

# PLAYING GOD WITH THE GENETIC CODE

by Jeremy Rifkin and Andrew Kimbrell

Besides its highly questionable health, ecological and socio-economic consequences, genetic engineering could mean the end of the natural world as we know it.

is, along with the nuclear issue, the most important ever to face the human family. We have heard much of late about the benefits of this great revolution in technology. We are long past due for a discussion of the costs. The full-scale use of biotechnology in military research, agriculture and industry, and in human reproduction and health, raises environmental, economic and ethical concerns that are without parallel.

### Environmental Risks

The biotechnology industry is preparing to release scores of genetically engineered viruses, bacteria, plant strains and transgenic animals into the environment in the next few years. In coming decades, hundreds, even thousands, of genetically engineered life forms may enter the world's ecosystems in massive commercial volumes. A central question that must be answered prior to any large-scale releases of biotechnology organisms into the environment is what risks such products pose to human health and the earth's ecology.

Because they are alive, genetically engineered products are inherently more unpredictable than chemical products. Genetically engineered products can reproduce, mutate, and migrate. Once released it is virtually impossible to recall these living products back to the laboratory. A survey of 100 top scientists in the United States acknowledges the potential benefits of genetic engineering, but warned that its imprudent or careless use... could lead to irreversible, devastating damage to the ecology.

Moreover, environmental scientists have compared the risk of releasing biotechnology products to those we have encountered in introducing exotic organisms to North American habitats. While most of these organisms have adapted to our ecosystems, several such as Chestnut Blight, Kudzu vine, Dutch Elm Disease, and the

Gypsy moth, have wreaked havoc on the environment. The long-term cumulative environmental impact of the deliberate release of thousands of genetically engineered organisms could be devastating. The sensible approach now being undertaken in Japan and several European countries is to have a moratorium on the deliberate release of any and all genetically engineered organisms until such time as a 'predictive ecology' can be developed which will be capable of adequately assessing the effect that these organisms will have on the environment.

### Socio-Economic Dislocation

The use of biotechnology creates the potential for considerable social and economic dislocation, espe-

cially in the American and international farming communities. Even a single biotechnological product can have significant adverse impacts. A timely illustration is the recent research and development of bovine growth hormone (BGH). When injected into cattle on a daily basis, this hormone, cloned through genetic engineering, can increase milk production by at least 30% per dairy cow. Because of the already flooded milk market BGH poses a serious threat to dairy farmers. It has been estimated that milk prices may fall 10-15% within the first three years of the introduction of BGH. It has been further estimated that the number of dairy farmers may have to be reduced 25-30% to restore market equilibrium. Additionally, a congressional

report concluded that the use of BGH could cause an historic shift in American milk production from the traditional, smaller dairy farms in the Northeast to larger dairy farms in the West. These dislocations, and problems resulting from similar biotechnology products, will have dramatic social, economic and cultural effects unless the dissemination of genetically engineered products is strictly controlled both nationally and internationally.

**Ethical Considerations**  
The use of biotechnology creates profound and difficult ethical questions. Its use in reproduction and genetic screening brings unique questions of discrimination, exploitation of women, and the prospect of a commercial eugenics. Moreover, genetic engineering is being used to revolutionise biological warfare through the creation of 'novel' viruses and bacteria that could have catastrophic effects and initiate a genetic arms race.

Most worrisome is that scientists are crossing species boundaries at an ever increasing rate, inserting human genes into animals, and animal genes into other animals and plants. Many recent achievements sound more like science fiction than science fact. For example, scientists have taken the gene that emits light in a firefly and inserted it into the permanent genetic make-up of a tobacco plant; the tobacco leaves light up 24 hours a day. Researchers have inserted human growth hormone genes into the genetic code of rats and pigs; the rats grow twice as fast and twice as big as normal. Scientists have fused sheep and goat cells, creating the geep, a half-sheep, half-goat chimera.

Should biotechnology be allowed to play God, crossing human genes into animals and animal genes into plants? These techniques go far beyond any traditional breeding of animal or plant species. Cross-species genetic transfers may be the



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ultimate offence to the dignity and integrity of the biotic community. Prolonged and expanded use of these cross-species engineering feats could mean the end of the natural world as we currently know it.

Recently the Patent and Trademark Office of the US granted the first patent on a genetically engineered animal. This regulatory edict, the first-ever commercial patent on animals, reduced genetically engineered animals to the status of manufactured products. This decision bodes ill for the future. Will succeeding generations of children grow up in a world where the genetic codes of plants, animals and humans are interchangeable and living things are programmed as engineered products with no greater intrinsic value than automobiles or toasters?

### Conclusion

Before we allow the biotechnology industry and the scientific community to push society headlong into the biotechnology revolution, the American and international communities need to give thorough scrutiny to the long-term environmental, economic and ethical issues raised by this powerful new technology. It is now clear that when society commercialised the nuclear and petrochemical revolutions, it did so without first resolving the 'hard' questions about the ultimate impacts of those technologies. As a result we are now confronted with a huge environmental and societal bill including undisposible nuclear waste, toxic waste dumps, acid rain, the 'greenhouse' effect, and ozone depletion.

Let us hope that the world's leaders have learned from these mistakes and this time, with biotechnology, will raise the important questions before rather than after the damage is done. Only through this kind of foresight can we assure that human choices will dictate the growth of technology rather than technology controlling the future of humans. — Third World Network Features

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# Science Briefs

## Aeronautics



The new Airbus A321 is assembled in Hamburg. It is the ideal aircraft for short and medium distance flights with relatively large numbers of passengers: the new Airbus A 321 can carry a total of 186 passengers over a distance of 4,350 kilometres.

The first passengers are particularly appreciative of the high standard of comfort, while aviation experts are bowled over by the air liner's efficiency and advanced technology. The A 321 is also the first passenger aircraft with more than a hundred seats to be assembled in Germany. In the new 'Otto Lilienthal Hall' in Hamburg (building costs: 100 million marks) the individual components are carried to their assembly points on cushions of air. As a result, production — from the delivery of the components to final assembly and test flights — only takes an average of 46 days. From 1996 onwards sixty of this new type of Airbus will be assembled annually in Hamburg, which has thus become another centre of the European aerospace industry alongside Toulouse. The orders list is topped by Alitalia, followed by German Lufthansa and Swissair.

## Solar energy



A new kind of solar house turns with the sun.

Theddo Terhorst, the Rheine-based architect, had a sudden flash of inspiration while he was on holiday in the south France. He noticed that sunflowers' blossoms always follow the sun. 'Sunflowers always face the sun at just the right angle so that they absorb the optimum amount of energy.' The architect, who has been working on energy-efficient buildings for some time, took an immediate liking to this idea.

He used the 'sunflower principle' as the basis for constructing Europe's first revolving solar house at the technology centre in Rheine. The technology involved functions in a similar way to a turntable at a shunting yard. The house stands on a concrete platform which is mounted on circular rails.

A twenty watt motor in the cellar moves the approximately 180 tonne house, which silently and almost imperceptibly travels a few centimetres every five minutes, always following the curve of the sun. At night the house is automatically moved back to its starting position. The house's pyramid shape also means that the garden does not have to be crammed full of solar technology.

The solar panels are evenly distributed around the roof where they collect enough solar energy to power not only the house's electrical appliances and lighting system, but also the turning mechanism itself. Additional solar energy is accumulated in a cellar storage unit which can distribute heat through pipes in the floors and external walls. The colourful house in Rheine cost roughly DM 450,000 to build.

The output of its solar cells is twice as high as that of a conventional solar building. The house is also rather luxurious. The windows in the roof can be opened to form small balconies, and you have a direct view of the sky from the bedroom, which is located directly beneath the top of the pyramid.

## Virtual reality



Darmstadt offers trips through computer worlds.

Martin Gobel, project manager at the Fraunhofer Institute for Graphic Data Processing in Darmstadt, has a great deal of faith in computers. He is sure that the new technology of virtual reality will come to be more than just a kind of Disneyland for computer freaks and that it will soon gain a permanent place in working life.

Interested parties can find out how this technology works in Darmstadt. The man in front of the monitor looks as though he cannot make up his mind whether he wants to be an astronaut, a skier or a diver. Wearing a rather bulky helmet and a dataglove, he stands somewhat awkwardly in front of the screen and occasionally moves one or two fingers or his head.

This person does not really look as though he is capable of doing anything at all and yet he has just completely reorganised the arrivals hall at Riyadh Airport. Using the dataglove, his oversized hand floated through the hall, silently and effortlessly moving furnishings around until eventually the interior of the building had been completely re-arranged.

Virtual reality technology allows humans to intervene in computer worlds, to move objects, modify colours and shift perspectives. 'This world inside the computer' enables architects to walk through the cities they are planning and move their proposed high-rise buildings to and fro as they please. Designers can change colours with a single movement of the hand. It is conceivable that one day tourists will be able to try out potential holiday destinations in advance using a computer.

The furniture-moving exercise in Riyadh is only one of the many examples which the Fraunhofer Institute for Graphic Data Processing is using to demonstrate the advantages of techniques of this kind.

## Industrial materials



Malleable and bendable ceramic materials have been developed in

Saarbrücken. Scientists at Saarbrücken's Institute for New Industrial Materials have recently developed what they refer to as 'nano powder'.

It consists of almost unimaginably small ceramic particles, billions of which would fit on the head of a pin. The ceramic particles are surrounded by an extremely thin lubricant film which ensures that the individual particles do not stick to one another but are able to move freely. This produces rather surprising results.

The new industrial material can be forged, rolled and bent without breaking. In the future ceramic materials of this kind could, for example, increase the performance of car engines, power station turbines and aircraft, and eventually even be used to find a substitute for heavy and environmentally harmful lead batteries.

## Superconduction



Superconducting SQUIDS can locate brain disorders and

cracks in concrete. Johann Hinken, the Jülich-based scientist, no longer regards high-temperature superconduction (when electricity flows through a loop without resistance at 35 degrees Kelvin) as a purely theoretical possibility. His SQUID chip can be used to monitor brain waves or detect the finest cracks in buildings. In SQUIDS (superconducting quantum interference devices) electricity flows through a loop without resistance. When a magnetic field enters this loop, a quantifiable drop in voltage occurs. SQUID sensors are so sensitive

that they are able to register magnetic fields twenty million times weaker than the earth's magnetic field.

# AN ELECTRIFYING BREW

WHAT'S cooking, good looking? A lot more than traditional Scottish porridge; these two campers are brewing their own electricity supply.

It is the latest device that could aid campers, caravanners, yachtsmen, surveyors, oil men and a host of others who may get stuck out in the wilds. Just heat one side over a gas ring or a flame and it will produce about 20W of power at 12V... more than enough to power a small TV set or charge a battery.

The Thermo Electric Generator, developed by Dr Willie Duncan at Glasgow University, Scotland, can be heated to about 600°C by a Butane source on one side, while the other surface is clamped to a water or convection cooled heat sink.

Brewing electricity over a camp fire is a new technology. Dr Duncan believes that his device is ahead of others that are under development and which he claims are limited to 250°C... and are frequently damaged by overheating. This is said to restrict them to about 1.5V without special circuitry.

This novel mini-power generator exploits a temperature difference of about 500°C across the semiconductor material in the cigarette-sized device, converting thermal energy directly into electrical energy.

It is a technology that is still under development. Tests have proved that it will work but more development is needed to produce a product for the mass market with a target price for the complete assembly of about £50... making it a cheaper option than solar energy.

The device uses hundreds of tiny silicon thermocouples connected in series. Connecting them is the tricky bit, so surface mount technology has been used to fix the ends of the thermocouples to printed circuit boards. A ceramic plate is bonded to the face which is subjected to the heat source. Suitable heat sources are liquid gas, coal and wood.

One possible application in the longer term is in replacing alternators in cars. Alternators are relatively cheap, but deliver a higher current on load which is only needed for a relatively short time while the car is running.

With a thermo-electric charger driven from the exhaust, it might be possible to eliminate fan belts and all the mechanical ancillary parts associated with the alternator, and increase engine performance.

The device is now in limited production in Glasgow. The first prototype was built by the Electronics and Electrical Engineering Department of Glasgow University, as part of a three-year project for the Ministry of Defence. — LPS



# Biggest Melon Gene Pool

## Threatened

by Nestor Cervantes

'superior horticultural characteristics'. FAO cited three with gold skins and one green skin honeydew.

In what may be a major innovation, a watermelon with approximately 75 per cent fewer seeds than standard watermelons has been developed at MRI, the UN experts noted.

Today, the gold skin honeydew varieties, developed by MRI, comprise over 85 per cent of the total honeydew melons planted in this province. The seed use melon variety, released in 1989, now accounts for 50 per cent of the seed use melons planted.

FAO urged increased emphasis on incorporating disease resistance into the institute's breeding programme.

'MRI should produce sufficient disease-free melon seed to meet growers' demands. Impediments such as inadequate land, equipment, or labour, simply must be corrected.

Under its Technical Cooperation Programme, FAO provided disease-resistant varieties and breeding lines for MRI. These were evaluated in 1990 and the best adopted were used in the next year's breeding programme.

'Gansu and surrounding provinces have what is probably the largest melon gene pool in the world,' they wrote in a report to Beijing.

Genes are the 'building blocks' of plant and animal life. These are found in Gansu melons, which evolved over the years, and today are in danger of becoming extinct.

One reason is Gansu melon farmers are shifting to new high-yielding varieties, some of them developed in the laboratories of MRI.

'Saving the genetic diversity, available in the old landrace melon varieties is extremely important and should begin immediately,' the FAO team observed. 'Each variety should be identified, any outstanding characteristics and disease resistance noted, and seed preserved for future use.'

(In like manner, international institutes carefully save seeds of rice varieties, wheat, corn, potatoes, etc. in seed banks to conserve their genetic material.)

The FAO team noted that plant disease, poor post-harvest handling and lack of adequate marketing structures severely slice into the income of Gansu melon growers.

Insects, specially aphids, inflict severe losses. And post-harvest losses often exceed a staggering 50 per cent.

Even those melons that are not lost to decay would often not be marketable by Western standards, because of excessive bruising,' the UN agency observed.

The Institute has effectively developed new melons with

incorporation of these introduce disease-resistant genetic material into the existing gene pool of the MRI, should boost the rate at which 'superior disease-resistant melon varieties can be developed', the FAO report predicted.

The UN team urged government to increase MRI's ability to produce sufficient high quality melon seed. FAO-provided equipment will allow MRI to increase its seed output by 500 per cent. But demand for seeds will skyrocket in the future.

Science-based skills will ultimately be the key to modernising Gansu's melon farms. FAO, therefore, assisted in training 50 specialists, in crop protection, genetics, improved seed quality, and crop improvement. And the UN agency sent three specialists for advanced training in Australia and the US.

But the link between laboratory and farmers remain extension agents who need to increase their contact with the area's farmers, especially the neglected peasants.

Due to the vastness of the area, and the large number of growers who need assistance, additional methods must be utilised to distribute technical production information, specially through printed literature,' FAO concluded. — Depthnews Special

# Time may run backwards

by Md Lutfor Rahman

TIME might run backwards, if the expansion of the universe halts. This was suggested by some physicists. But this idea is now in problems.

It is impossible for the universe to begin in an uniform state with matter spread evenly through space, go through a cycle of expansion and collapse, and end up uniform again. This was obtained by Mr. Raymond Laflamme of the Los Alamos National Laboratory in New Mexico, USA.

He finds that the universe could start out disordered, expand, and then collapse back into disorder. But NASA's COBE satellite observations tell us that our universe was born in a smooth and uniform state.

The two distinct 'arrows of time' both point in the same direction have puzzled the physicists. In the everyday world, things wear out, cups fall from tables and break, but broken cups never re-assemble

themselves spontaneously. So here the arrow of time points in the direction of increasing disorder. In the expanding universe, the arrow of time points in the direction of increasing separation of galaxies.

Long time ago, Mr. Thomas Gold suggested that these two arrows might be linked. If they are and the expansion of the universe were to reverse, then the everyday arrow of time would also reverse, so broken cups would re-assemble themselves. These ideas have been extended into quantum physics.

Murray Gell-Mann of the California Institute of Technology in Pasadena and James Hartle recently extended this idea to the whole universe. They argued that if the universe was born in a big bang and will expand in a finite time before collapsing into a crunch, the 'time neutral' quantum theory could describe time running backwards in the contracting half of the Universe's life.