential risks. It is time to fulfil our appointment with our coming of age in the universe and address these ethical issues democratically as a whole society.

Politics and Ethics of Genetic Technology

The growth of genetic technology is a politically and corporate driven process. Major transnational corporations see immense gains to be made by developing patented gene tech processes. These scientific advances are not developed primarily for the benefit of humanity as a whole but to make huge windfall profits, sometimes through processes which entrap society and individuals. Governments of major high tech countries, particularly the US see biotech as a national or superpower strategy to dominate markets by developing intellectual property rights which will give ownership over major food, commercial and medicinal production. The scientists in the piece are not engaging in fundamental research furthering the growth of knowledge for the common good but winner take all venture initiatives.

Because these vested interests have immense financial motivation to control markets, their position is ethically compromised and the developments they produce are often flawed or outright dangerous. However they lay claim to the progressive high ground citing medical biotech advances and GM varieties as essential for a prosperous future and claiming the general public is ignorant and irrationally suspicious of genetic technology. This position is indefensible double talk.

Arrayed against this formidable camp are groups of consumers, NGOs, particularly environmental organizations and those representing the farmers of the developing world, independent scientists, ethicists and concerned citizens. It is these people who speak the language of the genetic precautionary principle and are fulfilling an essential role in keeping the social discourse on genetic labelling, and ethics alive.

It is essential in any free society that policies on such major impacts as biotechnology and which uses we consider socially appropriate to engage are made collectively by the general public and not just by vested financial interests and the scientists under their patronage. A key part of keeping our genetic future safe lies in developing consensual social institutions independent of corporate influence

which can formulate and discuss social genetic policies which will sustain society over the generations.

Major global takeover by Genetic Engineering Companies

The genetic ethical question is being overtaken by extreme commercial pressures from large transnational corporations such as Monsanto who are also reaching towards a world monopoly on seed production. Monsanto began as a chemical company and made big gains on products such as aspartame sweetener and roundup (glyphosate) weedkiller. A decade ago it began prospectively moving into the gene tech area with the aim of effectively continuing its monopoly patents on roundup by generating patented engineered varieties such as roundup-ready soya, which can withstand its own herbicide, thus guaranteeing the monopoly on both.

Since then Monsanto has applied its massive capital to buying up and taking over a very significant proportion of the world's seed producing companies creating an potential monopoly over the seed producing resources of the planet.

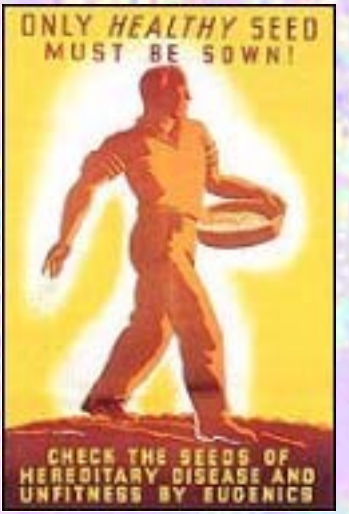
Bt. varieties have a bacillus thurigensis insecticide as a gene, but this exploits one of the world's best organic farming natural remedies in a massive profligate way liable to lead to insect resistance. Perhaps the most pernicious invention was the 'terminator gene' designed to render proprietary seeds sterile one generation after they have been soaked in an antibiotic. This would give biotech seed suppliers complete control over the species they sold but it could also lead to collapse of the natural diversity of our food species as farmers become forced to use terminator varieties and lose the capacity to store and grow their own regional strains.

Major attempts are now being made by several such trans-nationals to buy up and takeover world seed suppliers. This is a dangerous development which even without GM or terminator strains could lead to the loss of ownership by the people of planet earth of their own genetic endowments of natural species which are the product of our evolutionary heritage. This could prove lethal for humanity. Currently the diversity of many of our major food species are maintained by small scale farmers replanting regionally adapted varieties in a variety of habitats across the planet. If these are replaced by monoclonal, genetically modified or terminator varieties the risk of a total failure of the world's food supply and loss of its genetic diversity is made astronomically higher. Many of these varieties depend on high tech agriculture and cannot survive in the wild so a minor planetary disruption could lead to complete and permanent failure of the human food supply.

Genetic Technology and Biblical Myth

Articles on the ethics of genetic technology frequently cite biblical mythology with the proponents likening gene-tech's changes to the return of the Tree of Life in the hope of a biological immortality cloning and other technologies might provide. Contrasting this view is a concern shared by environmentalists, advocates of subsistence agriculture and ecofeminists to preserve genetic diversity from the 'Death of Nature' monoclonal biotech threatens. The Garden of Eden myth enters, not only into our ideas of the future, but the utopian dreams founding a Western industrial civilization still implicitly based on Christian theology in our ideas of dominion over nature and the rule of divine order. This invites religious thinkers into a dangerous liaison with materialistic scientists when they espouse the use of genetic technology to fulfil God's supposed divine plan. The belief in a transcendent (male) God of order violates the complementation of order and chaos essential for the

emergence and evolution of complex systems. It is liable to lead to a mechanistic cul-de-sac or a frank terminal condition. Respect for the immortal diversity of life and for the chaotic regenerative aspect of mutational evolution is key to our survival. The invention of the 'terminator gene' constitutes, in a biological sense, the biblical 'end of days', the death of immortality.



Eugenics Advertisement (Jones)

Eugenics and Genetic Testing

Currently many of us live in societies which promote individual rights and allow freedom of choice concerning reproduction, however China operates laws and policies which could be used to control population for attaining political ends. Canada, Australia and Sweden, to quote only a few, have an atrocious record of enforced eugenic sterilization, despite being apparently enlightened societies.

Given the vastly increased knowledge of human genes resulting from the Human Genome Project and its competitors, there is a major danger of eugenics being used on a national basis to eradicate genetic characteristics which society considers undesirable, and possibly with them characteristics essential for our survival. Society has never found the visionary mind easy to accommodate to and many counter-cultural aspects of our genetics could come under attack in the spirit of "Brave New World". This could in turn knock out key potential for our evolutionary fulfillment in conscious awareness in future.

The problem of eugenics is becoming ever more complex and severe as genetic testing gives us more and more genetic knowledge and advance knowledge in utero of the potential problems an individual possesses. The insurance industry and the high costs of modern high-tech medical care in 'free market' societies are coming to place an effective eugenic bias because people can no longer afford the costs of supporting individuals with genetically endowed deficits. China has contracted to investigate its entire population's genome, which could be a precursor to the application of totalitarian eugenic policies.

Will people with genetic anomalies be able to survive financially in a future free-market world? Changing financial pressures could irreversibly undermine the current free reproductive attitudes of democratic societies and alter our personal rights of reproduction. Pressures to remove undesirable genes could become a futuristic nightmare if insurers refuse to cover genetically disadvantaged offspring.

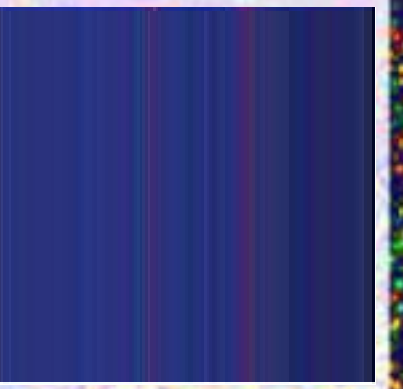
Cloning

Germ-line manipulation to correct genetic diseases also raises the spectre of potentially authoritarian societies cloning a super-race of genetically-engineered humans. To what extent do we genetically engineer the human race itself? While some people believe that cloning should be permitted, either as a personal freedom, to not bar any form of human knowledge and discovery, or even on religious grounds of man perfecting himself in the eyes of God, there are extreme dangers

for the future if we do not establish clear ethical guidelines for human cloning and germ-line engineering.

Two baby monkeys cloned by inserting DNA from an 8-celled embryo into enucleate eggs. The cloning of the sheep Dolly used both adult mammary cells and freezing techniques to reverse differentiation.

The continued fertility of the human species is founded on sexual recombination. This is also our fundamental altruism in the face of personal mortality. To change this scenario opens the greed for personal immortality leading back to the parthenogenetic regime of bacteria. Sexuality is essential to preserve antibody diversity and resist the co-evolution of parasites and diseases. Our evolutionary survival into the future depends on retaining the genetic make up which brought us into cultural existence in evolutionary time. If the nature of the human genome becomes a non-ecosystemic engineered identity, we are likely to become the ever-more artificial and robotic products of our own mechanistic fantasy. The master race concept is a phoenix which continually rises from the ashes, as Nietzsche has demonstrated in Hitler. Already writers are speculating on the prospect of the human genotype dividing into separate worker and master lines based on cloning and other genetic technologies.



Human telomeres highlighted (Jones). Successful long-term cloning may require reactivating telomerase as is done briefly during gametogenesis, to avoid the natural aging that occurs by loss of telomeres on somatic cells, probably as a defense against cancer.

Although defenders of cloning allege that it will only ever be a minor player in the human reproductive scene, totalitarian systems have by no means vanished from the Earth. As soon as the technology becomes facile for cloning, the extremes of economic inequality are likely to lead to a rash of poverty-stricken surrogate mothers raising cloned infants to term. Artificial wombs have also been used to successfully raise other mammal species. Given the gross inequalities of free-market capitalism, the non-democratic basis of transnational corporations and a variety of unscrupulous leaders, the way remains wide open for gross social abuse of cloning combined with germ-line engineering to empower the rich to become genetic masters over a cloned slave force, much as the non-reproductive worker bee attests.

Cloning in other species raises dual vistas of salvation and destruction. Some very rare species could be literally brought back from the brink of extinction by cloning additional females. However cloning can also spell the death of diversity. Indonesia plans to clone seedlings for forestry using a automated technique that will supply

10 million seedlings a year. This will cover up to 250,000 hectares a year with zero-diversity forest which is likely to replace the very biodiversity resources from which such engineered varieties have come. In a few decades when parasites have sexually adapted to these genetic monoclones, where will the next generation of teak come from?

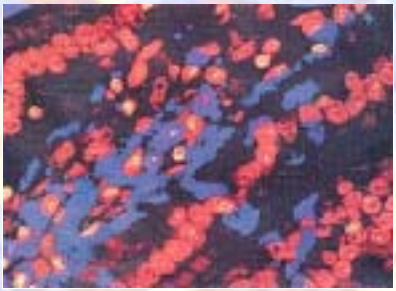
Reproductive Engineering

Associated with genetic technology is a complementary reproductive technology, which has very significant implications for the human evolutionary future. The increasing use of high tech solutions for infertility, such as IVF or in-vitro fertilization, raise the spectre of whole generations of humans having to continue to depend on such technologies to maintain their reproductive continuity. Automated techniques of in-vitro fertilization and genetic testing may lead to an expectation that most children will become IVF gene tested eugenics within a decade. This process began with the Caesarian section, but has accelerated to new limits with IVF. Cesarean has also been predicted to become the dominant means of birth within a decade, overthrowing in a single step the natural birth viability of the human species. IVF combined with genetic testing is now being used as a methodto provide designer babies which lack a genetic abnormality possessed by a sibling so that they can participate in a gene therapy cure, raising several ethical issues. IVF birth is also associated with three times the genetic abnormality rate. Society needs to explore more fully the evolutionary implications of reproductive technologies, which may over time result in a human gene pool which is ever more dependent on reproductive technology, just for humanity to survive. In the event of any social breakdown, this could leave a future human population vulnerable to reproductive collapse.

Even the apparent simplicity of in-utero sex determination has led to vastly disproportionate selective terminations of girl children, leading to banning the technique in India. The further advances of being able to select the sex of an offspring lead to the same serious problems of gender inequalities in societies which favor male offspring. It is simply a way of facilitating effective gendercide of the girl child. Technologies are under development to bypass sperms by using an ovum and a body nucleus which extrudes one chromosome set like the polar body, or to fuse two sperm nuclei in an enucleate egg, or initiative human parthenogenesis. These may be prevented by maternal and paternal imprinting requirements but they raise an ethical spectre of gay designer androids which are not fully human.

The difficulties of gene therapy, requiring mass uptake of DNA by whole tissues of cells, has caused the original declared taboo on human germ-line engineering to begin to crumble. Germ-line engineering gives promise to those with deadly genetic deficiencies that they could have healthy offspring. But with it germ-line engineering brings the potential to make an immortal mistake, which may not be able to be undone. It also has very deep implications for the evolutionary stability of the human genome. Extensive genetic manipulation of the human germ-line could lead to humanity itself losing key diversity characteristics or becoming inviable through its native versatility being designed out of the system. A deep and penetrating ethical discussion needs to take place in human society about this reflexive issue of what humanity may become.

We simply don't know how much the individual genes making up the human genome are interactive. Certainly embryogenesis of the human brain is a dynamically interactive process, which the 30,000 genes involved can only act as basic generators for so complex a structure. Articles are already appearing assuming that in 20 years we will no longer need dentists, because future humans will be engineered to have flawless teeth. However we have no idea how much such changes could subtly or grossly change the nature of other characteristics. For example a sexually imprinted gene for mothering inherited through the father also has subtle unspecified effects on body size and other aspects of physiology and behaviour in rodents. We could lose a variety of essential characteristics such as imagination, visionary or even psychic facilities which are extremely hard to quantify. Furthermore there are immediate eugenic implications which are sinister and serious. Where will society draw the line in attempting to engineer out 'undesirable' characteristics in bringing about the genetic conformity of "Brave New World"? Diverse social responses are required to deal with this long term.



New genetic material shows blue amongst red intestine cells in lactose intolerant rats, given gene therapy. This effect remained stable for several months, unlike some other gene therapy experiments).

Gene Therapy

Gene therapy raises the promise of correcting genetic diseases such as muscular dystrophy, Parkinsonism and certain forms of mental retardation which plague a small proportion of the human population. Gene therapy to cure has proved very effective with X-linked severe combined immunodeficiency where recombining the missing gene into bone marrow cells using murine retrovirus has proved syccessful. It is advances such as this which are used by the proponents of genetic technology to justify many of its excesses in the name of sweeping palliative progress, however the track record of gene therapy is so far a very mixed blessing. In many cases it may simply prolong a degenerative process rather than arrest it and can carry with it severe consequences, because of the intervention process, for example direct injections of cells or genes into brain tissue. Getting additional genes to take in the nuclei of existing cells is an ongoing problem. It is unlikely that gene therapy will ever prove as effective as pre-natal genetic testing and the avoidance of offspring with such deficits. Neither does it generally cure the germ line but leaves the problem unresolved for the next generation, possibly also causing uncontrolled heritable genetic changes.

Stem Cells and Foetal Cell Transplants.

Stem cell research is one of the most hopeful discoveries in biotechnology. Stem cells can be harvested from many organs, including the brain, skin and hair and even from cadavers. Stem cells, particularly foetal stem cells, are able to differentiate into any type of cell and to repair damaged tissues. For example neural stem cells appear to be able to almost miraculously reverse the effects of spinal injury.

Implantation of neural stem cells on a synthetic scaffolding partially restored function in rats with a severed neural cord.

Foetal tissue, because it is far closer to the totipotent germ cells and has not established antibody specificity, is ideally suited to adapting to new tissues and has the growth potential, as young cells, to repair tissues more effectively and completely than differentiated adult cells. Yet the use of foetal cells raises ethical concerns about the raising and killing of human foetuses specifically to provide cell and gene therapy for aging or diseased adults. One proposal is that every human born should have a clone, not to create a successor, but simply to produce tissue for perfectly-matched transplants. The implications of raising one's own embryos to be killed to provide organ replacements is a macabre spectre which requires very careful ethical foresight.

Staphylococcus aureus, Mycobacterium tuberculosis, Escherichia coli all have resistant strains (Sci. Am. Mar 98 32)

Genetic Engineering: Food, Medicines and Biodiversity

New genetic species can now be created by the transfer of genes between organisms in ways which go far beyond the natural mechanisms of gene transfer. This could bring profound advances, both providing tailor-made organisms to fight disease - for example monoclonal anti-bodies to fight a specific cancer, or fruit which provide vaccinations, but it also brings profound risks. The greatest danger is the runaway transformation of our natural foodstuffs into engineered varieties which have so many subtle changes which affect natural viability that they render our evolutionary heritage defunct or lost. There is vast risk of the loss of natural varieties and the replacement of natural diversity by engineered varieties of low or zero diversity, which have lost or irreversibly changed the viable living charac-

teristics for ones which can only be maintained by artificial technological means. There is continuing risk of cross-breeding and viral transfer of engineered genes into wild varieties, despite attempts to restrict engineering to safer sites such as the chloroplast. The terminator gene also promises to be the death knell of biological immortality for all commercial varieties, effectively rendering our bread basket infertile, except by the grace of transnational corporates like Monsanto - a perilous and foolish situation.

Antibiotic Resistance

Many genetically-engineered products have also resulted in needless risk of infectious antibiotic resistance. Flavr-savr tomatoes do not ripen because their natural rotting facilitating seed regeneration has been disabled, but these also carry an antibiotic resistance gene used simply as a marker during the cloning process to identify the successfully-engineered strains. By growing such crops on a very large scale, the risk of the dissemination of this gene back into the wild through viral exchange becomes multiplied.

Antibiotic resistance, because of unwise practice, particularly in veterinary use, has almost exhausted the supply of effective antibiotics with the emergence of a new multiply-resistant strain of staphlococcus, or even bubonic plague. While infectious antibiotic resistance happened through mismanagement of antibiotics, resulting in plasmids with multiple resistance factors in a single bacteria, a whole new era is dawning in which we are creating similar mistakes by design. It has become almost routine to include antibiotic resistance genes as markers, however this means that genetically-engineered foodstuffs frequently contain the genetic information to disable critically important medical agents.

Genetic Technology, Biodiversity and Evolution

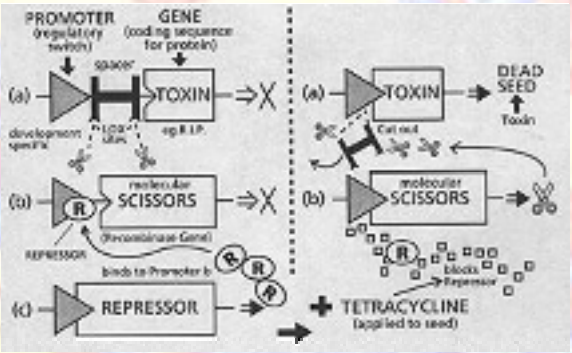
Jelly fish gene makes mouse pups fluoresce

To what extent do we mechanize the natural environment with genetically-engineered organisms? What is the logic of giving up the natural tomato, which does contain a full complement of natural genes which facilitate fertilization and regrowth of the species, and replacing it with a patented variety which cannot do so because it has become defective? Genetically modified strains are generally of very low diversity because of the bottleneck genetic manipulation requires. How will the world remain robust to environmental change over time if the vast majority of the organisms on which we depend are defective monoclonal or genetically modified organisms unable to survive without human intervention? Any mild astronomical event capable of disrupting social organization could then terminate human life on earth, because our food plants have become monoclonal genetically defective organisms and cannot sur-

vive the period of disruption and the natural varieties were lost in the failure of a germ plasm bank long before the crisis.

Even granted the prospects that genetic engineering can provide new horizons for humanity, it is still essential to preserve biodiversity so that we have the full repertoire of natural genetic diversity to draw from in future. Currently virtually all genetic manipulation is done by the transfer of existing genes from one organism or tissue to another. Although genes can be engineered, there is no practical prospect of engineering genes de novo from their DNA sequences because of the inherent complexity protein-folding problem. It is almost impossible to compute from a raw DNA sequence the three-dimensional properties of a protein translated from this sequence. Furthermore the genes in living organisms produce proteins which have co-evolved with the other genes and their proteins to produce the allosteric enzymes and multi-molecular complexes we call tissues and organelles with feedback relations which guarantee sensitive regulation. Natural evolution and genetic algorithms generally are one of the most efficient methods of parallel computation, which can never be matched by the tiny number of specific design changes achievable in a laboratory by genetic manipulation. Destroying our natural genetic diversity is thus utterly detrimental to the future of genetic technology as well as to our own prospects of survival.

Terminator Genes and Engineered Sterility



Terminator genes are set inactive but become active once the mature seeds are soaked in a reagent such as tetracycline causing future generations of seeds to be sterile. The repressor keeps the recombinase scissors inactive until treated with tetracycline. Once treated the protecting spacer is removed then the toxin gene will become activated during seed maturation, killing the seed.

Major corporates especially Delta Pine and Land with the USDA are investing in various forms of terminator technology and attempting to replace the diversity of seed stock held by small-scale farmers world-wide with expensive monoclonal genetically patented varieties so that they can gain control of the world's seed supply through intellectual property rights. As of writing Monsanto is currently trying to secure both the world's natural and GM soya. Terminator technology prevents subsequent generations of seed stock maturing once the seeds have been soaked in an antibiotic. This enables intellectual property right control to be total. The current excuse for terminator technology is to control GM varieties from spreading, but this does not prevent pollen transfer and better containment can be achieved using cytoplasmic GM genes in the chloroplast which does prevent pollen transfer.

In the fall from Eden immortality was disrupted by the pain of death. The advent

of the terminator gene signals the death knell for biological immortality of our food, medicinal and commercial species, the very ones upon which we depend for our survival. Although there have been selectively bred varieties of oranges and grapes and several other plants exist as cultivars which lack seeds and have to be grown vegetatively, the terminator gene represents an irreversible transition to 'throw-away life' dependent on private patent and continued domination by corporate giants to keep us all alive. This would be an end-game scenario for human existence. It's danger can not be underestimated or blurred in the utopian vision of another 'green revolution'. We have existed for 3000 million years in an unbroken germ line, humanity and all our symbiotic domestic species alike. Terminating this germ line immortality through the worship of winner-take-all intellectual property rights and corporate greed, is more dangerous in the long-term than the risks of nuclear holocaust. Its implications affect all of our descendents into the future. I call for a moratorium on use of terminator genes .

The implications for the future of evolution generally remain bleak unless much more stringent efforts are made to protect biodiversity and our future evolutionary potential. The likelihood is that our natural endowment of evolutionary diversity will be permeated by a smog of genetically-engineered changes which could genetically pollute natural species by horizontal transfer and sexual recombination. These come in a whole variety of forms from superweeds to outbreaks of diseases never before seen.

Reverse Xenotransplant: A six-year-old British girl flies to the United States to undergo the world's first surgical operation to grow a new ear. Scientists were able to grow a human ear in a test-tube and then graft it to the back of a mouse to grow.. The image evokes fundamental paradoxes of beneficent and diabolical uses of biotechnology.

The terminator gene was invented to secure proprietary rights to 'hire out' seed stock season by season which operate relatively smoothly with high yielding hybrids of species such as maize, which do not breed true the next generation, can be applied to all living plant species, hybrid or not, by introducing a gene which becomes activated in a mature plant in such a way as to render future generations of seed inviable. Similar technologies are being developed to engineer seedless varieties in species at will. The aim has been to guarantee a captive market of producers by seed, plant and chemical companies such as Monsanto. The consequences are allowing intellectual property rights to become death of immortality through replacing the vast majority of the productive growing areas of the planet with non-viable engineered varieties. Without even considering the potential risks of dissemination of terminator genes into wild or related food plants, risking the death of a living immortality which has carried us to this point over 3000 million years of evolution.

A newer technology called "exorcist" now aims to clean up GM varieties by executing a genetic process which deletes the genetic modification genes as the organism reaches maturity. This would both enable the organism to survive as a

non-GM variety and render many GM varieties apparently safer, since they should not be expressing the modified gene at maturity and would thus be ‘organic’ as food. However there is a potential risk here of a dangerous penetration of ‘exorcist’ strains into the organc market with subsequent failur of the GM represson causing serious undetected transfection.

Genetically-engineered Food

One of the most contentious issues in gene tech is the runaway use of genetically-modified foods in our common diet. The US, because it has been a principal financial beneficiary of the chemical and biological engineering industry's advances, has been very slow to recognize the potential disadvantages of a technology which has made it rich and is committed to forcing GM on the planet for its own strategic benefit.

Europe has shown a more mature ethical viewpoint, which has treated with caution the invasion of our natural foodstuffs by unnecessary genetically-modified varieties. The food industry has faced continued problems over pesticide and other contaminant residues in food. Although natural substances can also be toxic, this concern reaches new and unforeseeable implications with the advent of an unrestrained variety of subtle genetic modifications of our foodstuffs, many of which are contaminants which are not included to enhance food quality, which invite the profligate use of chemicals and insecticide resistance, and are un-called for by the consuming population .

The ecological penetration of Bacillus thurigensis into our food plants (Sci. Am. Sept. 95) involving tomato, tobacco, potato, cotton, corn, rice and sunflower. The implications of such a wide dissemination of this toxic crystalline protein into an environment which needs pollinating insects and its effect on both the food plants and its possible transfer to other species are still not fully explored. Its presumed safety to humans begs the question of food genetically modified to become an insecticide - is this substantial equivalence?

On many fronts this battle is being fought by unethical political subterfuge. Opponents of genetic engineering are discredited in the media by industry proponents as ignorant ‘luddites’ opposing the beneficent march of the next ‘green revolution’, following those of selective breeding and agri-chemicals, a revolution which is aired as essential to feed the burgeoning population next century. This is fraught with deceit because, rather than undeveloped populations caring for the natural diversity of food plants and retaining and preserving strains which are well-adapted to their conditions, they will become serfs of a feudal economy in which they can only hire out season by season the opportunity to mature patented terminal disposable gene stock, which has no hope of long-term survival or local protection.

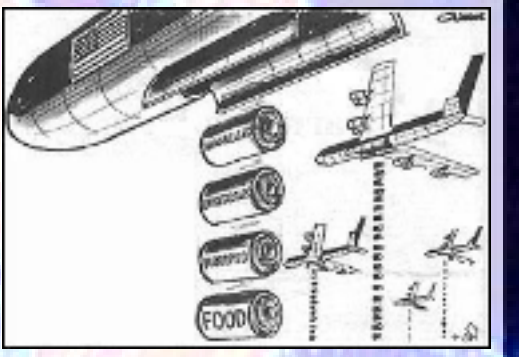
Entire consuming populations are accused by the industry of being ignorant of the marvels of scientific advance and governments have been encouraged to treat their own democratic electorates as hostages to the greater wisdom of the scientists hired by technological giants in a Brave New World double think. Genetic engineering is touted as the

technological utopian solution to world poverty, without which future poor will starve. This rhetoric is very far from the truth. It is scientifically inspired totalitarianism in action. It needs to be arrested by a broad-spectrum ethical debate getting to the root of the human condition.

Monsanto, starting as a chemical company, has cornered a very significant portion of the world seed production industry and is intentionally marketing varieties designed to secure the continuity of its chemical industry by making roundup-resistant and similar varieties which can be used only with its own proprietary herbicides or pesticides. The development process is generally undertaken in secret with no advance ethical consideration (under plea of commercial sensitivity), the developed product is then forced on to the market and regulators lobbied by the industry giants on the basis that it will further the economy and that it will provide a strategic advantage for US-based growth industries. Aware of this the US government applies a combination of pressure and threats to other countries to try to force them not to label undermining efforts to regulate genetic engineering effectively in ethically democratic terms.

Regulators have been blatantly pressured into the position that it is practically impossible and too expensive to continue to discriminate between engineered and natural varieties, despite an exponentially growing market in organic foodstuffs in response to the continuing industrial pollution of natural food. Monsanto's roundup-ready soya beans are intentionally mixed with natural ones at source to make it impossible for the consumer to know or to choose. This approach back fired when Aventis' Starlink GM corn approved only for animal use extensively permeated the human food chain. A key requirement is the full and complete labelling of all retail food products to let the consumer know just which components are genetically-modified. The myth of substantial equivalence - the idea that a genetically-engineered variety is not really different from the natural, despite carrying key introduced highly active genetic products has been used as a smoke screen to excuse the un-restrained inclusion of GM food into the human product chain without declaratory labelling. This is a fundamental abrogation of the rights of the consumer. We are clearly able to distinguish artificial food additives from natural food, so the excuse that labelling is too expensive, or an impossible task, is an anti-democratic initiative from venture industries to foist GM products on the population.

NZ Herald 17 Nov 98 The US world drive for "unlabeled genetically modified food" The US threatened trade retaliation if NZ did not support the opposition to labelling GM food.

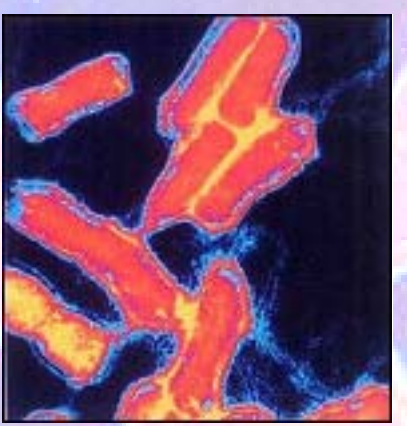


Moves are afoot to make a whole spectrum of substantially non-equivalent foodstuffs, such as potatoes containing toxins from the African clawed toad to inhibit soft rot. Such use of a toxic gene from an alien species is not substantial equivalence in any shape or form and constitutes the addition of a poison not currently consumed by humans into central staple foods, as is already the case with roundup ready and BT. varieties. Similar attitudes prevail toward the introduction of genes from other plants not consumed as staples such as potatoes with a lectin gene from jack bean, implicated in immune and

organ damage.

Many genetic modifications of food stuffs have subsequently proven to be unfortunate and damaging. The case of the allergenic Brazil nut protein genes spliced into soya to improve their amino-acid spread illustrates how difficult it is in practice to tell whether a modification is harmless or not. Testing for carcinogenic potentialities of foodstuffs can take up to 20 years, because of the intrinsically statistical nature of such investigations and the long time delays for such damage to show up.

Humans are converging from using a vast spectrum of dietary species in the gatherer-hunter phase to depend on ever fewer key species, which assume a disproportionate role in our diet. Soya beans are an example which, because of their high-protein content, permeate a vast variety of foods, from bread to many processed items. The use of unlabeled genetically-modified soya beans thus has a very pervasive impact on the whole human diet in diverse countries. Society needs to be able to make major qualitative ethical decisions as to how it wants to go about such transformation of its core foodstuffs. This is not happening. Venture industries and intellectual property rights are driving the entire process in secret and then through lobbying once the products become commercial. This is fundamentally anti-democratic and should not continue.



Modified salmonella can arrest certain tumors (New Sci. Oct 97)

High-tech Engineered Products

One of the more promising areas of genetic-engineering is in the restricted use of high-tech products to create new medicines and vaccines. These products do provide quite new and revolutionary potential for society and medicine and certainly deserve quite separate consideration from the modification of normal foodstuffs. However they also have very significant potential problems, if the modified varieties escape, or recombine, through pollen, or viral transfer, with their non-modified equivalents. Great care needs to be exercised to contain such varieties and prevent their escape into the wild.

A 'freaks gallery':

1. Goats genetically-engineered to produce spider silk as a high-tensile material.
2. Bananas genetically-engineered to carry vaccinations against specific diseases..
3. Maize engineered to become a human antibody factory.
4. Potatoes genetically-engineered to confer diabetes resistance.
5. Potatoes with genes for african clawed toad toxin to confer resistance to soft rot.
6. A virus against cabbage moth (white butterfly) containing a gene for scorpion toxin which could infect rare species of butterflies.
7. Biodegradable plastic lawns engineered from rape.
8. Tobacco which carries Hepatitis B antigens
9. Tumors arrested by genetically-engineered salmonella.
10. Cloned sheep carrying a gene for human clotting factor promising relief to hemophilia sufferers.
11. Dairy cattle with three changes: One would add extra copies of milk protein

genes, copied from goats or cattle, to boost casein, suited to cheese manufacturing. Another would insert the human myelin basic protein so myelin could be extracted from milk for treatment of rheumatoid arthritis. A third would produce a deletion of the gene that controls beta-lactoglobulin in cow milk. Beta lactoglobulin is the main whey protein in the milk of cows and many other animals, but appears not to occur in human milk. Variations in the type of lactoglobulin in milk can affect its suitability for manufacture of casein or cheese. At least two of the types of engineered cattle would also carry 'marker' genes for resistance to the antibiotic neomycin.

12. Sheep producing milk containing alpha-1-antitrypsin to treat emphysema.

Although the treatments may ultimately be beneficial to some, the needless inclusion of antibiotic resistance genes inside a mammalian physiology where they could directly infect bacteria pathogenic to mammals including humans is irresponsible.

Genetic patenting

Should a private business organization be able to hold patents on natural life forms and thus have a financial monopoly over our natural endowment? Some protection is needed for the development of specialized organisms for medicine, but how far should this privilege extend? Who takes responsibility for genetic diversity if patented food plant strains dominate commercial markets?

Intellectual property rights and the winner-take-all philosophy of free-market capitalism have grevious implications, not just for biodiversity and the rights of ethnic peoples, but for the future of all our genetic and food resources. The very concept of gene patenting has become a world political issue with the US failing to ratify the 1992 Rio Biodiversity Convention, because it wishes to keep the options open for US-based corporate giants to exploit to the maximum their venture capital appropriation of world genetic resources through gene patenting and the updated Biological Warfare Convention because inspections might undermine US corporate secrets. The recent entry into the market of a commercial competitor to the Human Genome Project Celera which is attempting to creme off the best human genes for advance patenting illustrates the irresponsible folly of intellectual property rights on a first-come take-all basis.

Genesis tells that God gave all species and the seed-bearing plants for the benefit of humankind as a whole and for all life. Patenting of natural genes or gene components, simply because they have a potentially unique exploitable use, overturns the fundamental ethics of altruism of humanity - to cherish and replenish the Earth for all beings. It abrogates the freedom of life on Earth as an immortal endowment and profoundly compromises the future of life by putting all life in bondage to intellectual property rights of the quickest exploiter of a potential resource, of the richest and the most unscrupulous venture capital exploiters in the world market.

I hereby call for a moratorium on the genetic patenting of any natural species, gene, gene fragment, or organism, pending an ethical decision made by the world's peoples as to how to best cherish the Earth and replenish her living genetic resources for the mutual and selfless good of all generations and for the biosphere itself.

Outlook

This issue ask of the unfolding genetic future - what are we going to become? Such a question in a sense cannot be rationally resolved because it requires prior insight to know which is the best course to take. It requires soul-searching, foresight and a sense

of conscience for that which has not yet evolved - for the eventual flowering of new life forms as yet unconceived. It is also a question of free creative choice. Humankind is going to paint a picture of itself and all the life-forms into the future. We stand with some genetic engineers trying to take exclusive hold of the brush of creation. It is up to us to make sure this painting is a rich endless unfolding and not a mechanistic technological nightmare.

Many of the most famous names in evolutionary biology and genetics talk like nineteenth-century mechanists in a way which would make Darwin horrified. Richard Dawkins and Francis Crick express attitudes which makes one wonder if they are conscious beings or merely robots of natural selection. Dawkins uses his own selfish-gene simplification of biology to propose a selfish ethic for human cloning. Their philosophy shows a very shallow understanding of the sentient mind. We are sentient beings, not just Darwinian automata. In short, neither hard scientists, nor old-time religions know how to handle this issue.

The future path of the seed requires soul-searching and ethical insight. The insidious march of the institutions, scientific and religious will have to be challenged throughout future history by the voices of prophetic conscience, the muse of civilization, warning against the many pitfalls that lie ahead and dreaming of the unfolding futures and their unforeseen potentials. The seed path needs continuing grass-roots support, consensual politics and great care to protect diversity against autocratic take-over, the tyranny of the majority and the tragedy of the commons.

Bioarmageddon

Anthrax bacillus

We are all alarmed at the prospects of nuclear holocaust, but the potential for a genetically-engineered biowarfare apocalypse is becoming realer by the day. While nuclear technology requires vast resources, a GM disease which could wipe out humanity could be engineered in a small private laboratory. Indeed the risk of a global epidemic destroying humanity is now the principal form of Armageddon. Genetic engineering opens up vast possibilities for splicing the most pernicious viral genes between such holocaust species as HIV, common cold, ebola and smallpox. Carcinogenic adenoviruses are already known in cats. While some of these viruses have differing replication strategies between DNA and RNA specialized and environmental niches, the possibilities for inducing a devastating world plague to which a few progenitors of this nightmare have selectively immunized themselves remains an almost unlimited Pandora's box. Bioarmageddon is a real threat which has been pursued to the testing stage in Russia with the outbreak of accidental anthrax deaths and in countries as contraposed as Israel and Iraq which admitted holding 2000 gallons of anthrax, enough to kill millions, and 5125 of botulism toxin.

Biowarfare poses completely new cutting-edge incentives which emerge from the

very nature of genetic technology because it provides the macabre option of selectively annihilating an entire population without making the habitat radioactive. Services and detection for biowarfare are only at a vestigial stage by comparison with nuclear defences and monitoring. Any serious outbreak of even a conventional disease is likely to completely overwhelm supplies of vaccines and medicines. The US currently holds 5 million doses of smallpox vaccine, insufficient to contain a hypothetical attack. Of the bacterial agents such as Anthrax, Russia has already produced specific antibiotic-resistant strains, rendering antibiotics potentially useless as a defence. Research is urgently going into quick investigation techniques using RNA analysis and rapid sequencing with the aim of developing some type-matched vaccine within 24 hours of an attack with a new engineered agent. Unlike nuclear and even chemical weapons, monitoring is much more difficult. Detectors are being researched which might detect agents directly from the air. Databases of disease outbreaks are also being set up to provide worldwide monitoring for signs of non-compliance internationally.

Marburg: A Tale of Russian Germ Warfare Research

"Ustinov had been doing basic military research on the Marburg virus, studying its potential as a weapon. The long-term goal was to see if it could be loaded into special biological warheads on the MIRV missiles that were aimed at the United States. (A MIRV has multiple warheads, which are directed at different targets.) At the time, the Soviet biological missile warheads were designed to be loaded with strategic/operational smallpox virus, Black Death, and anthrax. The Marburg virus had potential for weaponization, too. Marburg is a close cousin to the Ebola virus, and is extremely lethal. Dr. Ustinov had been wearing a space suit in a Level 4 hot lab, injecting guinea pigs with Marburg virus. He pricked himself in the finger with a needle, and it penetrated two layers of rubber gloves. Nikolai Ustinov exited through an air lock and a chemical decontamination shower to Level 3, and used an emergency telephone to call his supervisor. The supervisor decided to put Ustinov into a biocontainment hospital, a twenty-bed unit with steel air-lock doors, like in a submarine, where nurses and doctors wearing space suits could monitor him. He was not allowed to speak with his wife and children. Ustinov did not seem to be afraid of dying, but, separated from his family, he became deeply depressed. On about the fourth day, Ustinov developed a headache, and his eyes turned red. Tiny hemorrhages were occurring in them. He requested a laboratory notebook, and he began writing a diary in it, every day. He was a scientist, and he was determined to explain how he was dying. What does it feel like to die of Marburg virus? What are the psychological effects? For a while, he maintained a small hope that he wouldn't die, but when his skin developed spontaneous bruises he understood what the future held. Dr. Sandakhchiev's cryptograms to Alibek were dry and factual, and didn't include the human details. Alibek would later learn that perhaps twice Ustinov had broken down and wept."

"The Marburg virus seems to live in an unknown animal host in East Africa.... In 1967, the virus had broken out at a vaccine factory in Marburg, a small city in central Germany, and had killed a number of people who were working with monkeys that were being used to produce vaccine.... I have seen a photograph of a Marburg monkey worker taken shortly before his death, in late summer, 1967 ... a stout man, lying on a hospital bed without a shirt. His mouth is slack, his teeth are

covered with blood. He is hemorrhaging from the mouth and nose. The blood has run down his neck and pooled in the hollow of his throat. It looks spidery, because it's unable to clot. He also seems to be leaking blood from his nipples. The final pages of Dr. Nikolai Ustinov's scientific journal are smeared with unclotted blood. His skin developed star-like hemorrhages in the underlayers. Incredibly-the Vector scientists had never seen this-he sweated blood directly from the pores of his skin, and left bloody fingerprints on the pages of his diary. He wept again before he died. Ken..... Dr. Ustinov died on April 30, 1988. An autopsy was performed in the space suit morgue of the biocontainment hospital. If this was indeed the Popp strain of Marburg virus-and who could say? - It was incredibly lethal. It produced effects in the human body that were stunning, terrifying. Alibek says that a pathology team removed Ustinov's liver and his spleen. They sucked a quantity of his destroyed blood, out of a leg vein using large syringes. They froze the blood and the body parts. They kept the Ustinov strain alive and continually replicating in the laboratories at Vector. They named the strain Variant U, after Ustinov, and they teamed how to mass-produce it in simple bioreactors, flasks used for growing viruses. They dried Variant U, and processed it into an inhalable dust. The particles of Variant U were coated to protect them in the air so that they would drift for many miles. In late 1990, Biopreparat researchers tested airborne Variant U on monkeys and other small animals in special explosion-test chambers at the Stepnagorsk plant."

Biological Toxins

disease	agent	symptoms
aflatoxin	Aspergillus flavus	nausea, vomiting, liver failure, cancer
anthrax	Bacillus anthracis	high fever, bloomed breathing, rapid heartbeat
botulism	Clostridium botulinum	nausea, fatigue, cramps, headache, respiratory paralysis
plague	Yersinia pestis	lung infection, pneumonia, haemorrhage
ricin	Ricinis communis	convulsions, stupor, vomiting, bloody diarrhoea

"Marburg Variant U proved to be extremely potent in airborne form. They found that just one to five microscopic particles of Variant U lodged in the lungs of a monkey were almost guaranteed to make the animal crash, bleed, and die. With normal weapons-grade anthrax, in comparison, it takes about eight thousand spores lodged in the lungs to pretty much guarantee infection and death. Alibek said that by the fall of 1991, just before Boris Yeltsin came to power, Marburg Variant U was on the verge of becoming a strategic/operational biological weapon, ready to be manufactured in large quantities and loaded into warheads on MIRVs. ... Variant U never became part of the Soviets' strategic arsenal, which was stocked with Black Death, Alibekov anthrax, and powdered smallpox. Never less than twenty tons of weapons-grade dry smallpox was stockpiled in bunkers." (New Yorker 9 Mar 98).