Chapter 4

Biotechnology, Biopiracy, and the Mentality of Science

At the heart of these gatherings throbs the conviction that the Earth and what it gives rise to are sacred and that technological interventions to often desecrate the land and its life. This conviction is variously expressed through plain animism, the science of ecology, respect for the creation, the Conservation Movement, ecophilosophy, aesthetics, and evolutionary biology. The qualities of wildness, the integrity of landscape, the spontaneity of DNA are all sacred, aspects of the holy Earth. Arguments against further destruction of, or attempts to remodel, these bases of existence are among the most radical and essential positions of our technology criticism.

Diverse and compelling arguments against biotechnology were made at both the 1993 and 1994 conferences by Vandana Shiva, Jeremy Rifkin, David Suzuki, Andrew Kimbrell, Martha Crouch, and Beth Burrows. Because Vandana and Andrew spoke on the subject at both meetings, I have consolidated each of their presentations slightly. All of the presentations on biotechnology are grouped in this chapter.

From the Third World perspective, what makes biotechnology so epochally threatening is the drastic extent to which it permits the privatization of life forms, and of the qualities of life forms. Vandana Shiva and Beth Burrows detail the politics and the economic implications of patenting genetic material and the way the doctrine of intellectual property rights is invoked to sanction this expropriation of organisms and traits.

In the developed world, biotechnology as a means is usually justified by its ends, particularly insofar as those ends promise a reprieve from morbidity and mortality. Lately even unfashionability is subject to "cure" by genetic engineering. Andrew Kimbrell, David Suzuki, and Jeremy Rifkin explore the eugenic future biotechnology portends: a future wherein human beings will be evaluated in terms of their genetic readouts, where correlation will be confused with causation, and where biotechnological cures will be sought for traits in social disfavor ("like Luddism, " quipped one wag).

Martha Crouch, a "deprofessionalized" biotechnologist, critiques the pursuit in toto: It's globalizing, the focus on DNA's linear sequence is effacing the diversity of organisms, it entails a cult of experts and an industrial infrastructure, and it "delays the creativity of living within limits." And in addition to its fundamental hubris, ANDREW KIMBRELL and DAVID SUZUKI note, biotechnology has appalling potential as weaponry—to be "the poor man's nuclear bomb"—one that could be tailored to afflict only certain ethnic groups or staple crops. This, truly, is a mega technology that holds the potential to annihilate the integrity and commercialize the essence of life itself.

Vandana Shiva begins: When genetic engineering started, it used to be called that. Somewhere along the way, the public found this concept disturbing, so genetic engineering was renamed "biotechnology." Every biotech report begins by saying, "Bio technology is a wide range of technologies from bread and brewing to the new technologies." Because no one has died of drinking beer or eating bread, "biotechnology" has become a deliberately confusing term that confounds the benign agricultural and food-processing technologies that worked wit biological organisms with the new risk taking of genetic engineering.

Even prior to the emergence of specific applications, biotechnology is restructuring the way we think, the values we live by, and our imaginings. The new DNA language is becoming a basic mode of talking about the living world, which includes us. The DNA language has the power and the capacity to wipe out the history of the problems we suffer and to obscure what really needs to be done to deal with them. This is not an accident.

The real achievement of the new biotechnologies is that social control is so much a function of the fragmentation of living systems. What you are imagining is choice, but what is happening is control. You may have u read about pharmaceutical companies investing in the human genome project. All the scientists have done is DNA screening of the human genome, but converting those bits of our life into DNA language becomes in effect the creation of life, and those fragments are made available by appropriation for the pharmaceutical industry, which is already starting to bid for patents and control.

DNA language then creates property for one group of people.

When the biodeiversity Convention was being drafted, there was only one mention of generally engineered organisms. Thanks to U.S. lobbying, it now reads "living modified organisms," meaning anything that has been modified. All selection for agriculture or forestry modifies organisms. With biotechnology amorpously redefined, the technologies of the South, of communities that have employed organisms in all kinds of ways, have just disappeared—at least from being named in discussions of technology transfers. These technologies get used all the time, though, because biotechnology as the new genetic engineering is working on terrain that it has no knowledge about. We've worked with chemicals so far. We've worked with machines. The engineering of life still needs some kind of guidepost. The guidepost comes from indigenous knowledge, from interviews with native farmers who know that this is a drought-resistant wheat or that a particular sorghum doesn't get disease or that a particular herb has this property to cure illness.

Now that predation is being called prospecting." But biological organisms are not like oil. They're not raw materials. They are things complete unto themselves with a life, identify, and intrinsic worth. Genetic engineering is turning life, biodiversity, into mere raw material through a misplaced agency. The properties come from nature and from centuries of village utilization of biodiversity. It's made to appear as if the desirable property is being created in the lab, whereas all that's been done is a relocation.

The biotechnology metaphor creates an imperative; makes trade the basic logic of existence. If genetic material can be moved around, then it has commodity value. If it remains in the organism, it has none.

Recent amaranth has been patented and genetically modified. Amaranth is a grain that needs next to no inputs. You can put it in drought areas and amaranth will still give you four tons of seed and of leaf per hectare. It's highly nutritious. A genetic engineer found that amaranth has high protein, so he's making transgenic rice and transgenic wheat with the protein characteristics of amaranth. As usual, the announcements are that we will solve the hunger problem. In reality, the introduction of transgenic rice will displace complex polycultures of as many as twelve crops together, which are already giving high yields. Transgenic rice requires about eight times as much water as traditional varieties and ill require pesticide because it's an introduced species. It will produce far less nutrition overall than the original amaranth would have. Part of what the transgenic twist does is change the measure of the crop's merit: Protein in rice becomes the measure, whereas the measure should be protein in amaranth. Meanwhile, we've lost calcium, iron, and water. But because we've put protein in a place where it didn't belong, there's a sense of progress, and achievement, even though what's actually happening is a destruction.

In the new reports coming out of the United Nations Environment Programme or the United Nations Conference on Environment and Development or the General Agreement on Tariffs and Trade, what used to be a language of "rights to biodiversity" shifted quickly to "access to biodiversity" and is now "trade in genetic resources."

To talk of patents on life creates resistance, so the phrase is "patents to biotechnological invention." And what is merely a relocation of a fragment of life from one organism into another organism becomes a claim to the very reproduction of that organism and its future generations. In terms of formation of property, this is vastly greater than anything the enclosure of the commons could have achieved. It redefines living diversity with which cultures have always interacted, particularly domesticated crops, animals, and medicinal plants, into the realm of raw material.

Through the passing of knowledge from generation to generation, through building on all the surrounding diversity, the multiple technologies of the South have built very diverse agroecologies according to local conditions. Now such technologies are redefined into raw material. The technologies of sustainable agriculture, of knowing the uses of hundreds of medicinal plants, are devalued and erased. The capacity for communities to use their living knowledge is erased. That knowledge and that material disappear into a trade system.

I was invited to an area in India, which is a center of diversity for rice, where they were launching a campaign against patenting and GATT and free trade. I was there on the day of a festival that begins the agricultural season. On that day, all the villagers, hundreds of families, bring their seed in beautiful cups made of leaves to the village god, which is just a rock under a tree. Each of those cups contains a different variety of rice. Through this amazing ritual they mix them up. Then the local

priest, who is also the healer, distributes this mixed rice back to everyone. The ritual serves to erase the notion of private property, to honor diversity while doing agriculture, and to recognize that diversity makes its play only when it is given a chance to mix around.

Genetic engineering is really truncating time. By denying the history, denying where property came from, not recognizing it in nature, and not recognizing it as the contribution of Third World communities, by claiming it was created in the lab by white men in white lab coats, genetic engineering is reducing the past.

It's truncating future time, too, because the technologies are meant to end the production of life. If you take hybridization as a technology, for instance, its objective is to prevent seed from giving seed, to stop life from producing on its own terms. Patenting has the same objective except that it's through legal, rather than biological, instruments. Either way, you've killed the ability of nature to multiply its own seed ten thousand fold. That is a most crucial issue of sustainability.

Denial of the past is encapsulated in the notion of intellectual property rights. Native seeds have lovely names. They tell you which village they come from. The seeds carry memory and they carry gratitude. The new seeds deny both. The intellectual property-rights notion says we have originated these properties.

This assumption of creation is where the intellectual property rights notion comes in. genetic engineering has first to create a monopoly situation. Without intellectual property rights, genetic engineering fails to compete.

Piracy is a dominant metaphor of the biotechnology domain. In the last month, two Germans were arrested at Delhi Airport for attempting to take 30,000 insects out of the country. Every bit of life is now raw material. There will be patents on the soil bacteria from shovelsful taken from the tropical countries. Another example is the Indian neem tree. We've had knowledge of its medicinal properties and its use as an agricultural pesticide for centuries. Now there are patents on the biopesticide use of them. So neem, which used to be available in every village, is being captured by the corporations that have the patents and are setting up factories everywhere. The cost of neem seed, from which the medicinal oil comes, has shot up more than one hundred fold. Now there's no neem oil available in local markets.

For us in India, the freedom of the seed—defined as the freedom of wilderness in the seed—has become the key issue. We don't see it as geographic. Wilderness is the ability of life to reproduce on its own terms. Wilderness means supporting communities that elf-organize, that produce in their own terms what is necessary according to their own sense of values.

People know that our forest commons was stolen. They grasp the parallel: Our seeds as commons are being stolen through this notion of intellectual property rights and patenting. And the farmers are on the streets now protesting this issue. We've had demonstrations against Cargill—the world's biggest private corporation—which controls 70 percent of the seed trade of the world. The chief of Cargill has remarked that Indian farmers have had no genetic resources, that without Cargill (which came to India in 1988) we would have starved. He also touted brilliant new technologies that stop the bees from usurping the pollen. The farmers have taken that on in a big way—they say, "We are fighting for our freedom and the freedom of the bees—and the freedom of the seed-it's everyone's freedom we're fighting for—against the freedom of Cargill to create monopolies." This march [1993], 200,000 farmers came to Delhi, in spite of a ban on their rally, to protest against patenting. And that movement carries on. I don't think rural India can be stopped on this issue.

We're having tremendous conflicts within the scientific community in India right now. How do you retain for communities the rights, the capacity, and the continued use of their traditional agricultural knowledge, and its diversity as well? Our scientists have gotten sucked into the world of biotechnology and feel that they are denying value to their patent that indigenous knowledge. It's quite clearly a transfer of knowledge and power to the corporation. Yet many scientists are thinking they're somehow empowering the community by usurping this birthright of diversity.

The poor sleep on the floor; they have one sari, nothing more. Yet every year they put aside something for the birds in the rainy season when the birds can't find grain. It's that largeness of heart that seems to be lost every time we go for the wrong notion of growth and the notion of abundance as being something that's created by technology.

Intellectual property rights and genetic engineering are both denials of rights of species and rights of other cultures. Life cannot be owned.

ANDREW KIMBRELL brings to our attention the reality that the large capital investment required to genetically engineer a novel organism requires that scientists develop methods of cloning organisms. Natural reproduction is inadequate in that it allows for unplanned genetic material to enter the germ line of the offspring of genetically engineered organisms. Cloning technique is well advanced, and the cloning of larger animals, even human beings, has begun.

He also talks about the slippery patenting slope. In 1980 courts allowed the patenting of a genetically engineered bacterium. Now plants, animals, human cells, genes, and tissues have been patented. Most patented life forms have been genetically engineered, but recently the Patent and Trademark Office allowed the patenting of animals merely infected with a disease. He says this raises the question, "What are the limits of patentability?" He proceeds: Biotechnology is based in genetic engineering. What is happening here is the application of traditional engineering standards, quantifiable measurement, predictability of outcome, standardization, and utility to natural living substance, including genes. Just as our industrial-age predecessors soldered and molded and heated inanimate matter to crate the machines and products of the industrial age, we're editing, programming, recombining, and deleting genetic material to create the new living products of the age of biotechnology. Scientists have mixed and matched the genes of microorganisms, plants, and animals and created hundreds of thousands of novel life forms in the hopes of finding more profitable organisms for agriculture or research. Since natural reproduction is not efficient, they are also now cloning their newly created creatures. Cloning allows for producing life forms in industrial amounts. Biotechnology is based in a reductionist, mechanistic view of life. In a recent keynote speech, Dr. Robert Haynes, president of the 16th International Congress of Genetics, firmly reminded his audience that the doctrine of mechanism is the central organizing principle of the age of biotechnology. He said, "For 3,000 years at least, the majority of people have considered that human beings were special, were magic. It's the Judeo-Christian view of man. What the ability to manipulate genes should indicate to people is the very deep extent to which we are biological machines. The traditional view is built on the foundation that life is sacred. Well, not anymore. It's no longer possible to live by the idea that there is something special, unique, or even sacred about living organisms."

Haynes's proclamation was not some isolated view. Genetic engineering has really propagated the concept that all living things are biological machines. A few years ago we organized a religious coalition to fight the patenting of life and had a press conference. The religious leaders objected to the Patent Offices, legally defining life as a machine or manufacture, and therefore patentable. In response the New Your Times ran a lead editorial against the religious coalition, title "Industrialized Life." The editorial said, "Life is special, humans even more so. But biological machines are still machines that now can be clone, altered and patented. The consequences will be profound but, taken a step at a time, they can be managed." Biotechnology's revolution in the way we think about life is simply the ideological underpinning of the current massive engineering of virtually every segment of the biotic community. We can observe biotechnology's invasion into life in three general areas: its use in warfare, agriculture, and human health and reproduction.

Most are unaware of biotechnology's military role; perhaps the key moment in modern history was when the military got nuclear technology. Many in the world got their first horrific glimpse of the nuclear technology revolution when the bombs were dropped on Hiroshima and Nagasaki. It took a long time for the nuclear industry to shake off this image, which they originally tried to do in the 1950s with the "Atoms for Peace" propaganda campaign.

We've had the opposite problem with biotechnology: It's been used for warfare since its inception, but almost nobody notices.

This newfound ability to recombine or delete genes from organisms did no escape the notice of the Department of Defense. Since the early 1970s when Nixon signed the International Convention against Biological Warfare, the U.S. drastically reduced its funding and research in this area. But in the early 1980s Reagan's Secretary of Defense, Caspar Weinberger, realized that there was potential in biotechnology to begin a whole new era in biological warfare research. He began a significant and well-hidden expansion of the U.S. biological warfare program. During the Reagan-Bush years, over $120 million a year was being spent on biological warfare research in over 100 labs across the country. They were taking the most dangerous pathogens known to humankind—the plague, anthrax, botulism, snake venom—enhancing their virulence often through

genetic engineering, and then cloning large amounts of these new biological weapons.

The department of defense insists that all this genetic engineering of biological warfare agents is really defensive. We have to do it in order to find cures if some other country decides it will genetically engineer pathogens. They do admit that in the early stages there is no distinction between offensive and defensive use, since you have to come up with a new biological agent in order to find the antibiotic or antiviral agent that will stop it. In reality, with genetic engineering you can make endless changes to disease, causing organisms to avoid any interventive attempt. The idea that even spending billions would provide for cures is ridiculous. What we are seeing then is a new arms race—the genetics arms race—where nations are using biotechnology to create thousands of new pathogens targeted to people, animals, or plants. It is a very scary scenario, and international action to halt it is urgently required.

We have been able to stop some of this research. We successfully litigated against certain of these laboratories because they had failed to prepare environmental assessments, and these labs were working on incredibly dangerous organisms in some of the most populated areas in the United States. That program has also been trimmed somewhat by the Clinton administration under the force of our litigation and by some very careful scrutiny by the Congress. The Persian Gulf War showed that while we were spending billions on exotic genetically engineered biological warfare agents we did not have vaccines against simple basic biological warfare agents. Bu the U.S. is still leading the world into the new genetic arms race, and this must be stopped.

Another major area of public and private investment in biotechnology is in the agricultural sector. Agricultural use of biotechnology is very wide ranging. In general terms the idea is to genetically engineer microbes, plants, and animals to make them more efficient for agriculture. Years ago scientists debated the ethics of genetically engineering plants and animals with foreign genes. Did we have the right to alter permanently the genetic inheritance of plants and animals at will? I argued against it, as did many of my colleagues. We lost. Soon the government was spending billions of our taxpayers' money on permanently altering the germ lines of animals and plants. And this investment was being matched by biotechnology companies. In one well-reported example Dr. Vernon Pursel inserted the human growth gene in a pig. Pursel hoped to create giant pigs that would be major meat producers. The problem was that though the human growth gene was in every cell of the pig's body it did not act in the manner the scientists expected. Instead of making the pigs larger it made it squat, cross-eyed, bow-legged, and smaller than an average pig, with huge bone mass, a truly wretched product of science without ethics. Pursel tried to find a silver lining in his experiment gone wrong by claiming that the pig was leaner. Pursel's argument was that people are worried about cholesterol, so maybe we can sell this as lean pig. Did he really think the public was ready for pork chops with human genes?

Clearly biotechnology brings up unprecedented and grave environmental, economic, and ethical concerns. Here you are creating millions of novel organisms, organisms that the Earth has never seen, and then, releasing them into the environment. They are exactly analogous to exotic organisms like kudzu vine or those responsible for chestnut blight or Dutch elm disease. Any time you introduce an exotic organism into a new environment you are throwing the ecological dice. With the deliberate release of thousands of genetically engineered microbes, plants, or animals, you're putting something into the environment that could be very deleterious. Many of us have spent much of our working lives addressing the terrible ecological problems created by chemical pollution. Now we confront a whole new concept in pollution: biological pollution. Chemical pollution, however horrible, does dilute over time, and it can often be contained. However, once you release an organism into the environment it cannot be recalled or contained. It will not dilute but rather reproduce, disseminate, and mutate. It is unstoppable. My colleagues and I have sued many times to prevent the release of genetically engineered organisms and have often been very successful. However, with thousands of new releases planned every year we need a moratorium on any new releases and new national and international laws, which protect us from the very real threat of biological pollution.

Biotechnology research could also have disastrous impacts on human health. In one example Dr. Malcolm Martin of the National Institutes of Health genetically engineered mice so that they contained the entire genome of the AIDS virus in very one of their cells. The experiment was hailed in front-page stories across the country as a major breakthrough in AIDS research. Once again, however, nature was far too complex for the

scientists to predict. As it turned out, the AIDS had melded with native retroviruses inside the mouse to create a new virus, a kind of super-AIDS that could even be transmissible through air. This was reported with great alarm by Dr. Robert Gallo and others in Science magazine. One can only imagine the devastation if this new AIDS were spread by a researcher or by the escape of one of the mice. Once again our organization sued to stop this experiment, and a few others have been suing and petitioning. We've even organized locally to get counties to declare themselves genetic-engineered free zones, so as not to be subject to these kinds of dangerous experiments and hazardous environmental releases.

Another highly publicized biotechnology controversy surrounds the use of genetically engineered bovine growth hormone (rbGH). RbGH is injected into cows to make them produce 15 to 40 percent more milk at the height of their lactation cycle. The economic consequences of this technology are disturbing; we already have a glut in the milk market. The use of this hormone is destroying the small dairy farmer in America in one fell swoop. It also has hideous impacts on the cows and may cause some human health problems as well.

As we mix and match the genetic makeup of virtually the entire living kingdom, an ethical question arises: Shouldn't creatures allowed some biological dignity or integrity? Adding insult to injury, the industry since1980 has been allowed to patent genetically engineered organisms. That year, a five-to-four Supreme Court decision allowed for the patenting of a genetically engineered microbe that was supposed to eat oil. At the time Jeremy Rifkin asked, "What does the microbe eat for dessert?" And it turned out that the microbes did have a nasty appetite. The microbe was never commercially released, but the ability to patent all lifeforms as been decreed. By fiat the Reagan-Bush administration extended it from microbes to plants, and animals to human cells, genes, and cell lines. Now there are more than 200 genetically engineered animals standing, figuratively speaking, in line at the patent office. Over a dozen animals have already been patented.

Recently a scientist at the National Institutes of Health applied for patents on 2,000 brain genes he had isolated. His idea was that one of these might be the key to IQ or to cure brain cancer. He didn't' know what he had, but he was hoping that some of the genes would be massive profit makers. The race to patent lifeforms has reached extraordinary proportions. One European corporation is trying to patent women who have been genetically engineered to produce valuable biochemicals in the mammary glands. This technique has been mastered in animas, and they want to make sure that in case it's ever mastered in human beings they've got the patent. It is important to remember in the midst of the patenting frenzy that patenting is the trigger for the biotechnology revolution. If you halt the patenting of life you take the profit out of the technology. Therefore this must be a key in any campaign to halt the onslaught of biotechnology on life.

Human health and reproduction is another important biotechnology area. It is here where we are seeing the full force of this technological revolution affect the most basic definitions of life and death. Recently a California Supreme Court decision separated for the first time the birth process from legal rights of motherhood. A surrogate mother, an African-American woman who had been implanted with the embryo of a white couple, decided after the nine-month pregnancy that she wanted to share the parenting. This went to court and the court decided that she was not the mother, that she was a new class of woman, a paid "human incubator." It is an extraordinary decision because it allows the commodification of childbearing. Combined with the new techniques in gene screening of embryos, that will create a whole new industry in the selection of embryos to be implanted into surrogate mothers. Nine months later the yuppie couple can have their perfect children delivered. This is no longer science fiction but fact, and now the law in the State of California.

We are also seeing the human equivalent of the bovine growth hormone controversy. Last year Genentech sold $200 million worth of human growth hormone. Genentech genetically engineered industrial amounts of the growth hormone that is naturally produced in our pituitary gland. Since only a few people suffer from dwarfism, Genentech immediately began an aggressive marketing strategy, claiming that children totally normal in every respect, but in the bottom 3 to 5 percent of their height range, need therapy: genetically engineered growth hormones. Tens of thousands of parents—primarily in the U.S.—with the approval of their pediatricians are now injecting genetically engineered human growth hormones into their children three to five times a week. As you might expect, it's a costly therapy. Nine out of ten of these kids are boys since we like our boys tall. Needless to say, shortness is a

cultural stereotype, not a disease. We are seeing a new situation emerging where the solution to prejudice whether based in height, weight, skin color, eye shape, or the like will be not to educate the purveyors of discrimination or to outlaw it but rather to change the bodies of those being discriminated against. Human growth hormone is a sign of things to come. The most profitable drug in the biotechnology industry is being used to modify the bodies of the victims of the prejudice.

Genetic privacy is another major issue and may become the central civil rights issue of the coming century. The Human Genome Project, a $3 billion government program, is trying to decipher over 100,000 genes, purportedly to cure disease. They're also looking at the functions of all of our genes. They claim they've got the genes for alcoholism, for shyness, schizophrenia, and depression. Is Luddism next? Is the explanation for this meeting genetic inferiority?

It is easy to see how privacy becomes a central question. Once we have a catalogue of genes, which may predispose and individual to physical or mental diseases, can an insurance company use genetic screening to change your insurance rate? Can an employer insist on seeing your genetic readout? The office of technology assessment just revealed that many of the Fortune 500 companies already do genetic screening to avoid liability for workers who may be predisposed to a cancer or disease that might be a hazard of a given workplace. Rather than making the workplaces safe, we screen our workers to make sure they are not predisposed to the risk of occupational illness. Prenatal screening creates its own dilemmas. Prenatal screening has already caused a worldwide rise in sex-selection abortions. That may only be the beginning of a new type of eugenics. Recent polls said that 11 percent of Americans would abort a child that was genetically predisposed to obesity.

DAVID SUZUKI elaborates a bit on the potential applications of genetic engineering in war: When the Reagan administration supported a lot of this research they bought a font-row seat at the action. They were funding the best labs in the United States. The military was deeply attentive to what the state of the art was. When the U.S. was in this grubby little war in Vietnam, an article titled "Ethnic Weapons" was published by a Swedish geneticist in 1970 in the U.S. journal Military Review. At that time, he proposed a cocktail of chemicals that would be ethnically specific. But today, with fancy molecular techniques, it should be possible to design a retrovirus that would be absolutely ethnically specific. The military would never admit to doing that, but I don't believe there is any way that you could ever out-imagine the horrific possibilities of the military mind.

ANDREW KIMBRELL points out that genetically engineered pathogens could be employed in salt-the earth strategies: The destruction of a particular plant or animal that formed the basis of a particular Third World country's economy could be accomplished through biological warfare involving genetic engineering.

DAVID SUZUKI expects that the reductionism of modern genetics will engender a pseudoscience of social engineering: Modern claims by molecular geneticists are fostering a terrible biological determinism, the notion that virtually every aspect of human behavior has a biological basis. As soon as the genome is pretty well specified, scientists will no doubt determine that a high proportion of people with certain kinds of diseases will also carry particular sets of genetic markers. Don't think for a minute such discoveries will lead to immediate cures. But geneticists will very quickly run out of disease groups to compare DNA sequences. So no doubt they will turn to the socially difficult categories and look, for example, at people who are on welfare, homosexuals, criminals. No doubt they will find that people in these troublesome categories share subsets of DNA sequences. The problem is, correlation does not mean causation, but even scientists often confuse them.

If you examine a group of people who died from lung cancer, and found that out of 100, 90 of them have yellow-stained teeth and yellow fingers, that's a correlation. But it would be wrong to conclude that yellow-stained teeth and yellow fingers cause lung cancer, yet that is what scientists are already doing in some of these projects.

JEREMY RIFKIN thinks it likely that genetic engineering will usher back in some venerable forms of discrimination and abuse and set back the philosophical clock: With genetic engineering we are on the verge of a new Eugenics Movement. When we think of eugenics we think of what happened in America at the turn of the century—the sterilization laws and the new immigration laws—that set the basis for what happened in Nazi Germany in the thirties. That was a social Eugenics Movement. Many of our ethicists are

hoping that a new Hitler doesn't come along and abuse this new technology.

Unfortunately, what they miss is that the new Eugenics Movement is already here; it is endemic to the new technology. This time it's not social eugenics; it's commercial eugenics. People want healthy babies, we want more efficient means of production, and we want plants and animals that are predictable, quantifiable, and useful. So in the attempt to imprint engineering standards into the life code, we are automatically involved in a Eugenics Movement. The motivation of the scientists in the lab makes no difference. They are making eugenics decisions and doing so on criteria that we have not yet debated or understood. We have to understand the tremendous social import of this revolution in terms of the body politic.

The entire philosophical paradigm is shifting radically to the old pre-revolutionary concept that one's role in life is predetermined by biological destiny, by nature. And that while the environment—nurture—is a mitigating factor; one's genetic predispositions are the key to the kind of social performance that an individual can expect in life. This is going to set up a form of discrimination more virulent than anything in the past, because now there is a technology whereby to implement it. By the end of this decade we are going to see people judged by their genetic readout. We will see a new form of prejudice based on genotype, not just skin color, race, or ethnicity. The new global civil-liberty campaign superseding human right will have to do with genetic rights. We have moved from ant colonial struggles of civil rights to human rights. By the end of this decade we are going to see the struggle for the right of every person in the world to genetic privacy as protection against genetic discrimination.

SUSAN GRIFFIN finds it appalling that the response to the problems in human reproduction caused by various forms of pollution is to redesign the process of generation rather than to cease polluting and destroying. She also makes quite an interesting point about decontructionism: Cancer is part of the portrait of immune-system failure in this country. But another major system that is under attack now from environmental degradation is the reproductive system. And so we have something called reproductive failure, which is hidden by the fact that miscarriages, stillbirths, and congenital problems are also studied separately. But in fact they are all one phenomenon.

One might say that they are moving from nurture to nature in genetic engineering, but in postmodernism they are moving the other way. Rather it may look like it's different, but in fact the extreme end of deconstructionism holds that that any time you make a statement about any group of people or any person or any category, that that is essentialism, which is arguing that someone has an essence. I think that goes back to eighteenth- or nine-century thought of tabula rasa, that somehow there is no humane nature, you can just write whatever you want there. And I think both genetic engineering and postmodernism are moving toward the belief that nothing has any essence, and therefore we can just manipulate things and make them whatever we ant because nothing has essence to be violated.

CHELLIS GLENDINNING seems to say that postmodernism is an effect, not a cause, and that we might find some realities that are non relative in the indigenous experience of cultural interchange: I would like to propose that the postmodern thought patterns that tout the absence of values, that define all of reality as socially constructed and then revel in meaninglessness, that these states of mind actually spring form the latest stages of technological development.

One of the first times I met Kirkpatrick Sale was in 1991 at the Institute for Policy Studies roundtable on technology. He made a comment about postmodernism that has stayed with me. He said, "There's nothing new about postmodernism; it's just the same old rationalization from the dominant world."

And so it is! The postmodern dictate that virtually everything under the sun is relative and therefore meaningless is intertwined with the processes of expansion, conquering, colonization, and appropriation that have propelled Western technological development for centuries. It is the perfect expression of the mind-body, human-Earth split. Today these processes have reached the point where the entire world is encapsulated within the technological web. No culture in the world is exempt from the meddlesome hand of the techno-marketplace that picks up fragments of a culture in one place and carts them halfway around the world to sell in the Great Mall. You can watch Yanomami tribes people protesting mining in Brazil on your Japanese television screen while doing yoga in your Guatemalan peasant pants. You can jump on United Airlines and be in Tahiti in a few hours. I know a Dine' man who lives with his extended family on his

nation's land, speaks his native tongue, practices traditional ceremonies and listens to Bob Dylan bootleg tapes, flies Tibetan prayer flags, and drives a hot black car with tinted windows. The Associated Press photo that impressed me the most during the Rio Summit was an Amazon Kayapo Indian dressed in his jungle garb standing by a food boot drinking coca-cola.

The disorientation, uncertainty, ideological conflict, and sense of homelessness that result from such experiences lie at the base of postmodernism's grandiosity. But the driving force behind these experiences remains the imperial endeavor with its reliance on technological development to pull off its global vision of superiority.

So many aspects of life within the corporate techno-world get confused and removed from their origins that we forget what is truly human and truly healthy. Cultural exchange is, of course, a natural human activity. Yes, social construction has validity—to a point. What we need to be asking ourselves, to make reasonable sense out of the insistences of the postmodern ideologues, is, "How do indigenous people do cultural exchange?" "How do they view the origin of culture?" "How do they trade and give of themselves to other native people?" In other words, "What is communication when the playing field is leveled?" "What is truly human?"

MARTHA CROUCH elucidates the fundamental politics of biotechnology, its logic, and its ineluctable outcomes: Built into the way of thinking that developed biotechnology, and built into the technology itself, are monoculture, imperialism, and industrialization. You can't tease these attributes out, and you can't abstract the technology from its context to use in a way that doesn't have these kinds of consequences. If peasants in Mexico or sustainable agriculture researchers in Kansas developed a tool for agriculture or for reproductive technologies, it wouldn't be biotechnology. Biotechnology is not something that we want to support. In fact, it's something we want to oppose as a whole. Analyzing each little application isn't necessary, and biotechnology as a whole is going to have these inevitable consequences.

To convince you of that I'm going to talk about my own experiences. For about twelve years I ran a research lab that genetically engineered rape seed, an oil crop. We worked on seeds and pollen particularly. I had the opportunity to see some of our work applied and was horrified at the results. In consequence I had a chance really to think about how basic science, applied science, and the economic system are all integrated.

Biotechnology is born out of a scientific vision of control over nature, control over reproduction, and from the desire for man to be able to reproduce without nature and women. As a scientist I was trained to think in a very specific way. The training started young and it was very normalizing; the types of questions that were allowed were linear, reductionist, objectifying. They teased things apart into components that could then be controlled and commodified. Other kinds of inquiry were not allowed.

From the very outset of the enterprise, the type of thinking required to develop scientific tools, of which biotechnology is one example, predicts that the only kind of technologies that can use this thinking will be those that reduce the world. The idea of genetic engineering is to reduce an organism to little bits of information in a linear sequence. All organisms have the same elements in their genetic code, so it's a globalizing logic that makes all organisms part of the same soup. I can take a gene from an elephant or a bacterium and combine it with my genes and prove that we're basically the same stuff. It maximizes similarities and minimizes differences.

If with that kind of logic we develop a tool, it will suit the type of agriculture and the type of industry that we do. We take land that might have a different slope or be north or west facing, or have different amounts of rainfall or a different soil type, and reduce it. We do this using irrigation, mechanization, and fossil fuels so that the whole world can be treated in a uniform way. Where things used to be different, we make them the same. So the tool is developed out of a thought process aimed at monoculture rather than specific local applications. In order for something to be adapted to a local environment the people developing it must be able to modify it quickly. If we plant out our tomatoes and notice that they're doing better in one part of the field than in another, we save the seeds from that part, and we keep planting those tomatoes in the same place. To do that requires constant interaction and direct control.

In training to be a scientist and develop generic tools, we become more specialized—and more placeless. We're in an educational system where people from India, China, and Africa all rise above their home places, often traveling to centers in Europe or the United States to become part of a

global educational system. They may become unable even to talk to the people in the places that they came from. I could never talk to my mother about my work: My mother is an intelligent woman, yet I couldn't explain to her what I was doing. Even though I had the knowledge, I wouldn't have been able to do my work in my own backyard, because of the infrastructure required. So biotechnology becomes something that is developed in a way inaccessible to local communities and beyond their control. If it breaks or if it doesn't work in this little part of the field, it can't easily be modified. There's an elitism, a cult of experts that's integral.

The infrastructure required to support it is not only global in terms of the computer networks that store and link all the research data and the necessity for library systems; materially it requires an industrial infrastructure. Biotechnology requires purified enzymes that come on ice via two-day air; it requires ultra-centrifuges; it requires good air conditioning to keep all the equipment going; it requires lots of electricity. The result is that it maintains the status quo so that only the people who are already doing high-tech agriculture, or are already in medicine, can manipulate this infrastructure and extract resources with it.

The technology appears to extend limits: If we have a drought area, runs the thinking; we'll insert a gene for drought resistance so we can still grow plants there. Then we don't have to worry about why the rain isn't coming. We have a disease problem: We'll put in virus resistance, so we can keep doing monoculture, keep distancing the food system, and keep doing industrial medicine and so forth. It makes it appear that you're able to overcome the limits, but really you're just extending the time before you have to deal with them. That's dangerous: It delays the creativity of living within limits.

I can't think of a single human problem that can't be approached alternatively with local solutions that are more effective than biotechnology. One example in the United States is bovine growth hormone versus rotational grazing in the dairy industry. The dairy industry has economic problems from having surpluses and because of the high cost to farmers of intensification. The genetic-engineering solution is to invent a hormone that yields more milk per cow, thus further intensifying production. Rotational grazing is where farmers themselves have decided to get rid of the whole structure of expensive inputs and intensive farming. They just move the cows around on pastures managed optimally. They don't have to buy supplemental feed, or antibiotics, or go to the vet so often, or be around as much. They compete by lowering costs. This is a farmer-initiated solution, a method spread by farmer-to-farmer networks. They control it; they decide when to move the animals around the pastures. It requires very few industrial inputs.

There's always an alternative. The debate over the specific applications of biotechnology obscures the larger issue of what is inherent in the technology. We could as a group confidently opposes the entire proposition.

BETH BURROWS talks about the particulars that she, as an activist, had to understand in order to work on international trade agreements, biotechnology, and property rights. Shortly after she began, she became especially curious about a provision in GATT and NAFTA called TRIPS—Trade Related International Property. The biotechnology industry was advocating for these measures because, they said, "at least one sector of the U.S. industry relies heavily on effective patenting protection for its competitiveness and ultimate survival." There was a lot of evidence, Burrow says, that "patent protection was the knee-cap of capitalism."

The material was multifarious and complicated the responsibility Burrows assumed in studying it and grasping its implications was fearful. What would be the effect of these sections on consumers, biodiversity, and ecology? "What would be the effect of intellectual property sections on how we understand who we are as human beings?" was for Beth Burrows the most troubling question of them all.

She had to look at U.S. legislative and judicial actions relating to biodiversity patents, such as a case before the Supreme Court where a seed company sued a farmer for selling seeds to neighbors. "The effect of that case is to get the Supreme Court to punish people for exercising what used to be considered rights and now are being considered privileges and soon will be memories that computers will not be able to encode," she says.

Burrows learned of the Human Genome Diversity Project, where scientists will fan out all over the world taking genetic samples from indigenous peoples—labeled "isolates of historic interest"—ostensibly to understand the migrations of peoples and languages around the world over time. At about the same time that she became aware of the Human Genome Diversity Project, applications to

patent cell lines from indigenous people came to light. There also surfaced patents on species-wide characteristics of plants and animals, which would make any organism with such a characteristic private property. Burrows also learned that with such patented resources laboratories could create synthetic replacements for commodities that might be the entire basis of a nation's export earnings.

At one time, Burrow say, patents were awarded to human creations that had to be new, not obvious, and useful. But the trend has been away from these criteria—"Patents are not rewards for inventions; patents are protection for investment." And therefore the ratification of these patenting requirements in these trade treaties is a very serious business.

Burrows concludes with a story from an international conference on the future of intellectual property protection and biotechnology in the U.S., Europe, and Japan. She was struck by a remark of one of the eminent speakers who bewailed the difficulty, in Europe, of obtaining patents on lifeforms. He hoped, according to Burrows, that his colleagues elsewhere would not have to face "environmentalists and those who would bring ethics and other irrational considerations"—Burrow's emphasis—"to the table!" Which pairing, says Burrows, went entirely unchallenged.

MAIRA MIES talks about the successes and strategies of a number of small interconnected groups in Germany in creating resistance to the patenting of life: It is very important that we do this kind of mobilization. We are not scientists, but we are citizens—we take our citizens' rights to oppose what we don't want. Public mobilization may not hinder the industries from proceeding with their technology, but it may mean that they won't find the people to purchase their products.

Really mobilize your public; don't address yourself only tot he scientific community; it I possible to undermine the acceptance for these technologies. As a method it is important to link up our concerns: We are not only talking about women, but also about animals and plants, and not only about white people but about the Third World. Though ours is a small group, we publish, we talk, we make a big fuss whenever we can.

VANDANA SHIVA highlights the widening gulf between common sense and orthodox "evidence" in public debate on biotechnology and other such issues: With regard to "the ethics and other irrational considerations" bearing on biotechnology and trade agreements, all kinds of ontological shifts are taking place, some extremely crude. It may work among negotiators—but you bring it out in the public domain and thinking people will laugh at contentions such as that an animal gene is not animal-like, which would mean that you can put a pig gene into a carrot. Ask the Muslims of the world. Imagine what consternation it could create if we could get this in the hands of some good Islamic theologians!

Every time a problem occurs with biotechnology and opposition is mounted, the response is characterize as irrational, emotional. International scientific bodies are run by corporations, so only their scientific evidence will be counted as evidence to resolve any kind of public debate. None of the work that we've done in the Environmental Movement has been reflected in the formation of any of these governing agencies. Under these global conventions and agreements, environmental issues will be resolved by a body called the International Standards Organization. It used to work only for industry. In five or six years it's become the big standards-setting institution or international environmental issues.