

Sandra Seekins / OF MOLECULES AND MATTER: THE PROMISES AND PERILS OF BIOTECH ART

Genetic engineering has incited much debate. But while activists picket, big business quietly investigates, and intellectuals issue grave warnings, art has taken its usual place poking sticks in the eyes of all positions.¹

... wake up and smell the GMO coffee.²

What are the cultural, political, and aesthetic roles of artists working with advanced technologies, such as bioengineering? Genetic research provides artists with significant new tools, and the impact of technologies on contemporary existence is an urgent issue, perhaps one of the most vital of our era, since it deeply impacts normative notions of human identity and corporeal integrity. How and in what ways it challenges these notions depends on where one positions oneself along the bioethics, biopolitics, and biopower continuum.

Biotechnologies reveal that bodies are composites of replaceable parts, open to reorganization, surveillance, and psychological and physical modification or augmentation. This can be an unsettling proposition, but one that is faced by artists concerned with the metaphors and media of biotechnologies. Although artists have always utilized technologies, contributing to and shaping discourses about them, those working with advanced genetic technologies are a relatively recent phenomenon, since the technologies themselves are still in their infancy. We should expect, however, that novel types of art continue to draw inspiration from art of the past.

Artist André Brodyk dates the beginnings of what he refers to as “genetic art” and “genetic artists” to the early nineties.³ What makes such art different from art dealing with other technologies? Genetic artists work with scientific techniques, merge biotechnologies and digital technologies, or deal with the

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metaphors of biological techniques. This type of art has also been dubbed “sci-art,”⁴ but I prefer the term “biotech art,” because it captures notions conjured up by the fashionable currency – in the media and on the stock market – of the term biotech as something cutting-edge and lucrative.

Contemporary art practice is being transformed (as art has always been) by technological imperatives, and art has a contribution to make in terms of raising the level of public awareness about the technical, economic, political, and social discourses surrounding biotechnologies. Artists working with biological materials or genetic engineering inhabit what is arguably the most controversial realm of emergent art activity. They face unique challenges. By stretching the boundaries of acceptable art practice, they not only provoke the familiar and persistent debates about why or whether something is, or is not, considered art, they also face some of the same dilemmas (philosophical, moral, and ethical) as do scientists who develop and experiment with applications of biological and genetic technologies. In addition, both artists and scientists are familiar with the commercialization of their respective fields by patrons, entrepreneurs, institutions, and corporations. Social roles and economic roles are often in tension.⁵ In advanced biological science there is, on the one hand, the ideal that scientific inquiry benefits the public good, and, on the other, that a free market drives innovation.⁶ Art is equally caught between goals of personal expression, social relevance, and commercial value.

Enthrallment with visual representation has always played a role in the trajectory of genetics. Upon their discovery of the double helix structure of DNA in 1953, James Watson and Francis Crick noted: “We knew it was right because it was so beautiful.”⁷ As an art historian, I am struck by the misleading correlation in this statement. Beauty is both relative and deceptive, frequently disguising more than it reveals. Beauty should not be automatically equated with accuracy, goodness, or “truth” (one need only think of the classically-influenced aesthetics of fascism). The awesome “beauty” of some scientific imaging only describes one possible component (and certainly not always the most interesting one) of biotech art, which frequently examines, as did twentieth-century avant-garde movements, the unpleasant, the ugly, the violent, the brutal, and the terrifying.

Brief Encounters with Biotech Art

*A ghost is haunting the arts, the ghost of biotechnology.*⁸

Scholars, curators, and galleries have been quick to showcase trends in biotech art.⁹ A review of just a few of the artists who have garnered attention for their interventions into advanced technologies is useful for defining the contours of, and themes within, genetic art activities. This is intended to be a selective introduction to some of the issues in bioart, not a survey of its practitioners, too numerous to mention in a short article.¹⁰ I have divided my examples into four categories: co-opting the lab, genetic portraits, the language of DNA, and collapsing boundaries. In what follows, I will connect these themes in biotech art to relevant stories from biotech research.

Co-opting the Lab

One group that has been involved for several years with biotech issues is the Critical Art Ensemble (CAE). Founded in 1987 in Tallahassee, Florida by Steve Barnes and Steve Kurtz, CAE is a collective whose members have recently staged their responses to the paucity of public debate on the biotech industry.¹¹

The CAE create faux scientific labs as part of their performances. This aura of authority or authenticity facilitates encouragement of audience participation in scientific processes. The spectator interactivity they encourage is intended to demystify complex technological processes by making them more comprehensive and accessible. CAE also raise debates about the values, ethical ramifications, or potential recklessness of biotech research. For example, they describe their performance *GenTerra* (2001) as “a theatre of transgenics.”¹² Transgenics involves the transfer of genes from one organism to another or from one species to another.

In *GenTerra*, CAE investigates the consequences of the penetrability of species boundaries in light of the creation of transgenic life forms. They do so by simulating a biotechnology corporation balancing profits with social responsibility. Biotech activities are brought into public space. Lab-coated assistants (members of CAE) introduce bioproducts to the audience, and explain transgenic initiatives (outlining the social benefits of genetic engineering). They

dispel myths of monstrous hybrids by demonstrating the practical applications of such research (disease treatment and xenotransplantation could serve as examples). Viewers are given material and instructions to make and store their own transgenic bacteria. The audience can spin a bacteria release machine with only one of its ten chambers holding active bacteria. They are told that the bacteria they might release into the environment is a benign strain.

Audience members have to decide whether or not they have faith in this claim and whether or not to play this game of “genetic roulette.” Given the history of media coverage of now discredited chemical agents (such as ads from the 1950s showing happy families and livestock under a cloud of mist accompanied by the inscription “DDT is good for me!”), it is unsettling that the majority of the participants in the many performances of *GenTerra* choose to spin the wheel.

While the participants in *GenTerra* might have shrugged off the significance of spinning the wheel, the authorities were not so blasé. In curator Robin Held’s account of the exhibition *Gene(sis)* at Seattle’s Henry Art Gallery (April 6–August 28, 2002), during which CAE was to perform *GenTerra*, she noted that the performance was pending approval by the University of Washington Institutional Biosafety and Recombinant DNA Committees as well as registration with the National Institutes of Health.¹³ Even though CAE had performed *GenTerra* prior to the Seattle performance, since the Seattle date occurred *after* the anthrax attacks in the United States, the Henry Art Gallery had to go through lengthy negotiations with environmental agencies and register with the National Institutes of Health in the interest of public safety. The state has certainly intervened in art practices before, but such precautions to protect the public are highly unusual, even unprecedented, in art circles. However, they may become more frequent as biotech art proliferates.

Acute nervousness surrounding artists’ use of biological materials is largely due to a post-9/11 environment of fear and suspicion, as well as to the public’s exposure to increased media coverage of threats of bioterrorism. Artists working with biotech are not just appropriating novel tools, they are working under new sets of constraints imposed by government authorities who are fearful of genetic experimentation outside of recognized institutional laboratory settings.

As testimony to such fears, on May 11, 2004, co-founder of Critical Art Ensemble, University of Buffalo professor Steve Kurtz, became embroiled in an FBI investigation.¹⁴ Paramedics responded to a 9-1-1 call from Kurtz’s home;

he told them his wife was non-responsive. They arrived to find his wife, Hope Kurtz, dead. The rescue workers were alarmed by the petri dishes and lab equipment they saw in the home, so they called in the FBI hazardous materials response team. For some reason it was the Joint Terrorist Task Force that actually arrived, sealing off the residence (as well as the entire block), and removing bacteria samples (*Bacillus globigii*, *Serratia marcescens*, and *Escherichia coli*). Kurtz uses DNA in his work, which, like most of the work by CAE, is meant to encourage public debate about safety issues and the global impact of genetic research.

Within hours, Kurtz's grieving process was disrupted as agents from the Joint Terrorism Task Force searched his house, seizing, in addition to his wife's body, Kurtz's computer equipment, disks, books on biowarfare, papers, and lab equipment, including a polymerase chain reaction or PCR machine (something not generally found in a residence or anywhere outside of a laboratory environment). Kurtz explained that the machine allowed him to test for the presence of genetically modified organisms, and that the books were related to his current work on the group's latest project, *The Marching Plague*, which would simulate an anthrax attack as a critique of government germ warfare research. Needless to say, this did little to placate the authorities. Although an autopsy revealed that Hope Kurtz had died from heart failure, a natural cause unrelated to the relatively harmless bacterial samples, Kurtz's problems were just beginning.

Justice Department lawyers argued to a federal grand jury that the artist was a threat to national security and should be indicted under section 175 of the U.S. Biological Weapons Anti-Terrorism Act of 1989, which had been expanded by the Patriot Act and states that no one should possess "any biological agent, toxin or delivery system" unless it is justified as "research."¹⁵ Research, in this case, seems to refer only to laboratory, not aesthetic, practices.

These events were followed by an investigation of the independent publishers of CAE books, Autonomedia, and the serving of subpoenas to several of Kurtz's colleagues, some of whom pleaded the Fifth Amendment. Many people rallied to Kurtz's defense, outraged at the events. A lawyer at George Washington University, Jonathan Turley, noted that the Patriot Act "is designed to deal with the likes of al-Qaeda, not Andy Warhol."¹⁷ In an article in *The Guardian*, Gary Younge suggested that: "What began as a personal tragedy for Mr. Kurtz has turned into what many believe is, at best, an overreaction

prompted by 9/11 paranoia and, at worst, a politically motivated attempt to silence a radical artist.”¹⁷ While censorship of art is as ancient as art itself, the reasoning behind this particular case certainly shifted the terms of the debate. Critical Art Ensemble Defense Fund spokeswoman Carla Mendes notes:

Today, there is no legal way to stop huge corporations from putting genetically altered material into our food ... Yet owning the equipment required to test for the presence of “Frankenfood” will get you accused of “terrorism.” You can be illegally detained by shadowy government agents, lose access to your home, work, and belongings, and find that your recently deceased spouse’s body has been taken away for “analysis.”¹⁸

Ultimately Kurtz was not charged with bioterrorism, but with mail and wire fraud under the United States Criminal Code, Title 18, United States Code, Sections 1341 and 1343. Federal prosecutors in Buffalo argued that Kurtz had fraudulently acquired samples of difficult-to-obtain bacteria by using his connections with Robert Ferrell, head of the human genetics lab at the University of Pittsburgh’s School of Public Health. Ferrell was also charged. Ferrell had identified himself as a primary researcher on application forms for the purchase of the materials, as well as signing a document stating that the material was for lab use only. Usually such a breach of contract would be a civil case not a federal one. Each count of mail and wire fraud carries a maximum sentence of twenty years.¹⁹ The men have yet to be convicted. The date for the hearing was set for January 11, 2005, but was postponed,²⁰ and in May 2005 motions were heard by a Buffalo judge for a dismissal of the charges.²¹ This case is indicative of the kind of censure artists can expect when entering the highly charged domain of biotech.

Many art groups besides CAE have been drawn to the realm of biotechnology. Karl Mihail and Tran T Kim-Trang are co-founders of Gene Genies Worldwide© (GGW©). Utilizing satire, they address how biotechnology re-raises the issue of eugenics, and how biotechnology is predominantly funded not by the government but by the corporate sector, which has a huge amount at stake in its profitability. Commercial application is highly lucrative. Organizations like Genetic Savings and Clone offer to store (for a fee) the DNA of deceased domestic pets, in order to eventually clone dogs and cats. There are other organizations that promise – for a tissue sample and a fee of about \$250,000 – to clone your pet (at some future date when it is a more

efficient procedure with a better success rate than is evident in current cloning experiments).²²

In their performances, such as one staged at a shopping precinct in Pasadena, GGW© set up a faux boutique. Wearing white lab coats, standing amid biotechnological paraphernalia, floor displays, and pamphlets, and using mass media marketing strategies, GGW© targeted potential clients, offering them catalogues from which to pick out “designer personalities” and personality traits associated with animals (“the cunning of a fox, canine loyalty, feline intuition, reptilian cool, survivalist properties of a cockroach and the harmonious sisterhood traits of honey bees”).²³ The artists offered a convincing façade of technological competence and professionalism. While artist André Brodyk takes this to mean they have “complicity in the process they are critiquing,” it appears to me that their tongue-in-cheek approach, and the nature of their offerings – currently untenable – demonstrates how their critique operates strategically from within their utilization of the rhetoric and accoutrements of the corporate biotech industry.

Genetic Portraits

*... it's impossible to move, to live, to operate at any level without leaving traces, bits, seemingly meaningless fragments of personal information. Fragments that can be retrieved, amplified ...*²⁴

Other artists have begun to alter (even interrogate) notions of portraiture and self-portraiture by constructing identity in relation to, and often critical of, ideologies of genetic determinism. In Gary Schneider's *Genetic Self-Portrait* of 1997, the artist's body is represented by 55 black and white photographs. With the help of Dr. Dorothy Warburton, an expert in DNA research and director of the Diagnostic Laboratory at the Babies and Children's Hospital at Columbia Presbyterian Medical Center in New York, images of the artist, including the nucleus of a single cell, fingerprints, sperm samples, hair and blood samples, became large-scale photographs. Schneider calls it “a diagnostic self-portrait” that allowed him to “harvest images” of his body and stage his “emotional response to the issue of privacy in the new World of the Genome.”²⁵ The patenting of DNA has resulted in debates over who can “own” biological material and the commodification of such material, often by

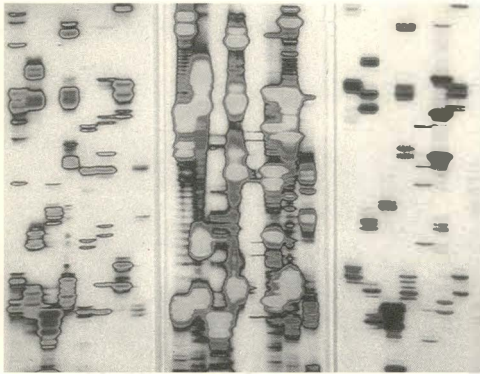
large pharmaceutical companies funding institutional research. Is Schneider reclaiming his ownership over the representation of his body and its materials, or is this question misplaced given the business of biotech? The portrait has morphed to encompass the complex nature of subjectivity in the age of forensic analysis. When we scrutinize one aspect of the human system, we often lose our connection to the larger picture. Our genetic blueprint adds another layer to representations of selfhood, but none of these layers is sufficient, in isolation, to explain who we are.

The cultural necessity for questions about selfhood and ownership of genetic material can be illustrated by the case of John Moore, a Seattle businessman, who had surgery to remove his spleen when he had hairy cell leukemia.²⁶ He received treatment from a specialist at the UCLA School of Medicine. The doctor kept him flying back to Los Angeles for tests over the next seven years. Unknown to Moore, the doctor had been patenting unique chemicals in Moore's blood and negotiating with a Boston company for shares. What piqued Moore's suspicion was his doctor's request for bone marrow, skin, and sperm samples in addition to his usual blood samples. Moore found out that his tissues had been patented and turned into a product. A Swiss pharmaceutical company, Sandoz, paid 15 million dollars for the right to develop Moore's cell line (named the Mo-cell line). He sued his doctor for "property theft" in addition to malpractice.

Although the California Supreme Court that heard the case in 1990 stressed that physicians must inform patients in advance of surgery that their tissue could be used for research purposes, they nevertheless ruled that Moore had no property rights to his own tissue. The ruling clearly illustrated the shift from private research to a dramatically expanded global biotech marketplace catering to the interests of large pharmaceutical companies (forging alliances with researchers) and their stockholders.

Returning to Gary Schneider, the artist raises questions about what signifies "identity" and "ownership" in the age of forensic evidence, medical imaging technologies such as CAT, MRI, and PET scans, and the patenting of bloodlines. If a portrait is not a naturalistic or abstracted representation of the external semblance of a human individual, but one or more enlarged fragments of a private interior identity that enters the public realm, how does this alter how we perceive subjectivity and selfhood?

In a piece by Iñigo Manglano-Ovalle, entitled *Doug, Joe, and Genevieve*, of 1998, each person is represented by a computer-manipulated image of their DNA and the three vertical photographs are hung together in a triptych (fig. 1). The participants are Doug Ischar, an artist, his partner Joe, and their artist friend, Genevieve Cadieux. Each image is over five feet high; the DNA samples are thus given anthropomorphic scale. This is part of Manglano-Ovalle's project *The Garden of Delights*, in which the Spanish-born artist made 48 Cibachrome prints of digitized DNA samples. The artist asked sixteen people to choose two relatives or friends to participate with them. Manglano-



Iñigo Manglano-Ovalle, *Doug, Joe, and Genevieve*,
from *The Garden of Delights*, 1998

Ovalle was assisted by Dr. Suzanne Hart at Wake Forest University (who was then the director of the biochemical and molecular genetics laboratory). She put the samples through polymerase chain reaction tests and helped the artist develop the chainlike DNA imagery.²⁷ By hanging the images as triptychs Manglano-Ovalle, not only utilized the format of the altarpiece (the title makes reference to Dutch artist Hieronymous Bosch's triptych *The*

Garden of Earthly Delights, of the early 1500s), he also redefined the family portrait. *Doug, Joe, and Genevieve* raises questions about genetic information and its relation (or not) to emotional intimacy.

In the works of Schneider and Manglano-Ovalle, the DNA profile – usually associated with forensic labs identifying the perpetrators of violent crimes or with medical labs determining paternity or hereditary propensity to disease – changes their artistic perceptions of self-portraiture and portrait likeness. They represent individuals as genetic “profiles.” For better or for worse, something invisible to the naked eye becomes implicated in new perceptions of selfhood. The artists struggle with what that might mean.

The Language of DNA (or "The Code of Codes")

*It is a new era and we need a new kind of art.*²⁸

The language of DNA, the metaphors used to describe it, and how this information is "translated" is also a concern for biotech artists. Brazilian-born Eduardo Kac (pronounced "Katz"), an artist and a professor at the School of the Art Institute of Chicago, is a pioneer in biotech art. At the festival *Ars Electronica 99*, Kac presented his controversial and ongoing work *Genesis* (first exhibited in 1999 and on display at the festival). Central to this work are notions of translation, coding, and decoding.

The artwork begins with the imperialist and authoritarian statement about human supremacy over nature taken from the Old Testament book of Genesis: "Let man have dominion over the fish of the sea, and the fowl of the air, and over every living thing that moves upon the earth." Perhaps it was the inflexible ideology of the statement that spurred Kac to convert it into Morse code (dots, dashes, word spaces, and letter spaces). Morse code is significant, both because it has a similar binary logic to digital 1s and 0s, and because it was the technology that arguably ushered in the global information age.²⁹

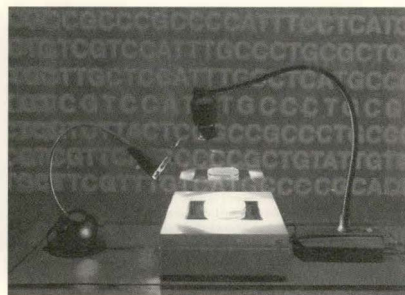
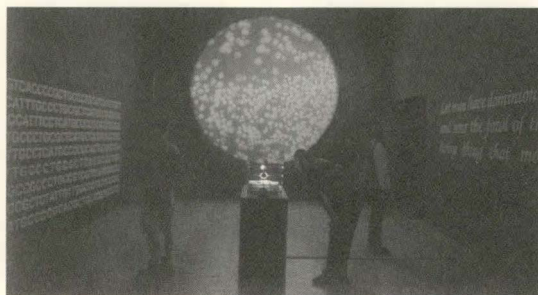
Kac then converted the Morse code into genetic code – Adenine, Guanine, Cytosine and Thymine, abbreviated as A, G, C, T (the chemical base pairs that make up the rungs of the DNA molecule, the famous double helix). DNA is used by Kac on numerous levels, as material, as process, as life form, and as metaphor. Kac is well aware of the way DNA is spoken of as a map, blueprint, or recipe for life, as the "code of codes," or as a "souped up photocopy machine."³⁰ He plays with this notion of coded information.

With the assistance of a biotech company and Charles Strom, a Chicago geneticist and director of the Department of Medical Genetics of the Illinois Masonic Medical Center, a gene "written" by the code was synthesized.³¹ Biblical passages are no strangers to translation, having been translated from Hebrew, into Greek, into other languages, and now into Morse code and the "language" of DNA.

The "artist's gene" carrying the coded biblical passage was combined with a protein that glows cyan when illuminated by ultraviolet light. The gene and the protein were inserted into a species of *E. coli* (commonly found in the human gut), which could reproduce the gene. The genetically engineered

bacteria was then put in a petri dish along with another strain of *E. coli* that glows yellow under ultraviolet light, but does not carry the Genesis gene.

How does all this appear as an installation piece (figs. 2-3)? Entering the dark exhibition space, the viewer is confronted with the petri dish illuminated by lights on a pulpit-like platform. On one wall is a large projected image – the bacteria in the petri dish blown up in scale. Due to its increased size and its focal colour within the darkened room, this large circle of blue with greenish-yellow areas almost resembles a planet in space, mysterious and compelling. On the wall next to it is projected the genetic alphabet: CTCCGCGTATT and so on. On another wall is the biblical passage itself. A computer screen also shows the bacteria in the petri dish.



Eduardo Kac, *Genesis*, 1999

Multiple languages coexist, like esoteric messages with hyperbolic significance: the Book of God, the Book of Life or Nature, Information. Biology, language, and technology are contingent in this seductive piece. Biological “life” – bacteria – is in the petri dish for us to examine. Translation from one “language” to another is what allows us to “read” the genetic alphabet of biology. Technology is what facilitates humans to manipulate, transfer, and splice genes.

The piece is interactive. By using the internet or by visiting the gallery, the viewer can hit a switch that illuminates the bacteria with either white or ultraviolet light. The flick of a switch or the click of a mouse accelerates the mutation rate of the bacteria when it is exposed to ultraviolet light. The result of this mutation is not only the creation of a new strain of bacteria, it is a new translation of the biblical verse. The easy public access to manipulating the building blocks of life raises questions about the power to change, and makes one wonder about biotech regulations or lack thereof. By giving an old myth – the biblical passage – a contemporary twist, Kac has made every spectator a co-author of the Book of Life. The language of genetics becomes a communal process.

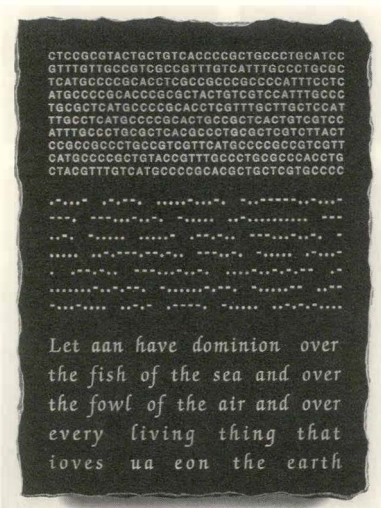
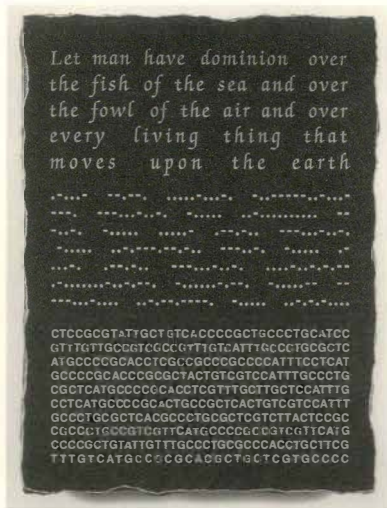
But does this rewriting undermine the dogmatic assertion of the original passage, which grants “man” absolute authority over the earth, while unnerving those already afraid of human tinkering with the genome as an act of defiance against “nature” or God? Or does it reinscribe DNA as the master code and humanity as the master species? The resultant ambiguity is unsettling.

At the end of the exhibit the translation occurs again in reverse: from the now mutated DNA back into Morse code, then back into English. In one version it reads: “Let aan have dominion over the fish of the sea and over the fowl of the air and over every living thing that ioves ua eon the earth.” Slight changes, perhaps, but in animal and human populations, small corruptions in DNA can, of course, have devastating consequences in terms of disease, disability, and even survival.

In later exhibited versions of *Genesis*, Kac included two laser-etched granite *Encryption Stones* (figs. 4-5). Kac has adapted the idea of the Rosetta Stone discovered by Napoleon’s troops in 1799, by using a triple language system. While the Rosetta Stone, which proved so evocative to antiquarians and linguists, contains three languages – Greek, demotic script, and hieroglyphs, each stone in Kac’s diptych includes three different “languages” – the biblical passage, Morse code, and the DNA alphabet. On one slab the order is from the biblical passage to Morse code to DNA, and on the other, the order is reversed with the now mutated biblical passage listed last. Because there are two stone slabs, they also recall the tablets Moses brought down from the mountain, inscribed with the Ten Commandments.³² These references call up the age-old interest in how life (as well as power and authority) is defined through text.

Yet *Genesis* also includes living organisms. Flesh and logos must coexist. Information cannot be disembodied. There is interplay between durability and permanence (the stone slabs) and the fluidity and unpredictability of life processes (the bacteria itself). N. Katherine Hayles’ astute account of *Genesis* also notes that the “sentence that emerges from the bacteria’s mutations speaks not only of dominion but also of rich interconnections in which causation is multiple and massively parallel, thus giving the lie to human agency as the uniquely important element in the rich stew of recursive feedback loops we call life.”³³

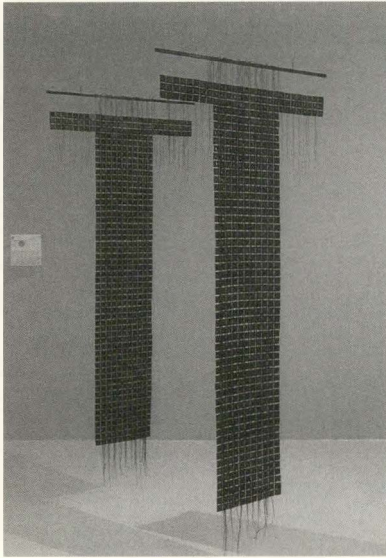
Does Kac “relocate humanity within the complex ecological systems of life rather than above or below it”?³⁴ Is the artist less involved than the biblical text in placing humanity at the apex of creation? Are we authors, are we observers, or are we equal participants in *Genesis*? Viewers are implicated in



Eduardo Kac, *Encryption Stones*, 2001

the act of translation, interpretation, and mutation. This is not merely about what humans are capable of. Why do we want to do certain things? How do we demonstrate responsibility and complicity in relation to biotechnologies? It is unnerving when artist George Gessert reminds us that *Genesis* was first displayed in Linz, Austria, a favorite city of Hitler's, close to where Hitler himself was born, thus making a link between Nazi eugenics, genetic engineering, and megalomania.³⁵ Kac, a Brazilian, is also of Jewish origin. *Genesis* brings issues and questions about genetic research – from the past and present – to a viewing public, opens up a dialogue, and leads us to ponder its charged implications.

Christine Davis' *ACGT I and II* of 1998–1999 provides a different take on the genetic code (fig. 6). Combining tiny squares of steel, each etched with a letter of the genetic alphabet, with thread, she turns the genetic code into two hanging panels that resemble flat pieces of fabric. Under a microscope the code is indeed tangled and stringy in appearance. Only via its abstraction and interpretation does it become the clear string of information, a series of letters in particular combinations. Life is much messier than this, and perhaps this is alluded to by the tangled string ends. According to Davis, "The genetic code seemed to be a radical shift from mechanics to communication, from how the body "works" (blood and guts) to how it "means" (blocks of letters). The idea of genetics as a universal language of life was something I found quite menacing."³⁶ Why does she find it menacing? A universal language of genetics is one



Christine Davis, *ACGT I and II*, 1998–1999

that can easily become conflated with new standards of normativity (insertion of “desirable” or “healthy” genes) and deviance (removal of “undesirable” or “unhealthy” genes).

ACGT I and II also calls up a gendered approach, given the association of needlework and sewing with the labour and sociability of women. The so-called code of life is here stitched together from various components (and disciplines): steel and thread represent technology and life, the biological code supposedly “programs” our fragile flesh. Life literally hangs in the balance. Davis seems to suggest that products of art and products of life are both routinely manufactured and commodified, albeit in dissimilar ways.

Both Kac’s *Genesis* and Davis’ *ACGT I and II* were presented at “Paradise Now: Picturing the Genetic Revolution,” a major show of genetic art that opened at Manhattan’s Exit Art Gallery in September 1999. According to the catalogue introduction,

Most of the work in the exhibition has been made outside of the sanctioned interests of the mainstream art world, and as a result has been marginalized as much by its seriousness and specificity as by its subject matter. But the issues about which these artists make art are now central to the world at large.³⁶

The media spotlight on new developments in genetics facilitates an increased public awareness, and, given the central focus on technological developments in the work of many contemporary artists, genetic art will indeed be extremely important to biotech debates. Whether or not it will ever move into the “mainstream” of art production depends on how one defines that term. Politically effective art often only becomes mainstream in retrospect, once some distance and time has passed, and it depends on the theoretical lens applied or the interpretative tools utilized to assess it.

Some critics are skeptical of biotech art’s longevity, assuming it to be a novelty or trend; Peter Schjeldahl in *The New Yorker* gives it “the shelf life of milk.”³⁸

Compare this to Carole Kismaric, a co-curator of the exhibition *Paradise Now*, who calls biotech art the “imagery of our times.”³⁹ I caution against embracing either account. The Human Genome Project will continue to galvanize public attention longer than it takes milk to sour, and the gene is not the only visual catalyst of the twenty-first century.⁴⁰

Collapsing Boundaries (Hybrids)

Artists not only comment on the communicative metaphors of genetics, they also comment on how genes can be combined to create life forms that are simultaneously innovative, fascinating, and disturbing. There is a long historical tradition of public fascination with freaks, chimeras, monsters and the grotesque. Artists tap into this history, from the literary tradition that begins with Mary Shelley’s *Frankenstein*, to the display of living specimens in circus side-shows, to Hollywood films about cloning, mad scientists, and eugenics.⁴¹

In this section, I offer four examples of hybrids: biological, digital, sculptural, and painted. Firstly, Eduardo Kac’s most notorious work, *GFP Bunny*. Kac defines the term he invented, “transgenic art,” as a

new art form based on the use of genetic engineering techniques to transfer synthetic genes to an organism or to transfer natural genetic material from one species to another, to create unique living beings With at least one endangered species becoming extinct everyday, I suggest that artists can contribute to increase global biodiversity by inventing new life forms.⁴²

Art’s role has dramatically expanded if it can contribute to increased biodiversity. Kac’s artworks are so unorthodox that they instigated a symposium at Chicago-Kent College of Law: “Art, Science and Free Speech: The Work of Eduardo Kac.”⁴³ His work raises many questions, including what does it mean to use biotechnology as an artistic medium? The *GFP Bunny*, Alba, an albino rabbit born in February 2000, is indeed a creature that could not exist without human intervention. Her name means both white and, fittingly, dawn of day. Kac, in this work, relied on collaborations with scientists and technicians. Alba was created in Jouy-en-Josas, France, by zoosystemician Louis Bec (Bec coined this term to describe the digital modeling of living systems), and scientists Louis-Marie Houdebine and Patrick Punnet, both working at the Institute National de la Recherche Agronomique.⁴⁴

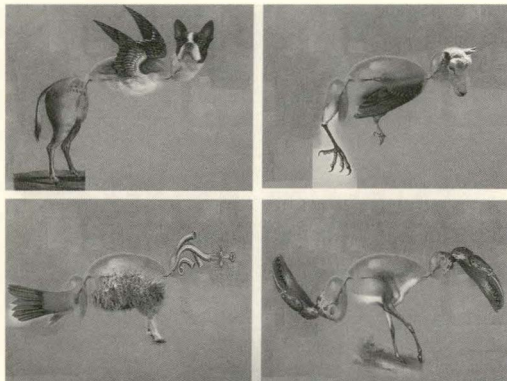
GFP is green fluorescent protein, and it is found in the Pacific Northwest jellyfish *Aequorea Victoria*. *GFP* occurs in many organisms: slime mold, yeast, bacteria, fruit flies, viruses, and zebra fish. After its isolation from the jellyfish, the *GFP* was modified in the bacteria to become *EGFP*, a synthetic mutation that enhances *GFP*, giving it a magnitude of two times greater fluorescence in mammalian cells.

The genetic sequence that produces the enhanced green fluorescent protein was joined with the rabbit genome through the molecular biological process of zygote microinjection. Supposedly (although it has been argued that Alba would have to be shaved first), the rabbit glows bright green under blue light with a maximum excitation at 488 nm.⁴⁵ The rest of the time she is an ordinary white rabbit with pink eyes. Kac states that the *GFP* is harmless to her, as well as to other animal species (many lab experiments with *GFP* back him up).⁴⁶ However, to assert that *GFP* does no harm is not the same as stating that genetic modification or transgenic experiments are animal-friendly. The number of lab animal deaths from genetic experimentation is truly appalling, and certainly reiterates the point about domination made in the biblical passage in Kac's *Genesis*.

Kac asserts that he is concerned with taking responsibility for the creatures he modifies. He wants to counter any idea that a genetically modified animal is a monstrous thing, and he often brings up issues of the crossbreeding of plants and the selective breeding of animals throughout history, as if to imply that this is the logical next step. Alba was supposed to return home to Chicago to live with Kac, his wife, and their daughter in July 2000, but the director of the French government laboratory refused to release the bunny.⁴⁷ The integration of Alba into a family setting would have allowed Kac to experience a transgenic being on an informal and emotional level.

When the lab withheld Alba, Kac began a "Free Alba" campaign on his website. This jibes with the artist's notion that Alba herself is not the artwork, but rather that *GFP Bunny* as a whole is the artwork, which includes the creation of Alba, her social integration, and the public debate surrounding her creation. The issue of ownership of the bunny remained unresolved at the time of Alba's death at the age of four.⁴⁸ In *GFP Bunny*, Kac utilized a bioengineering process, attempted to humanize it, and opened up space for a critique of it, all in one work.

Artist Eva Sutton, who has also worked as a software designer, created *Hybrids* (2000), an interactive digital installation that she has described as a “surrealist slot machine.”⁴⁹ It allows users, with the click of a mouse, to create transgenic creatures by randomly altering combinations of animal body parts (fig. 7).⁵⁰ The very nature of the artwork makes connections between software design and biological system manipulation, while Sutton’s project was also influenced by recollections of the Grimm’s fairy tales read to her as a child.⁵¹ Are these the new monsters under the bed? What are the consequences of



Eva Sutton, *Hybrids*, 2000

such recombinations in our fantasies and in reality? The permeability of species boundaries is certainly highlighted in transgenic research; Sutton gives us a playful way to explore what this means in terms of selective breeding and aesthetic experimentation.

In 1994, Thomas Grünfeld created *Misfit* (*St. Bernard*) (fig. 8).

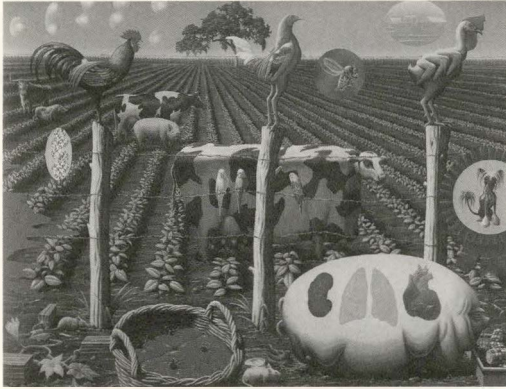
This sculpture, part of the Saatchi Collection, London, is made from taxidermied animal parts, with the body of a Saint Bernard dog and the head of a sheep. This chimera has a surprising appeal despite, or perhaps because of, its incongruity. *Misfit* raises the specter of genetically modified creatures that might one day exist, although, to what purpose, remains an open question. Will they be living works of art?

Lastly, the painting *The Farm* (2000), by Alexis Rockman, offers the spectacle of genetically modified animals and produce coexisting with more familiar



Thomas Grünfeld, *Misfit* (*St. Bernard*), 1994

livestock (fig. 9). The painting combines a naturalistic style and mathematical perspective with flattened elements more reminiscent of advertising or graphic design. Against the backdrop of a field of neatly planted rows of soybeans, stand an obese pig bred for organ donation, a three-winged chicken, a square-bodied cow, a basket of square tomatoes, a plant producing rectangular



Alexis Rockman, *The Farm*, 2000

cucumbers, and in the very foreground, the infamous mouse with a human ear growing on its back, referring to a 1997 experiment by Dr. Jay Vacanti. Vacanti, a transplant surgeon at Massachusetts General Hospital in Boston, grew a human ear from cartilage cells and grafted it onto the back of a mouse. To some critics, despite the possible applications of this research in terms of growing

replacement tissue, the still photographs and filmic images of the mouse are a dramatic example of monstrous experimentation.

Floating vignettes in Rockman's *The Farm* include a prize-winning show dog and the DNA double helix. Pressures on the farm are evident in terms of human food consumption and crop enhancement, advances in genetic engineering, and medical applications of modified livestock. The farm has become a locale serving corporate and pharmaceutical interests. Scientific experiments first performed in a laboratory are now part of the "natural" environment. As Rockman puts it, "The flora and fauna of the farm are easily recognizable; they are, at the same time, in danger of losing their ancestral identities."⁵²

The Monstrous Future

*... learn to remember that we might have been otherwise, and might yet be ...*⁵³

*Let us be transformed!*⁵⁴

We are sometimes told that "the future is now," or informed that there is nothing we can do about our information-driven economy and inevitable technological transformation. I am profoundly skeptical of any statements stressing that the future is a done deal with no viable alternatives, because these attempt, through foreclosure, to undermine agency and political efficacy. Rather than giving in to the inevitable, an engagement with the monstrous

future, as defined by Jacques Derrida, is much more significant, radical, and productive. This approach also respects the alterity of any future(s).

A future that would not be monstrous would not be a future; it would already be a predictable, calculable, and programmable tomorrow. All experience open to the future is prepared or prepares itself to welcome the monstrous *arrivant*, to welcome it, that is, to accord hospitality to that which is absolutely foreign or strange, but also, one must add, to try to domesticate it, that is, to make it part of the household and have it assume the habits, to make us assume new habits. This is the movement of culture. Texts and discourses that provoke at the outset reactions of rejection, that are denounced precisely as anomalies or monstrosities are often texts that, before being in turn appropriated, assimilated, acculturated, transform the nature of the field of reception, transform the nature of social and cultural experience, historical experience. All of history has shown that each time an *event* has been produced ... it took the form of the unacceptable, or even of the intolerable, of the incomprehensible, that is, of a certain monstrosity.⁵⁵

Significant art often produces such unacceptable or initially incomprehensible events. Returning to the original question: what are the cultural, political, and aesthetic roles of artists working with advanced technologies, such as bioengineering? In the best scenarios, the roles are to expand art-making practices and possibilities; to stage interventions; to critique; to provoke; to transform; to startle us out of our complacency; to reveal the conflicted and contradictory impulses implicit in complex cultural investigations; to jar us out of ineffectual and anachronistic dichotomies which privilege one term over another (male/female, culture/nature, flesh/metal, human/animal, self/other); to push forward a politics *other than* what currently exists; and never to be blindly complicit in, or indifferent to, those workings of late capitalism and liberal humanist rhetoric that privilege individual interests over communal ones.

Biotech is not automatically Biopower Inc.; it does not *have* to be a handmaiden to capitalism and globalization. There is nothing innately liberatory or oppressive about biotechnologies themselves. They are motivated by, facilitated by, or embedded in, modes of thought and action that determine their applications, their uses/abuses. Technological development, according to professor of political science Langdon Winner,

begins with the recognition that as technologies are being built and put to use, significant alterations in patterns of human activity and human institutions are already taking place. New worlds are being made ... The construction of a technical system that involves human beings as operating parts brings a reconstruction of social roles and relationships.⁵⁶

Artists are “operating parts” in this reconstruction. Can they uncover more productive options than unbridled individualism and wealth? Can they promote options that evoke promises of integration and kinship with all matter? To escape entrenched ways of thinking about bodies, one must come to terms with the fact that “genomes are constantly changing, the taxonomy of living things cannot be rigid, and boundaries between its objects cannot be sharply defined, including the definition of *Homo sapiens*.”⁵⁷

Artists speculate about future embodiment through representation. Future bodies are frequently imaged as cyborgs or hybrids, biological-digital entities commingling various genders, sexualities, ethnicities, nationalities, classes, species, abilities, and intelligences. These are anxious bodies, alien others, post-humans. These are the ghost-haunting alarmist visions of biotechnology (when scientists are accused of “playing God” or introducing “unnatural” life forms into the environment). The posthuman body is also the promising stranger embraced by the transhumanist movement, and groups such as the Extropians, who believe in taking charge of and directing our own evolution.

Transhuman means a human in transition. The World Transhumanist Association reports on scientific research regarding all topics related to the improvement of human capabilities and the extension of life.⁵⁸ The Extropians, once a little known California-based organization, have formed the Extropy Institute. Their central goal is to achieve immortality through technology.⁵⁹ Spokesperson and president of the institute, Max More, writes:

We challenge the inevitability of aging and death, and we seek continuing enhancements to our intellectual abilities, our physical capacities, and our emotional development. We see humanity as a transitory stage in the evolutionary development of intelligence. We advocate using science to accelerate our move from human to a transhuman or posthuman condition.⁶⁰

The Extropians seem oblivious to the political and economic implications of their manifesto. What is not mentioned is the fact that the inevitability of death and obstacles to emotional development for most of the earth’s human

population are not the result of aging or infirmity, but of famine, extreme poverty, lack of clean water, absence of medicines to treat disease, the lack of access to an adequate education, and civil war. The Extropian blindspot is their unstated awareness that they are speaking from a position of economic, educational, western privilege. The promotion of self-transformation falsely affirms the singularity and denies the heterogeneity of bodies.

Privileging the individual and individual “choice” is a central tenet of capitalist free enterprise, market expansion, and consumerism, all things that generally interfere with equality among peoples and nations. It denies recognition of how an individual is produced within a social matrix; everything becomes a matter of personal choice, and the limitations placed on individuals by social and political circumstances are rendered opaque. Any dynamics of transformation will likely be tempered by economic, class, racial, ethnic, gendered, and sexual realities, as well as by age and ability. These are the differences that must be taken into account, and that responsible postmodern theorists value as indicative of human diversity, as illustrative of systemic inequalities and injustices, and as instructive regarding the social operations of power.⁶¹ Attempts to whitewash such differences should be viewed with extreme caution.

Posthumanism describes a state of awareness that “human” is no longer an adequate description of what we are becoming. Social democratic posthumanism, as an ontology and phenomenology, could allow us to experience the world differently, open our corporeality and subjectivity to co-mingling, co-evolution, and a more equitable co-existence. What is required, are ways for a group to be a “constant generator of de-individualization.”⁶²

In terms of a biopolitics of biotech art, is it possible for there to be new fusions of organisms, machines, and systems concerned not with individual self-enhancement, but rather with the proliferation of difference and the creation of innovative systems that can foster cross-cultural and cross-species alliances with the goal of benefiting all matter? If people have affinities with others based on an understanding of the world as a series of differential yet interconnected systems, all of which are effected by a negative change in just one, then perhaps liberal humanist notions of autonomy can be sabotaged with a more social democratic vision.⁶³ I am not suggesting that all biotech art producers are interested in promoting social justice. Rather, how artists who incorporate biotechnologies position them, whether they like it or

not, in relation to certain debates regarding the role of technology in human experience.

We are *embodied*, and biotechnology reveals that this embodiment, rather than being about how we are distinct from other entities, demonstrates the degrees to which we are compatible, adaptable, permeable, and modifiable, especially in view of proposed integrations of organic and digital technologies (wetware and direct human-to-computer communication). Xeno-transplantation investigates the possibility of human recipients of transplanted pig organs that have been genetically modified to resist rejection. How many species will need to be incorporated within the human body (through xeno-transplants or the ingestion of GMO foods) before we consider ourselves transgenic and give up the notion of species superiority and species integrity?

Such investigations tweak our recognition of the Others crowding out the archaic yet hardwired notion of a singular separate unique self, a conscious boundaried autonomous being (the diehard myth and illusion that has so frequently legitimized rampant individualism, and class and racial hierarchies leading to exploitation and prejudice).

The thought of becoming part of a fusion of organisms, machines, and systems is terrifying to many, as is making genetic modifications that are passed to subsequent generations. Whereas formerly evolution, a messy and haphazard process, happened over thousands of years, the purposeful alteration of genomes (particularly in organisms grown on a commercial scale such as industrialized agriculture) may result in dramatic changes within a short time period. How do we (re)define ourselves in light of these mind-boggling possibilities? The panic implicit in bodily instability is profound, raising fears of "contamination." What if, instead of encouraging empathy, egalitarianism, and symbiosis, viral hostility or totalitarianism infiltrate these hybrids?

What we make of this bodily instability will determine how we negotiate our mutation into something *other than* our current human condition. To embrace this indeterminacy, this collapse of boundaries, would be the ultimate outcome of that strand of thinking that views all life, energy, and invention as interdependent and contingent. We do not evolve (whether biologically or culturally) in isolation. The stress is placed not on an outmoded "survival of the fittest" paradigm, but on our symbiotic interactions with other species and with the environment.⁶⁴

The ultimate outcome of such views has variously been described as a networked consciousness, a hive mind, or a global brain; life becomes a massive parallel processor. It is tempting to label this view *holistic* in a (Gaian new-age) way that diminishes its appeal, import, or shock. However, it is a prevalent view, one promoted by the interconnectedness of biology, cosmology, and systems theory, and the desired outcome of proponents (physicists, biologists, chaos and systems theorists) of a Theory of Everything (TOE).

The audacious human quest for a Theory of Everything would supposedly resolve all the contradictions between quantum, biological, and cybernetic approaches to the world. It would be the final explanation and demystification of how the universe works, an event horizon beyond which nothing would ever be the same again. The veil of ignorance lifts as intelligence goes supernova, or so the story goes (as usual, humanity could use less hubris and more humility).

Biotech art, like the genre of science fiction, prepares us for the unforeseen changes to come by negotiating treacherous terrain, exploring both the seductive appeal of biotechnologies and strategies for bioresistance. Biotech art engages us in a dialogue about the challenges, promises, and perils of biotechnology today, as well as its aesthetic dimensions. I use the term “aesthetics” not in reference to a detached objective view of art, wherein values are falsely argued as implicit in the artworks themselves, but rather to describe an ideologically informed approach to the visual that acknowledges the social construction of values. In other words, an awareness that some types of bodies or forms are privileged to the exclusion of other types, an approach that has real consequences.

Tobin Siebers, when discussing “the body aesthetic,” states, “the making of any object, out of any substance, by a human being is also in some way a making and remaking of the human.”⁶⁵ In light of this assertion, the political, corporeal, and psychic dimensions of our engagement with biotech art and its aesthetics are crucial. In the balance hangs nothing less than a stake in the redefinition of “the human.”

What would a *bioaesthetics* entail? Entering the culture of advanced genetic technologies requires an extreme experimental attitude, the breaching of boundaries, and the transgression of established rules.

Bioaesthetics needs to be excessive as well as critical. It must be wasteful, extravagant, and non-utilitarian. It must be ready, at any moment, to turn back upon itself, experiment upon itself, and put itself at risk It must try

to imagine the unimaginable, to ask questions that are not supposed to be asked, and to transgress the limits of positivist understanding.⁶⁶

Serious art, as always, is burdened with a hefty social responsibility.

Rather than submitting to the dystopian mantra of Star Trek's Borg, "resistance is futile," or buying into the Telus assurance that, "the future is friendly," we would do well to remember that the term utopia, derived from Greek, literally means *ou* 'not' plus *topos* 'place,' in other words, "nowhere." The future is not a pre-mapped destination, but an imaginary realm up for grabs (after all, it never occurs, all we ever have is *now*). The fear of this nowhere seeps through our protective yet vulnerable membranes. This is a necessary fear; in the words of artist Gregg Bordowitz, "utopian potential always risks proximity to horror."⁶⁷ The monstrous future looms.

To avoid the twin dangers of technophobia and technophilia requires ongoing visual inquiry and an informed critical stance. Biotech artists, in their efforts to expose for public perusal what they see as the underlying implications of genetic technologies, operate as *if* there remains an opportunity to expand current dimensions of thought (and they will attempt to do so without any guarantee of success). Mergings of biotechnology and art have the potential to challenge ideologies of human "progress" that are entrenched in anthropocentrism. Some of the most subversive weapons against dominant biomedical and corporate ideologies of human "progress" (which often dangerously elevate egoistic initiatives or profits over egalitarian impulses, or value human life over other life forms) include appropriation, manipulation, refusal, irony, satire, and skepticism. Fortunately these are modes in which a great deal of biotech art excels.

NOTES

¹ Michelle Kasprzak, "GFP Bunny," <http://www.ekac.org/kasprzak.html>.

² Frank Moore, in Ian Berry, ed., *Paradise Now: Picturing the Genetic Revolution* (NY: Tang Teaching Museum, 2001), 29.

³ André Brodyk, "Genetic Art and Culture," www.aw.mq.edu.au/ANZIHLE/docs/brodyk_cp_01.pdf.

⁴ See "SCI-ART: Post-Photography, Documenting our Genetic Possibilities," http://www.artn.com/bibliography/003_006_nyarts.html.

⁵ For example, when scientists do research, own shares in companies, and sit on ethics boards. See Elaine Dewar, *The Second Tree: Of Clones, Chimeras and Quests for Immortality* (Toronto: Random House, 2004).

⁶ See Dewar 341.

⁷ Quoted in Barbara Pollack, "The Genetic Esthetic," *ARTnews* 99, no. 4 (2000): 137.

⁸ Melentie Pandilovski, "The Ghost of Biotechnology: Art of the Biotech Era," *Art in the Biotech Era* (Adelaide: Experimental Art Foundation, 2006).

⁹ A few examples of exhibitions on this theme: *Paradise Now: Picturing the Genetic Revolution*, Exit Gallery, New York; U of Michigan Museum of Art, Ann Arbor; Tang Teaching Museum, Skidmore College, Saratoga Springs (2000); *Gene(sis): Contemporary Art Explores Human Genomics*, Henry Art Gallery, Seattle; Berkeley Art Museum; Frederick Weisman Museum of Art, U of Minnesota; and Mary and Leigh Block Museum of Art, Northwestern U (2001); *How Human: Life in the Post-Genome Era*, International Center of Photography, New York (2003); *Art of the Biotech Era*, Adelaide Bank Festival of Arts, Australia (2004).

¹⁰ For more thorough coverage of biotech artists, see Suzanne Anker and Dorothy Nelkin, *The Molecular Gaze. Art in the Genetic Age* (New York: Cold Spring Harbor Laboratory, 2004), and George Gessert, "A History of Art Involving DNA," *Ars Electronica Archive*, http://www.aec.at/en/archives/festival_einstieg.asp.

¹¹ On CAE, see Mark Dery's "Interview with Critical Art Ensemble," <http://www.levity.com/markdery/cae.html>.

¹² Quoted in Robin Held, "Generating *Gene(sis)*: A Contemporary Art Exhibition for the 'Genomic Age,'" http://web.archive.org/web/20050308061419/www.gene-sis.net/new_essays.html.

¹³ Ibid.

¹⁴ This incident was reported in numerous newspapers and magazines in May and June 2004, including *Nature*, the *Washington Post*, *WIRED News*, and the *Los Angeles Times*.

¹⁵ The act can be found at <http://www.law.cornell.edu/uscode/search/index.html>.

¹⁶ Quoted in Geoff Brumfiel, "Bacteria Raid May Lead to Trial for Artist Tackling Biodefense," *Nature* 429. Also at <http://www.nature.com/nature/index.html>.

¹⁷ Gary Younge, "Art Becomes the Next Suspect in America's 9/11 Paranoia," *The Guardian* (June 11, 2004), <http://www.guardian.co.uk/usa/story/0,12271,1236288,00.html>.

¹⁸ See "FBI Abducts Artist, Seizes Art," <http://www.refuseandresist.org/article-print.php?aid=1386>.

¹⁹ Rebecca Dana, "In N.Y., Case of Germs Shifts from Bioterror to Moral Error," *Washington Post* (June 30, 2004).

²⁰ For updates on the Critical Art Ensemble Defense Fund, see <http://www.caedefensefund.org>, particularly "When Thought Becomes Crime." The CAE defense team also notes that The New York Council for the Humanities revoked a grant awarded to the City University of New York due to the fact that they invited Steve Kurtz as one of the speakers in its series on academic freedom!

²¹ Joan Hawkins, "When Taste Politics Meet Terror: The Critical Art Ensemble on Trial," *CTheory* (June 14, 2005), <http://www.ctheory.net/articles.aspx?id=482>.

²² As I was writing this article, it was reported that the first dog (an Afghan hound) had been successfully cloned in South Korea by stem cell scientist Woo-Suk Hwang and his researchers (it took the implantation of more than a thousand embryos in more than one hundred dogs to get this result). See "Koreans Produce World's First Cloned Dog," <http://www.msnbc.msn.com/id/8808883>. For more on Genetic Savings and Clone, see Charles Graeber, "How Much is the Doggy in the Vitro?" *WIRED* 8 no. 3 (2000): 220-229.

²³ Brodyk, "Genetic Art," 5.

²⁴ William Gibson, "Johnny Mnemonic," *Burning Chrome* (NY: Ace Books, 1987), 17.

²⁵ Quoted in *Paradise Now*, 94.

²⁶ Moore's story is relayed in Lori Andrews and Dorothy Nelkin, *Body Bazaar: The Market for Human Tissue in the Biotechnology Age* (NY: Crown, 2001), 1-2.

²⁷ Barbara Pollack, "The Genetic Esthetic," 137.

²⁸ Eduardo Kac, quoted in Gareth Cook, "Cross Hare: Hop and Glow," *Boston Globe* (Sept. 17, 2000). Also available at <http://www.ekac.org/bostong.html>.

²⁹ Morse code was invented by a painter, Samuel F.B. Morse. In 1836 he created the first working telegraph set.

³⁰ David Hunt, "Eduardo Kac: Metaphor into Motif," <http://www.ekac.org/dhunt.html>.

³¹ See Lisa Lynch, "Trans-Genesis: An Interview with Eduardo Kac," <http://www.ekac.org/newformations.html>.

³² See Sheilah Britton, and Dan Collins, ed., *The Eighth Day. The Transgenic Art of Eduardo Kac* (Arizona: Arizona State U, 2003).

³³ N. Katherine Hayles, "Who is in Control Here? Meditating on Eduardo Kac's Transgenic Art," *The Eighth Day*, 85-86.

³⁴ Any M. Youngs, "The Fine Art of Creating Life," *Leonardo* 33, no. 5 (2000): 377-80.

³⁵ George Gessert, "Art is Nature: An Artist's Perspective on a New Paradigm," *Art Papers* (March/April 2001): 16-19.

³⁶ Quoted in *Paradise Now*, 56.

³⁷ *Paradise Now*, 10.

³⁸ Mentioned in John Travis, "Genes on Display – Art Movement has Grown Out of Genes" (review of the exhibition "Paradise Now: Picturing the Genetic Revolution"), *Science News* (December 16, 2000).

³⁹ See Travis.

⁴⁰ One could add the microchip, the refugee camp, the sweatshop, large-scale weather disasters exacerbated by global warming, the terrorist suicide bomber – all recurring images symptomatic of our times.

⁴¹ In addition, the growing belief in the plasticity of the body, its malleability, is what gives reality TV shows like *The Swan* and *Extreme Makeover* their popularity, or people like Lizard Man his context. Lizard Man (Erik Sprague) has green hair, scales tattooed on his body, and has had his tongue split and reptilian bumps implanted above his eyebrows. The subcultural (and sometimes erotic) appeal of surgically created "animal-human" hybrids is fast becoming a lucrative mini-industry.

⁴² Eduardo Kac, "GFP Bunny," *Telepresence, Biotelematics, Transgenic Art* (Ljubljana: Kibla, 2000), 101.

⁴³ See Jeremy Manier, "Art Takes a Genetic Engineering Leap," *Chicago Tribune* (Sept. 19, 2000): sec. 2: 3.

⁴⁴ Eduardo Kac, "GFP Bunny," 102.

⁴⁵ Ibid.

⁴⁶ See George Gessert, "Art is Nature."

⁴⁷ Blake Eskin, "Building the Bioluminescent Bunny," *ARTnews* 100, no. 11 (2001): 118-119.

⁴⁸ See Kristen Philipkoski, "RIP: Alba, The Glowing Bunny," *WIRED News* (August 12, 2002), <http://www.wired.com/news/medtech/0,1286,54399,00.html>.

⁴⁹ Anker and Nelkin, *The Molecular Gaze*, 107.

⁵⁰ The program can be experienced at <http://www.genomicart.org/eva.html>.

⁵¹ Quoted in Anker and Nelkin, 107.

⁵² Alexis Rockman, in *Paradise Now*, 86.

⁵³ Donna Haraway, *Modest_Witness@Second_Millennium. FemaleMan©_Meets_OncoMouse™* (NY: Routledge, 1997), 39.

⁵⁴ Artist Jean Tinguely, September 1959, quoted in Douglas Davis, *Art and the Future. A History/Prophecy of the Collaboration Between Science, Technology and Art* (Washington: Praeger Publishers, 1973), 126.

⁵⁵ Jacques Derrida, "Passages – from Traumatism to Promise," in Elizabeth Weber, ed., *Points... Interviews, 1974–1994, Jacques Derrida*, trans. Peggy Kamuf (Stanford: Stanford UP, 1995), 387.

⁵⁶ Langdon Winner, *The Whale and the Reactor. A Search for Limits in an Age of High Technology* (Chicago: U of Chicago, 1986), 11.

⁵⁷ Pierre Baldi, *The Shattered Self: The End of Natural Evolution* (Cambridge: MIT Press, 2001), 24.

⁵⁸ Transhumanists publish the online magazine *Better Humans*, <http://www.betterhumans.com>.

⁵⁹ The Extropians published *Extropy: The Journal of Transhumanist Thought* from 1989 to 1996.

⁶⁰ Max More, "The Extropian Principles, Version 3.0, A Transhumanist Declaration," 1998, <http://www.maxmore.com/extprn3.htm>. Also see "Transhumanism: The Most Dangerous Idea?", *Reason Magazine* (August 25, 2004), <http://www.reason.com/news/show/34867.html>.

⁶¹ There have been expansions to Extropian and Transhumanist agendas which do take politics into account; see James Hughes, "Democratic Transhumanism 2.0," <http://www.changesurfer.com/Acad/DemocraticTranshumanism.htm>.

⁶² This expression is borrowed from Michel Foucault, in his preface to Gilles Deleuze and Felix Guattari's *Anti-Oedipus: Capitalism and Schizophrenia*, trans. Robert Hurley, Mark Seem, and Helen R. Lane (Minneapolis: U of Minnesota, 1983), xiv.

⁶³ The situational solidarity and social justice promoted by non-technologically determinist approaches in cyberfeminism and queer theory can help here, because they describe agendas regarding oppressed or socially marginalized bodies involved in a process of struggle for difference recognition, while also promoting equality, dignity, access to resources and education as the right of all (in other words they advocate a real rather than an ideal equality and thus unsettle the dominant order). This vision can be extended to incorporate non-human intelligences and non-human species, bypassing the human-centrism that has been so destructive to the planet and its inhabitants.

⁶⁴ Some challengers of Darwin posit this view of evolution. For an example, see Lynn Margulis, *Symbiotic Planet: A New Look at Evolution* (NY: Basic Books, 1998).

⁶⁵ Tobin Siebers, "Introduction: Defining the Body Aesthetic," *The Body Aesthetic from Fine Art to Body Modification* (Ann Arbor: U of Michigan, 2000), 3.

⁶⁶ Steven Shaviro, "Genetic Disorder: Bioaesthetics," *Artforum* XLII, no. 5 (2004): 42.

⁶⁷ "Tactics Inside and Out: Gregg Bordowitz on Critical Art Ensemble," *ArtForum* XLIII, no. 1 (2004).