

Second Genesis: The Biotechnology Revolution

"We can hold in our minds the enormous benefits of technological society, but we cannot so easily hold the ways it may have deprived us, because technique is ourselves. All descriptions or definitions of technique which place it outside ourselves hide from us what it is."

—George Parkin Grant in *Technology and Empire*

A technological revolution has begun. This revolution could affect each of us in the most intimate, yet permanent, fashion. It could indelibly change the destiny of mankind and the other members of the biotic community. The growing technology revolution is being made a reality by dizzying advances in the biological sciences and the application of that knowledge to a variety of techniques, most importantly recombinant DNA technology. It is now becoming possible to insert, recombine, rearrange, edit, program, and produce human and other biological materials just as our ancestors were able to heat, burn, melt, and solder together various inert materials. A growing group of engineers are in the process of manipulating, and creating, new combinations of living matter just as the machine makers of the past centuries created new shapes, combinations, and forms of inanimate matter. We are in a historical

transition from the Age of Pyrotechnology to the Age of Biotechnology.

Over the last decade, the achievements of biotechnology seem more like science fiction than science fact. The accomplishments of the engineers of life have triggered visions of a utopia on earth, and concerns over the creation of a "brave new world." Consider just a few recent successes:

- Researchers at the University of Texas announce that they have produced genetically duplicate cattle from the biological information contained in a single body cell. This "cloning" of cattle is viewed as a significant step

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towards cloning human beings.

- Scientists at the National Institute of Health (NIH) gains approval for first experiments in gene engineering of somatic human cells. Many call for approval of germline genetic "surgery" that is aimed at altering the genetic makeup of future generations.
- Surgeons in Denver, Colorado perform the first U.S. transplant of fetal organ parts into the brain of a victim of Alzheimer's disease. Meanwhile, researchers in California report successful transplants of fetal organs into laboratory mice. Fetal organs and tissues suddenly become valuable commodities.
- Congress approves a massive 3 billion dollar scientific effort to map the entire human genetic structure. Researchers claim that in the next few years, diagnostic tests will be able to determine an individual's genetic traits and predispositions to physical and emotional disorders. Critics raise the specter of a new form of social discrimination based on genetic make-up. Corporate employers and insurance companies express an interest in mandatory genetic screening of workers and insurance applicants. Prenatal screening increases sex selection and other "eugenic" abortions.
- Researchers successfully place human growth genes into the permanent genetic code of mice and pigs. Other scientists create hundreds of transgenic animals including cows and fish containing human genes. In one bizarre experiment, researchers insert the gene that emits light in a firefly into the genetic code of a tobacco plant. The leaves of the plant glow 24 hours a day.
- U.S. patent officials announce that all genetically engineered animals, including those with human genes inserted into their permanent genetic code, are patentable. Under the Patent Act the legal status of these new species is that of "manufactures" indistinguishable from non-living commodities. Over 160 genetically engineered animals are now patent pending. Moreover, prompted by the patent decision, several U.S. institutions apply for patents on genetically engineered mammals, including humans, which are engineered to produce valuable proteins in their mammary glands.
- Corporations and universities are releasing genetically engineered viruses and bacteria, as well as genetically engineered plants and animals into the open environment. If one of these new genetically engineered organisms becomes dangerous, the results could be catastrophic—since these living organisms mutate, reproduce, and have extraordinary mobility, they cannot be recalled.
- As part of its biological warfare research program, the Department of Defense is using new genetic technology in experimenting with virtually every known dangerous micro-organism in 129 university, corporate, and military laboratories across the country. Scores of these experiments involve controversial gene-splicing technology.
- Dozens of "baby brokers" have set up shop in the U.S., contracting with women to become surrogate mothers. Amniocentesis and other pre-natal genetic tests are used to ensure that the child contracted for is "fit." Under the contract, "abnormal" children are aborted upon request of the paying client. Since the famous Baby M case over two dozen law cases have been filed challenging the controversial business.

As societies scramble to cope with each new techno-dilemma, the new cadre of biological technicians and decision-makers are slowly beginning to assume a novel, though controversial, role in the natural scheme. Scientists and engineers, often with the best

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of intentions, are assuming the roles of creator and designer of the biotic community, from microbe to man. They are using their new-found abilities to alter the very blueprint of life—to apply traditional engineering values such as efficiency, utility, quantifiability, predictability to the manipulation of life forms. Driven by billions of research dollars and massive profit possibilities, these techniques, whether in the areas of human health and childbearing or in the manipulation of animals, plants, and microbes, are invading the most intimate aspects of human life, and the most hidden areas of the natural world.

There can be little question that extension of the techniques and ideology of the industrial age to the living kingdom, including the human body, is among the most significant technological and philosophical transitions in recorded history. The question of whether we should embark on a long journey in which we become the architects of life is among the most important technological issues ever to face humanity.

Those overseeing and promoting biotechnology assure us that the consequences of the technological revolution can be managed. *The New York Times* in a recent editorial noted that, "Life is special, and humans even more so, but biological machines are still machines that now can be altered, cloned, and patented. The consequences will be profound but, taken a step at a time, they can be managed."¹ Biotech's supporters also point out that, whatever the short term dislocations, these novel techniques and practices will bring dazzling social benefits. The engineers and salesmen of biotechnology confidently predict cures for cancer and AIDS; they hail the coming abolition of man's most pernicious hereditary diseases; they pronounce an end to human infertility; they herald a new biotech "green" revolution that will help end world starvation.

Those questioning the new technology

are skeptical of these claims. As part of the generation brought up with a plethora of techno-booster bromides (i.e., that "Progress Is Our Middle Name," that we would have "Better Living Through Chemistry," "Cheap and Clean Nuclear Power," and even that "DDT Is Good for Me"), they find the promises of utopian technologists hollow, even tragicomic. Certainly, for a society viewing a new genre of social threats, including the destruction of the family, disintegration of communities, urban blight, growing crime; and a new genre of global environmental threats, including ozone depletion, deforestation, species extinction, and global warming, it is now painfully evident that every new technological revolution has both benefits and costs. Society's experience with industrial technology demonstrates that the more powerful a technology is at appropriating and controlling the forces of nature, the greater the disruption of our society and destruction of the ecosystems that sustain life.

The biological revolution is no exception to the technological rule. Though less than two decades old, it has spawned unprecedented environmental, economic, and ethical concerns. Environmentalists have raised alarms about biological pollution as the prospect of the release of thousands of genetically engineered microbes, plants, and animals comes closer to reality. Farmers, researchers, and workers around the world anxiously await the economic consequences of corporate controlled genetic engineering techniques and novel life forms replacing more traditional production methods and native plant and animal species.

Perhaps most compelling, the bio-revolution is creating an upheaval in the way in which we define, understand, and use life. As we transplant and engineer human organs, tissue, and genes into other animals, we blur the line between human and non-human. As we engineer, patent, and clone

life forms as if they were "biological machines," we obscure the line between life and non-life. In our haste to better harvest human materials including the newly defined "brain dead" and fetuses, we throw into confusion traditional concepts of life and death. As we seek to cure infertility with in vitro fertilization, egg and sperm donors, and surrogate mother contracts, we no longer have clear lines on what constitutes motherhood or fatherhood. As we screen our unborn for abnormalities, we force eugenic decisions on what constitutes a life worth living. As we patent life forms, we turn the biotic community into corporately-owned commodities. As we open up a market for "contract" children and human body parts, we initiate a bio-slavery for the economically disenfranchised who are lured into selling the irreplaceable. The human body itself, once held "sacred," or at least reverable, is rapidly becoming the raw material for the new bio-industrial age. The body has become commodity.

We are, today, unprepared to cope with the myriad ethical, economic, and political consequences of the biotechnology revolution. Clearly, the questions raised by the manipulation and marketing of life are among the most important ever to face the human family, yet we have done little to establish adequate bio-policies to guide us through the moral morass. Furthermore, despite its epochal impact, biotechnology's chief decision-makers are not world leaders or elected officials. The issues surrounding the technology are not decided by democratic decision-making or popular opinion. Rather, the managers of biotechnology are a haphazard group of researchers, bureaucrats, doctors, businessmen, scientists, and judges. Their decisions are, more often than not, made through corporate board decisions, arcane bureaucratic regulations, and local and federal court opinions. They do not constitute a conspiracy, nor do they all

share the same political ideology. In fact, they are generally guided in their decision-making by the narrowest of notions concerning efficiency and marketability.

Unfortunately, then, those now authorized to make decisions on regulating or limiting the genetic engineering are not inclined, or able, to guide society in addressing the policy challenges of biotechnology. Often goaded by scientific curiosity, the drive to cure disease, or raw personal profit, current actors in the forefront of the bio-revolution do not seem to have the breadth of vision to confront the implications of what they are bringing to society. Perhaps it should not surprise us that those who spend their lives looking through microscopes tend to develop microscopic vision.

Even those employed as so-called "bio-ethicists" seem to be incapable of saying no to any new advance in the marketing of life, no matter how questionable. As the ethicists line up in favor of the continuing extension of biotechnology into the body's organs, cells, genes—even offspring—they seem intent on guiding the unthinkable on its passage to becoming debatable, and then toward being justifiable, and on to finally becoming routine. We are in an ethical free fall.

How will society limit biotechnology in order to reduce its risks and still reap its benefits? The prospect is far from reassuring. After all, we have never limited a technology to its beneficial uses. And, so far, there are no new answers. The biotechnology revolution is being managed and regulated in the same manner as have the other major technological breakthroughs of the last several decades. Author Langdon Winner has termed this mode of dealing with technology the "utilitarian-pluralistic" approach. The problem of technology is primarily seen as a question of benefits and costs. The utilitarian-pluralistic approach attempts to assess the possible risks of a

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technology as against the benefits it provides. Questions arising from this approach are routine public policy fare. "What are the trade-offs between eliminating various sources of air pollution and possible productivity costs for industries affected by the restrictions? What are the trade-offs between preserving wilderness areas and the loss of jobs to the lumber industry?" "What are the trade-offs between the environmental threat of nuclear power as against the need for more energy?"

Biotechnology is following the pattern. Regulating biotechnology now involves various federal agencies in the U.S., and similar international bodies, preparing a variety of risk assessments on sundry actions involv-



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ing the use of genetic engineering techniques. Environmental agencies assess the risks of releasing genetically engineered organisms into the environment. Other regulators gauge potential health risks of genetically engineered foods (some of these foods border on the bizarre—tomatoes with flounder genes to enhance resiliency, pork produced by engineering human genes into pigs to create 'leaner' meat). Advisory panels look into the risks posed by engineering the human germline. The Department of Defense evalu-

ates the dangers of using biotechnology to create new biological warfare weapons as against possible advantages for national security.

Once risks and benefits of a technology are assessed, the next major regulatory issue required by the utilitarian pluralistic approach becomes distribution. The pluralistic approach to technological regulation attempts to ensure that the benefits of a technology be distributed equally and that the costs be allocated so that no sector of the population is overly burdened.

The utilitarian-pluralistic approach has been the dominant approach to technology by government and social activists alike. The environmental, consumer, and social justice movements have all taken this route. Social and environmental legislation are based in this approach to technology. Congress, scientists, and regulatory decision-makers use this approach almost exclusively. Even Marxism is primarily based in the pluralistic mode of viewing technology. The central social question as presented by Marxism becomes the relationship of various classes to the ownership of the means of production.

The utilitarian-pluralistic model of technology controls is woefully inadequate to the task. The major difficulties about technology are not its side effects, or projected "trade-offs" necessitated by its introduction, but rather the fact that technologies ultimately become controlling influences on the very fabric of human thought and activity.

Man does not only reshape nature through technology. Technology shapes man and his thinking. The discovery of the clock gave us the "clockwork universe" of the early enlightenment thinkers, and it also gave us the idea that living organisms including our own bodies are machines. "Living bodies, are even in the smallest of their parts, machines *ad infinitum*," noted Gottfried Wilhelm von Leibniz. As technology devel-

oped into the great motors of the industrial age, experts in thermodynamics such as Helmholtz assured us that "The animal body does not differ from the steam engine." In more recent times, we see our ourselves as computers. Computer mavin Marvin Minsky has compared the brain to a "meat-machine." Scientists see genes as information chips that can be manipulated as if they were parts of a computer. The utilitarian-pluralistic approach to technological thinking cannot deal with the tendency of technology to embody, and even create, social and political beliefs. Indeed, the utilitarian approach is merely another technological solution to the problems of technology. As noted by author Langdon Winner:

The utilitarian pluralistic approach sees that technology is problematic in the sense that it now *requires legislation*. An ever-increasing array of rules, regulations, and administrative personnel is needed to maximize the benefits of technological practice while limiting its unwanted maladies. Politics is seen as the process in representative government and interest group interplay whereby such legislation takes place. . . .²

The alternative approach to understanding technology, an approach necessary if we are to control the biotechnology revolution, begins with the crucial awareness that technology *is* legislation. That technology and its bureaucratized forms of human regulation and control determine a large majority of what we are and what we believe. Technology is itself a political, social, and theological phenomenon.

As such, technology is not in any sense neutral. A nuclear power plant, for example, regardless of how efficiently its risks are dealt with or how democratically it is owned or operated, contains certain political suppositions in the technology itself. For the technology to be used, a society must be capable of amassing large capital expendi-

tures in the building of the facilities; a society must have centralized control of energy production and dissemination, either state-controlled or utility-controlled or both (no individual or smaller community could or would use such a large and potentially hazardous power source). There must be a massive bureaucracy to ensure safety of facility operations and disposal of nuclear waste. A scientific elite is required to build and supervise the plant. A military elite is necessary to guard against sabotage and use of the nuclear by-products. The social vision inherent in nuclear power involves a society that is capital-intensive, committed to centralized control of resources, extensive bureaucracy, and scientific and military elites. Compare this with the politics of solar power. This technology involves low capital accumulation, individual or community control of energy, no bureaucracy of risk assessment, and no need for a scientific or military elite. Clearly, every technology encodes a vision of the individual and of society. Different technologies realize different concepts of social and political life.

But that is not all. The biotechnology revolution demonstrates that technologies can also have a metaphysical content. A pig genetically engineered to contain the human growth hormone gene in order to make it a leaner, larger pig for the production of pork (a pig then patented as a "manufacture") reflects a view of life as machine and genes as information chips that can be inserted in the same manner as changing the program of a computer. Genetic screening of the newborn to find and abort those with abnormalities encodes the belief that the value of life is in "quality" of life, not in the eternal life of the soul. The genetic engineering and use of fetal tissue reflects a non-sacred view of the unborn.

But the biotechnology prospect is even broader. The biotechnologists are attempt-

ing to recreate nature in the image of efficiency. In fact, the genetic engineers envision little less than a second genesis—a genetic mixing and matching of the biotic community to create more useful and efficient life forms. This time the genesis is not of sacred origin but rather a secular creation based on the technological imperative. The view that life can be remade through biotechnology is the most breath-taking example of the tendency of the technological ethos itself to challenge traditional religious and cultural understandings of life—and life as a given good. As Gregory S. Butler argues:

[T]he unlimited application of science and technology . . . involve[s] the intelligent control and manipulation of both human and non-human nature so that the material ends of the collective are better served and the deficiencies of nature finally overcome. A necessary part of the unbridled technological ethos, furthermore, is a conscious act of rebellion against the traditional moral authority given in classical and Christian metaphysics, especially insofar as the authority posits limitations on the creative powers of man by a claim to a knowledge of the nature of things. If a deficient creation is to be overcome or recreated, one must break free from those who persist in talking about eternal justice of a benevolent creator-God, or about the inherent worth and dignity of the individual before that God. The will to recreate is strong; it tends to eschew any understanding of man or God which might limit the progressive building of the future.³

The biotechnology revolution tends strongly in the direction of an anti-sacred, mechanistic view of life and the human. The Biblical understanding that we are created in the image of God falls by the wayside. Scientists see the new technology as reifying the mechanistic world-view set out centuries ago by Rene Descartes and his critic/follower Julien Offray de La Mettrie. Dr. Robert Haynes, a keynote speaker at, and president of, the 16th Congress of Genetics,

firmly reminded his audience that the doctrine of mechanism is a key organizing principle for the age of biotechnology. "For 3,000 years at least, a majority of people have considered that human beings were special, were magic. It's the Judeo-Christian view of man," said Haynes. "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, even sacred, about living organisms."⁴

Advances in biotechnology will further embody this mechanistic view of life. The new medical and genetic engineering technologies of the last few decades have and will save lives and perhaps will provide new cures for humanity, but, without resistance, these technologies and the ideology behind them will also lead to the devaluation and commercial exploitation of the human body, and the biotic community of which it is part. Biotechnologies are becoming ever more sophisticated. Additionally, extraordinary profits on body elements and processes are awaiting the scientists and biotechnologists who are pushing the new technologies. Unless checked, these advances in biotechnologies will, without doubt, significantly accelerate current trends. Advances in utilization of fetal parts for curing disease or for enhancement therapy will make the unborn ever more valuable commodities for the medical marketplace. As reproductive technologies become refined and increase the percentage of successful births via artificial insemination, egg donation, and embryo transfer, sperm, eggs, embryos, and children will be subject to increased marketing and will soon be legally defined as property by the courts and legislatures. As genetic screening of the unborn allows prospective parents to know a

wide range of genetic traits of their offspring, eugenic abortions based on sex and other non-disease characteristics will expand. Greater understanding of the location and functions of genes will accelerate the marketing and patenting of valuable genes. Discoveries in genetic links to undesirable physical or social traits will also continue to lead to increased genetic manipulation of humans, including proposals to permanently change the genetic code of certain individuals through germline genetic surgery. Genetic engineering will also allow for even more transfer of human genes into animals, animal genes into plants, and plant genes into foreign species. Finally, breakthroughs in cloning could change the modes of reproduction for all members of the living kingdom, including the reproduction of humans. The warning is clear. Unless human choices control biotechnology, biotechnology will control human choices.

As biotechnology begins to change our traditional views of central aspects of our being—life, death, birth, our bodies, motherhood, nature—we are shocked into a revelation about the history of our politics over the last century. During that time, the near cataclysmal struggle was between the market system and the communist economic vision. The great cold war was essentially fought over different views about the ownership of the means of production. As the market system triumphed, some view the end of that struggle as the “end of history” itself.¹ However, the extraordinary issues surrounding biotechnology, and our other modern technologies, now demonstrate, to paraphrase Burke, that Marxism was not a revolution made, or failed, but rather one avoided. By fighting over the ownership of the means of production, society neglected the real political duty of our time—namely, the struggle over the means of production themselves. Each technology encodes an ide-

ology. The technology becomes the embodiment of the ideology. As that technology becomes part of the means of production, it brings with it the full plethora of theological and social suppositions contained within it. Those suppositions then become an inherent and inextricable part of the social structure. Different ideas of God, what man is or is not, what a community is, or what is sacred require different technologies for their realization. The politics of technology is therefore the real politics of the next century.

Technological politics cannot be fought in the utilitarian-pluralistic framework—inside the regulatory forum. There is little reason to hope that current government agencies, themselves the product of a spiritually impoverished enlightenment liberal culture, will recant from the development and use of technologies that encode their basic beliefs, and begin constructing technologies resonant to a sacred view of life. Clearly, the major force behind reshaping our technological future and limiting biotechnology will have to be those whose religious and cultural beliefs respect the sacred over the efficient, those who see life not as a commodity but as divine gift. They must re-inhabit the “naked public square” and have the vision to begin supporting technologies that reify their beliefs. G. K. Chesterton noted that every revolution is a revival. The task of remaking the technology of our culture in a sacred image is daunting but urgently required.

¹ *The New York Times*, February 22, 1988, “Life Industrialized,” Editorial.

² Langdon Winner, *Autonomous Technology*, (Cambridge, Mass: MIT Press, 1967).

³ Gregory S. Butler, “George Grant and Modern Justice,” *Humanitas*, Vol. 4, No. 2, Spring 1990, p. 1.

⁴ Quoted in Virginia Morris, “Human Genes Not So Special,” *The New Haven Register*, 28 August, 1988.

⁵ Francis Fukuyama, “The End of History?” *The National Interest*, 16 (Summer 1989), pp. 3-18.