

Donna J. Haraway



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Feminism and Technoscience
Second Edition

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Second Edition

Modest_Witness@Second_Millennium.FemaleMan[©]_Meets_OncoMouseTM explores the roles of stories, figures, dreams, theories, facts, delusions, advertising, institutions, economic arrangements, publishing practices, scientific advances, and politics in modern technoscience. The book's title is an e-mail address. With it, Haraway locates herself and her readers in a sprawling net of associations more far-flung than the Internet. The address is not a cozy home. There is no innocent place to stand in the world where the book's author figure, FemaleMan[©], encounters DuPont's controversial laboratory rodent, OncoMouseTM. This 20th anniversary edition includes a new interview with Haraway, as well as a teaching guide and discussion questions updated for the 21st century.

One of the founders of the posthumanities, **Donna J. Haraway** is Distinguished Professor Emerita in the History of Consciousness Department at the University of California, Santa Cruz, USA. Author of many books and widely read essays, including the now-classic essay 'The Cyborg Manifesto,' she received the J.D. Bernal Prize in 2000, a lifetime achievement award from the Society for Social Studies of Science.

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Modest_Witness@

D o n n a J .

**Preface and Study Guide by
Thyrza Nichols Goodeve
With paintings by Lynn M. Randolph**

Second_Millennium.

FemaleMan[©]_Meets_OncoMouseTM

FEMINISM AND TECHNOSCIENCE



H a r a w a y

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Front Cover: Lynn Randolph, *The Annunciation of the Second Coming*, oil on canvas, 58" x 64", 1996.

Lynn Randolph's angel, painted according to Renaissance conventions except for her transparent wings, announces not the birth of Christ, but the warning that life on earth is changing irrevocably. On the right hand of the painting, a cosmic galaxy made of a giant DNA molecule echoes the angel's message. Striding through the stylized fifteenth-century Italian colonnade along the pathway of a computer circuit board, the classical and statuesque electronic goddess carries in her troubling body both a threat and a promise. She is a matrix, one who is pregnant with contradictions, emergencies, delusions, and hopes of colliding sociotechnical worlds.

material cultural practice of technoscience. Dorothy Neklin and Susan Lindee explored the many faces of genetic essentialism in popular U.S. culture. “Genetic essentialism reduces the self to a molecular entity, equating human beings, in all their social, historical, and moral complexity, with their genes” (Nelkin and Lindee 1995:2). Stressing what is implicit in this splendid characterization, I would add two things. First, genes, as well as people, are misrepresented in genetic, or corporeal, fetishism. Indeed, the mistake of gene fetishism, which takes the gene as a nontropic thing-in-itself, sets up and justifies the mistake of genetic essentialism in Nelkin and Lindee’s explicit sense. “Life itself” is a cascading series of self-invisible displacements, denied tropes, reified relationships. Second, popular culture most certainly includes activity inside laboratories and their associated institutions.

Inside and outside laboratories, genetic fetishism is condensed, replicated, ironized, indulged, disrupted, consolidated, examined. Gene fetishists “forget” that the gene and gene maps are ways of enclosing the commons of the body—of corporealizing—in specific ways, which, among other things, often put commodity fetishism into the program of biology at the end to the Second Millennium. In the following section, I would like to savor the anxious humor of a series of scientific cartoons and advertisements about the gene in order to see how joking practice works where gene fetishism prevails. We move from Maxis’s SimLife to maps and portraits of the genome itself.

Genome

A word found readily in science news and business sections of ordinary newspapers, *Genome* is also the title of “the story of the most astonishing scientific adventure of our time” by two *Wall Street Journal* staff writers (Bishop and Waldholz 1990).²² In a human being, the genome, or the full set of genes in the cell nucleus contained on chromosomes derived from both parents, contains about six billion base pairs of DNA, representing copies from each parent of 50,000 to 100,000 genes plus a large amount of noncoding DNA. The *Oxford English Dictionary* traces the first use of the term *genome* to the early 1930s, when the word designated the chromosomal genetic complement but without the references to databases, programs, instrumentation, and information management that permeate 1990s genome discourse. My reading of comic portraiture and cartography—the story of life itself—picks up after the implosion of informatics and biologics, especially genetics, since the 1970s.

Still absent from Webster’s 1993 unabridged dictionary, *genome* progressively signifies a historically new entity engendered by the productive identity crisis of nature and culture. The cultural productions of the genome produce a category

crisis, a generic conundrum in which proliferating ambiguities and chimeras animate the action in science, entertainment, domestic life, fashion, religion, and business. Of course, the pollution works both ways; culture is as mouse-eaten as nature is by the gnawings of the mixed and matched, edited and engineered, programmed and debugged genome. Borderlands are often especially heavily polluted and policed; they are also especially full of interesting traffic and powerful hopes. The gene and the genome constitute such borderlands on the maps of technoscience. The gene, a kind of stem cell in the technoscientific body, is enmeshed in a hypertext that ramifies and intersects richly with all the other nodes in the web.

In a quarter-long seminar at the University of California Humanities Research Center in the winter of 1991, much time was spent on the Human Genome Project. One philosopher in the seminar put his finger on potent double meanings when he understood the science studies scholars, who were suggesting the term *the cultural productions of the genome* as the title for a conference, to be referring to musical, artistic, educational, and similar “cultural productions” emerging from popularization and dissemination of science. The science studies professionals meant, rather, that the genome was radically “culturally” produced, and no less “natural” for all that. The gene was the result of the work of construction at every level of its very real being; it was constitutively artifactual. “Technoscience is cultural practice” might be the slogan for mice, scientists, and science analysts. No one understands that more clearly than the marketing department for the Maxis Corporation’s SimLife game, from whom the first epigraph of this chapter was taken. It remains to be seen whether the rush-hour traffic across the boundaries of nature and culture in genome discourse constitutes a case of fluid practice or a particularly grave case of hardening of the categories in technoscience.

Let me tell a parochial story, which travels widely, about turgid and hardened entities. Like toys in other games, Genes R Us, and “we” (who?) are our self-possessed products in an apotheosis of technological humanism. There is only one Actor, and we are It. Nature mutates into its binary opposite, culture, and vice versa, in such a way as to displace the entire nature/culture (and sex/gender) dialectic with a new discursive field. In that field, the actors who count are their own instrumental objectifications. Context is content with a vengeance; autonomy and automaton interface intimately. Nature is the program; we replicated it; we own it; we are it. Nature and culture implode into each other and disappear into the resulting black hole. ManTM makes himself in a cosmic act of onanism. The nineteenth-century transfer of God’s creative role to natural processes, within a multiply stratified, hegemonically Christian,

industrial culture committed to relentless constructivism and productionism, bears fruit in a comprehensive biotechnological harvest in which control of the genome is control of the game of life itself—legally, mythically, and technically. The stakes are very unequal chances for life and death on the planet. If it were



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Figure 4.1 Courtesy of E-C Apparatus Corporation. Cartoon by Wally Neibart.

written today, *Of Mice and Men* might be titled *Of OncoMouseTM and ManTM*—or *FemaleMan[®] Meets OncoMouseTM*.

Attending to how the permeable boundary between science and comedy works in relation to the genome—and at the risk of giving comfort to those who still think the cultural production of the genome means its popularization—I want to pursue my story literally by reading the comics. My structuring text is a family of three images, all cartoon advertisements for lab equipment drawn by Wally Neibart and published in *Science* magazine in the early 1990s. I am reminded of David Harvey's (1989:63) observation that advertising is the official art of capitalism. Advertising also captures the paradigmatic qualities of democracy in the narratives of life itself. Finally, advertising and the creation of value are close twins in the New World Order, Inc. The cartoons explicitly play with creation, art, commerce, and democracy.

The Neibart cartoons suggest who “we,” reconstituted as subjects in the practices of the Human Genome Project, are called to be in this hyperhumanist discourse: ManTM. This is man with property in himself in the historically specific sense proper to the New World Order, Inc. Following an ethical and methodological principle for science studies that I adopted many years ago, I will critically analyze, or “deconstruct,” only that which I love and only that in which I am deeply implicated. This commitment is part of a project to excavate something like a technoscientific unconscious, the processes of formation of the technoscientific subject, and the reproduction of this subject's structures of pleasure and anxiety. Those who recognize themselves in these webs of love, implication, and excavation are the “we” who surf the Net in the sacred/secular quest rhetoric of this chapter.

Interpellated into its stories, I am in love with Neibart's comic craft. His cartoons are at least as much interrogations of gene fetishism as they are sales pitches. In his wonderful cartoon image advertising an electrophoresis system, a middle-aged, white, bedroom-slipper-and-lab-coat-clad man cradles a baby monkey wearing a diaper²³ [Figure 4.1]. Addressing an audience outside the frame of the ad, the scientist holds up a gel with very nice protein fragment separation generated by the passage of charged molecules of various sizes through an electrical field. The gel is part of a closely related family of macromolecular inscriptions, which include the DNA polynucleotide separation gels, whose images are familiar icons of the genome project. In my reading of this ad, the protein fragment gel metonymically stands in for the totality of artifacts and practices in molecular biology and molecular genetics. These artifacts and practices are the components of the apparatus of bodily production in biotechnology's materializing narrative. My metonymic substitution is warranted by the

dominant molecular genetic story that still overwhelmingly leads unidirectionally from DNA (the genes) through RNA to protein (the end product). In a serious and persistent joke on themselves, the kind of joke that affirms what it laughs at, molecular biologists early labeled this story the Central Dogma of molecular genetics. The Central Dogma has been amended over the years to accommodate some reverse action, in which information flows from RNA to DNA. “Reverse transcriptase” was the first enzyme identified in the study of this “backward” flow. RNA viruses engage in such shenanigans all the time. HIV is such a virus; and the first (briefly) effective drugs used to treat people with AIDS inhibit the virus’s reverse transcriptase, which reads the information in the viral genetic material, made of RNA, into the host cell’s DNA. Even while marking other possibilities, the enzyme’s very name highlights the normal orientation for control and structural determination in higher life forms. And even in the reverse form, Genes R Us. This is the Central Dogma of the story of Life Itself.

In the Neibart cartoon, while the scientist speaks to us, drawing us into the story, the monkey’s baby bottle is warming in the well of the electrophoresis apparatus. The temperature monitor for the system reads a reassuringly physiological 37°C, and the clock reads 12:03. I read the time as five minutes past midnight, the time of strange night births, the time for the undead to wander, and, as Evelyn Keller suggested, the first minutes after a nuclear holocaust. Remember the clock that the *Bulletin of Atomic Scientists* used to keep time in the Cold War; for many years it seemed that the clock advanced relentlessly toward midnight. As Keller argued persuasively, the bomb and the gene have been choreographed in the last half of the twentieth century in a complex dance that intertwines physics and biology in their quest to reveal “secrets of life and secrets of death” (Keller 1992a:39–55).

In the electrophoresis system ad, of course, Neibart’s image suggests a reassuring family drama, not the technowar apocalypse of secular Christian monotheism or the Frankenstein story of the unnatural and disowned monster. But I am not reassured: All the conventional rhetorical details of the masculinist, humanist story of man’s autonomous self-birthing structure the ad’s narrative. The time, the cross-species baby, the scientist father, his age, his race, the absence of women, the appropriation of the maternal function by the equipment and by the scientist: All converge to suggest the conventional tale of the second birth that produces Man. It’s not *Three Men and a Baby* here but *A Scientist, a Machine, and a Monkey*. The technoscientific family is a cyborg nuclear unit. As biologist—and parent—Scott Gilbert insisted when he saw the ad, missing from this lab scene are the postdocs and graduate students, with their babies, who might really be there after midnight. Both monkey and molecular inscription

stand in for the absent human product issuing from the reproductive practices of the molecular biology laboratory. The furry baby primate and the glossy gel are tropes that work by part-for-whole substitution or by surrogacy. The child produced by this lab's apparatus of bodily production, this knowledge-producing



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Figure 4.2 Courtesy of E-c Apparatus Corporation.
Cartoon by Wally Neibart.

technology, this writing practice for materializing the text of life, is—in fruitful ambiguity—the monkey, the protein gel (metonym for man), and those interpellated into the drama, that is, us, the constituency for E-C Apparatus Corporation’s genetic inscription technology.

I over-read, naturally; I joke; I suggest a paranoid reading practice. I mistake a funny cartoon, one I like immensely, for the serious business of real science, which surely, my professional self duplicitously asserts, has nothing to do with such popular misconceptions. But jokes are my way of working, my nibbling at the edges of the respectable and reassuring in technosciences and in science studies. This nervous, symptomatic, joking method is intended to locate the reader and the argument on an edge. On either side is a lie—on the one hand, the official discourses of technoscience and its apologists; on the other hand, the fictions of conspiracy fabricated by all those labeled “outsider” to scientific rationality and its marvelous projects, magical messages, and very conventional stories. In the end, the joke is on us. Inside and outside are lies. The edge is all there is, and we, inhabitants of the hypermodern cities of technoscience, are surely on it in the late twentieth century. As John Varley (1986) put it in his paranoid SF story, all we have to do is “Press Enter •”.

My interest is relentlessly in images and stories and in the worlds, actors, inhabitants, and trajectories they make possible. In the biotechnological discourse of the Human Genome Project, the human is produced in a specific historical form, which enables and constrains certain forms of life rather than others. The technological products of the several genome projects are cultural actors in every sense of the term. Technoscience’s work is cultural production.²⁴

Portrait™

A second Wally Neibart cartoon for a *Science* ad makes an aspect of this point beautifully—literally [Figure 4.2]. In its evocation of the world of (high) art, this ad is a deliberate pun on science as (high) cultural production. But that should not prevent the analyst from conducting another, quasi-ethnographic sort of “cultural” analysis. I think Neibart subtly invites a critical reading; I think he is laughing at gene fetishism as well as using it. Our same balding, middleaged, white, male scientist—this time dressed in a double-breasted blue blazer, striped shirt, and slacks—is bragging about his latest acquisition to a rapt, younger, business-suit-clad, white man with a full head of hair. They get as close to power dressing as biologists, still new to the corporate world, seem to manage. The two affluent-looking gentlemen are talking in front of three paintings in an art museum. Or at least they are in an art museum if the *Mona Lisa* has not been relocated recently as a result of the accumulated wealth of the truly Big Men in

informatics and biologics. After all, in 1994 William H. Gates III, the chairman and founder of the Microsoft Corporation, purchased a rare Leonardo da Vinci notebook, *Codex Hammer*, with over 300 illustrations and scientific writings done by the artist from 1506 to 1510 in Florence and Milan, for a record \$30.8 million in a manuscript auction (Vogel 1994:A1, A11).²⁵

None of Neibart's three paradigmatic portraits of man on display is of a male human being, nor should they be. The self-reproducing mimesis in screen projections usually works through spectacularized difference. One painting in Neibart's ad is da Vinci's *Mona Lisa*; the second is Pablo Picasso's *Woman with Loaves* (1906); the third, gilt framed like the others, is a superb DNA sequence autoradiograph on a gel. The Italian Renaissance and modernist paintings are signs of the culture of Western humanism, which, in kinship with the Scientific Revolution, is narratively at the foundations of modernity and its sense of rationality, progress, and beauty—not to mention its class location in the rising bourgeoisie, whose fate was tied progressively to science and technology. Like the humanist paintings, the sequence autoradiograph is a self-portrait of man in a particular historical form. Like the humanist paintings, the DNA gel is about technology, instrumentation, optics, framing, angle of vision, lighting, color, new forms of authorship, and new forms of patronage. Preserved in gene banks and cataloged in databases, genetic portraits are collected in institutions that are like art museums in both signifying and effecting specific forms of national, epistemological, aesthetic, moral, and financial power and prestige. The potent ambiguities of biotechnical, genetic, financial, electrical, and career power are explicitly punned in the ad: "I acquired this sequence with my EC650 power supply." The E-C Apparatus Corporation offers "the state-of-the-art in Power Supplies"—in this case, a constant power-supply device.

The unique precision and beauty of original art become replicable, everyday experiences through the power of technoscience in successful proprietary networks. The modernist opposition between copies and originals—played out in the art market with particular force—is erased by the transnational postmodern power of genetic identification and replication in both bodies and labs, *in vivo* and *in vitro*. Biotechnical mimesis mutates the modernist anxiety about authenticity. "Classic sequence autoradiographs are everyday work for E-C Electrophoresis Power Supplies." No longer oxymoronically, the ad's text promises unlimited choice, classical originality, 18 unique models, and replicability. At every stage of genome production, in both evolutionary and laboratory time, database management and error reduction in replication take the place of anxiety about originality.

But a calmed opposition between copy and original does not for a minute subvert proprietary and authorial relations to the desirable portrait in all its

endless versions, although the subjects of authorial discourse have mutated, or at least proliferated. Just as I am careful to credit Neibart and seek permission to reprint, E-C is careful to confirm authorial and property relations of the beautiful framed DNA sequence autoradiograph, which is reproduced in the ad “courtesy of the U.S. Biochemical Corporation using Sequenase™ and an E-C Power Supply.”²⁶ E-C used the molecular portrait of man with permission, just as I did, in the escalating practices of ownership in technoscience, where intellectual and bodily property become synonymous. The “great artist” of the technohumanist portrait is a consortium of human and nonhuman actants: a commercially available enzyme, a biotech corporation, and a power-supply device. Since there is no credit given, copyright protection for reproducing images of the Renaissance and modernist humanist paintings seems to have lapsed. Like the art portraiture, the scientific portrait of man as gel and database signifies genius, originality, identity, the self, distinction, unity, and biography. In eminently collectible form, the gel displays difference and identity exhaustively and precisely. Human beings are collected up into their paradigmatic portrait. No wonder aesthetic pleasure is the reward. The autoradiograph reveals the secrets of human nature. Intense narrative and visual pleasure is intrinsic to this technoscientific apparatus, as it is to others, that nonetheless try to ensure that their productions can only be officially or “scientifically” discussed in terms of epistemological and technological facticity and nontropic reality. Genes *are* us, we are told through myriad “cultural” media, from DNA treated with reagents like Sequenase™ and run on gels to property laws in both publishing and biotechnology. Narrative and visual pleasure can be acknowledged only in the symptomatic practices of jokes and puns. Displayed as “high science,” explicit “knowledge” must seem free of story and figure. Such technohumanist portraiture is what guarantees man’s second birth into the light and airy regions of mind. This is the structure of pleasure in gene fetishism.

The strong bonding of biotechnology with the Renaissance, and especially with Leonardo da Vinci, demands further dissection. Commenting on the potent mix of technique, ways of seeing, and patronage, a venture capitalist from Kleiner Perkins Canfield & Byers summed up the matter when he observed that biotechnology has been “for human biology what the Italian Renaissance was for art” (Hamilton 1994:85). Leonardo, in particular, has been appropriated for stories of origin, vision and its tools, scientific humanism, technical progress, and universal extension. I am especially interested in the technoscientific preoccupation with Leonardo and his brethren in the “degraded” contexts of business self-representation, advertising inside the scientific community, science news

illustration, conference brochure graphics, science popularization, magazine cover art, and comic humor.

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Figure 4.3 Du Pont advertisement from *Science* magazine. Courtesy of Du Pont NEN products. On May 19, 1995 Du Pont announced its intent to divest its medical products business. The former Du Pont NEN products business will become NEN life science products.

The text occurs underneath a color reproduction of Andy Warhol's giant nine-foot-two-inch by seven-foot-ten-inch 1963 photo-silkscreen, in ink and synthetic polymer paint, that "clones" the *Mona Lisa*.²⁸ Filling in a grid of five *Mona Lisa*'s across and six down, Warhol's multiplied version is entitled *Thirty Are Better Than One*. In Warhol's and Du Pont's versions, the paradigmatic, enigmatically smiling lady is replicated in a potentially endless clone matrix. Without attribution, Du Pont replicates Warhol replicates da Vinci replicates the lady herself. And Renaissance™ gets top billing as the real artist because it facilitates replicability. But how could Warhol, of all the artists who ever lived, object to his work being anonymously appropriated for commodity marketing under the sign of "debased" high art and high science enterprised up? In the Du Pont ad, the only mark of intellectual property is—in a comic, but probably unintended, recursive self-parody—Renaissance™. The mythic chronotope itself bears the trademark of the transnational biotechnology corporation. Recursively, the brand marks detection and labeling tools, for the code of codes, for life itself.

Leonardo is also my patron and father figure for a little-known genetic investigation, the dog genome project. Leonardo's drawing of the human figure of perfect proportions called the *Vitruvian Man* (ca. 1483–1490) illustrates countless announcements of Human Genome Project convergences and mapping breakthroughs. So when a cartoon called "Leonardo da Vinci's Dog" appeared anonymously in 1994 in my university mailbox, I realized at once that the dog of perfect proportions for the canine genome project had appeared from heaven²⁹ [Figure 4.4]. Companion to human beings, partner in work, and surrogate in medical research, the dog turns out to be perfectly proportioned for life itself. The actual dog genome is of potential interest to veterinarians dealing with disease, dog breeders seeking diagnostic tools to identify undesirable traits, and evolutionary biologists studying complex behaviors conditioned by multiple genes (Mestel 1994).³⁰ It is this last interest that merits more comment under the sign of the canine surrogate to the *Vitruvian Man*. Leonardo's dog's escapades take place in the chronotope defined by material and narrative tools such as Renaissance™.

Well-maintained dog breeds are the Mormons of the canine world. That is, the family histories, the genealogies, of anatomically and behaviorally distinct kinds of dogs are known for many generations and for large numbers of individuals. Human geneticists accustomed to working with truncated family pedigrees can only be envious.³¹ Moreover, even for the most resolute believer in the genetic determination of many aspects of human behavior, it is a vain dream to expect to be able to find and study most of the critical genes. The

unlikely of actually identifying more than a very few behavioral genes in human beings and locating them on genetic chromosomal, and molecular maps rises astronomically for notoriously complex behaviors such as “intelligence” or “aggression.” Controlled breeding of humans is out of the question. Ask any marriage counselor. Further, even describing human behavior in terms remotely useful to a genetic investigation is hopelessly controversial, even among those who are not convinced that characteristically human behavior

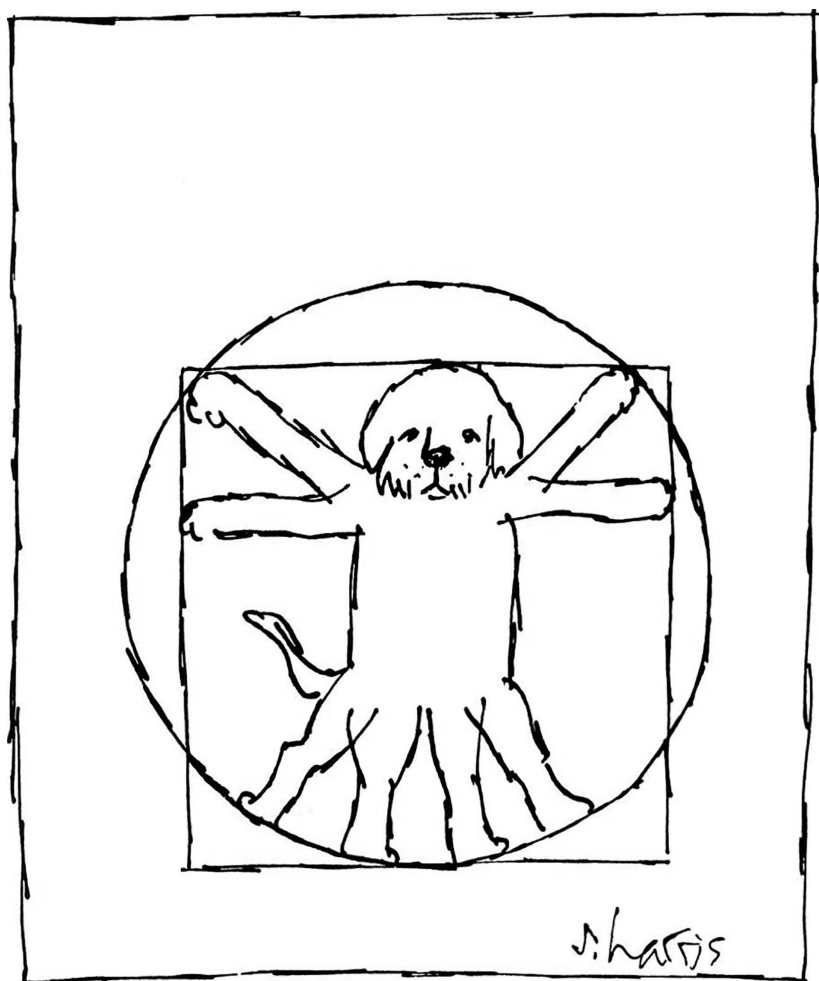


Figure 4.4 Leonardo Da Vinci's Dog. © 1996 Sidney Harris.

owes much more to developmental, cultural, economic, and experiential aspects of life than to genes. In the eyes of large sections of the public and of other scientists, human behavioral genetics always teeters on the edge of pseudo-science and frank ideology.

However, dogs are another matter. Little controversy arises in ascribing a great deal of complex canine behavior to genes. After all, dogs have been subject to intense selection by breeders for specific patterns of behavior. Important and distinct behaviors such as pointing, retrieving, water rescue skills, and herding are unlikely to be conditioned by single genes. Dog behavioral genetics ought to be a rich world for those looking to understand the interaction of several genes related to the development of complex, specific behaviors. That this goal may be far in the future does not reduce its feasibility in principle.

With the goal of understanding the evolution of breeds, Jasper Rine at the University of California at Berkeley; Elaine Ostrander, now at the University of Washington; and George Sprague at the University of Oregon launched the dog genome project in 1991.³² They sought knowledge of the genes implicated in both anatomy and behavior. The ensuing story of the border collie Gregor and the Newfoundland Pepper and their offspring, scattered among scientists and dog lovers on the U.S. West Coast, is the story of canine genome discourse. The dog genome is large and uncharted, and the intrepid researchers have to do the genetic, chromosomal, and molecular mapping practically from scratch and on modest budgets. They also have to socialize quite a lot with the dogs. But then, that is the stuff of good scientific narrative and the occasion of a lot of hard work, called knowledge-making practices by science studies scholars.

If I lived in another mythic time than the New World Order, Inc., the dog genome project would elicit only my curiosity and support. But in the time of RenaissanceTM, I admit to paranoid fears that the study of the genetics of complex, polygenic behaviors in any “model” species bodes little good for those of us who want mutated discourses about the determinants of complex behavior to flourish—for dogs, worms, yeast, mice, and people. In a time of florid fundamentalist hereditarian and genetic discourse—including sober comments about the genetics of homelessness made by an officer of a major national scientific association and the publication of well-received racist and classist tracts on the correlation of IQ, genetic inheritance, and social power³³—we need to learn how to engage in knowledge-making practices in genetics, as well as in other cultural domains, that produce critical and cross-cutting multidisciplinary, multi-species, and multicultural savvy. We need a critical hermeneutics of genetics *as a constitutive part of scientific practice* more urgently than we need better map resolution for genetic markers in yeast, human, or canine genomes.

Without becoming prudish and prohibitive, *how* can we develop this kind of critical relation to the technoscientific knowledge-making practices that touch on the most easily ideologized and abused aspects of life in the regimes of technobiopower? How do we move from reified taxonomic exercises that constitute “aggression” and “intelligence” as materialized, measurable entities to sciences held to higher standards of critical objectivity, beginning at the level of category formation? How do we learn *inside the laboratory and all of its extended networks* that there is no category independent of narrative, trope, and technique? To pretend otherwise is symptomatic of an advanced case of hardening of the categories. Can reading the comics be a little part of the solution to epistemological and political plaque formation? I like to think of Leonardo’s dog as a sign of hope that the next brochure for a conference on human genetics will show a little more savvy about its appropriations of the signs of the Renaissance that link science, genius, wealth, power, high art, and career power.

In the Company of Genes

Aside from the dubious society of dogs, the company the gene keeps is definitely upscale. Fetishes come in matched sets. Master molecule of the Central Dogma and its heresies, the gene affiliates with other power-objects of techno-scientific knowledge production: neuroimaging, artificial intelligence, artificial life, high-gloss entertainment, high technology, high expectations. The ten-part series “Science in the 90s,” which ran from January 5, 1990, to May 8, 1990, gives a broad sense of what counts as cutting-edge technoscience for the news writers and editors of *Science*. In general, the excitement came from high tech/high science, prominently including neuroscience, computing and information sciences, and molecular genetics. The boring and discouraging notes came from (very brief) consideration of such matters as ongoing racial and sexual “imbalance” in who does technoscience and the troubles that arise when “politics” gets into the career of a scientist.

Overwhelmingly, the chief power sharer in the gene’s new world community is the nervous system. Even the *UNESCO Courier* carries the news that links mind and origins, neuron and gene, at the helm of life itself: “No one would deny that, within the highly organized framework of a human being, two ‘master elements’ account for most of our characteristics—our genes and our neurons. Furthermore, the nature of the dialogue between our genes and our neurons is a central problem of biology” (Gros 1988:7).³⁴

Every autumn since 1990, *Science*, the magazine of the American Association for the Advancement of Science (AAAS), has put out a special issue updating its readers on progress in genome mapping, and especially in the

Human Genome Project. The table of contents of the first special issue highlights the tight coupling of genetic and nervous systems in the discourse of millennial science.³⁵ Citing a recent example of homicidal mania, *Science* editor Daniel Koshland Jr. introduced the issue with the argument that hope for the mentally ill—and for society—lies in the high cultures of neuroscience and genetics. Necessary to the topological diagrams of life itself, the tie to informatics is made explicit: “The irrational output of a faulty brain is like the faulty wiring of a computer, in which failure is caused not by the information fed into the computer, but by incorrect processing of that information after it enters the black box” (Koshland 1990:189). Besides the articles on the genome project and the map insert, the issue contains a research news piece called “The High Culture of Neuroscience” and eight reports from neurobiology, spanning the range from molecular manipulation of ion channels to a study of primate behavior to a psychological assessment of human twins reared apart.

Located in the potent zones where molecular genetics and neurobiology ideologically converge, this last study on twins reared apart lists as its first author Thomas Bouchard, a former student of Arthur Jensen (Bouchard et al. 1990). Jensen promoted the idea of the linkage of genetic inheritance, IQ, and race in a famous 1969 *Harvard Educational Review* article. The special gene-map issue of *Science* was the first major professional journal to publish Bouchard’s controversial work, which ascribes most aspects of personality and behavior to genes. Many of Bouchard’s papers had been rejected through peer review, but he brought his message successfully to the popular media anyway. Following *Science*’s publication of his study, Bouchard’s ideas gained authority and prominence in public debates about genetics and behavior (Nelkin and Lindee 1995:81–82; Jensen 1969).


Cartography, the high science of the Age of Exploration, tropically organizes the first *Science* gene-map issue from the design of its cover to the content of its prose. Collectively labeled “The Human Map,” the cover is a collage of mapping icons—including a Renaissance anatomical human dissection by Vesalius, a Mendelian genetic-cross map superimposed on the great scientist’s facial profile, a radioactively labeled region of metaphase chromosomes, a linkage map and a bit of sequence data rendered by the cartographical conventions that have emerged in the genome projects, a flow diagram through the outline of a mouse body, and a computer-generated colored-cell map of an unidentified abstract territory. The cover design is explained inside: “Just as the ancient navigators depended on maps and charts to explore the unknown, investigators today are building maps and charts with which to explore new scientific frontiers.”³⁶

The reference to the Renaissance cartographers, a common rhetorical device in genome discourse, is not idle. Genomics “globalizes” in specific ways.

Species being is materially and semiotically produced in gene-mapping practices, just as particular kinds of space and humanity were the fruit of earlier material-semiotic enclosures. Traffic in bodies and meanings is equally at stake. The orthodox stories of the Renaissance and early modern Europe are useful to my narrative of genome mapping as a process of bodily spatialization akin to enclosing the commons in land, through institutions of alienable property, and in authorship, through institutions of copyright. Harvey points out that the introduction of the Ptolemaic map into Florence from Alexandria in 1400 gave Europeans the critical means to see the world as a global unity (Harvey 1989:244–52). The Ptolemaic map and its offspring were the air-pumps of scientific geography, embedded in material, literary, and social technologies that made the “global” a mobile European reality. “Mathematical principles could be applied, as in optics, to the whole problem of representing the globe on a flat surface. As a result it seemed as if space, though infinite, was conquerable and containable for purposes of human occupancy and action” (Harvey 1989:246). The elaboration of perspective techniques in midfifteenth-century Florentine art was entwined with the construction of individualism and perspectivism critical to modern spaces and selves. The sixteenth-century Flemish cartographer Gerardus Mercator, after whom at least one biotechnological corporation is named, crafted projections of the globe geared to navigation on the high seas in a period of intense world exploration by Europeans. All of these practices constituted a major reworking of conceptions of space, time, and person. And all of these practices are in the family tree of genetic mapping, which once again is a local practice enabling certain sorts of power-charged global unity. No wonder Mercator’s grids and projections are part of the scientific unconscious of biotechnology researchers and advertisers.

Bruno Latour discusses the mobilization of worlds through mapping practices; cartography is a metaphor and a technology of the highest importance (Latour 1987:215–57). Cartography is perhaps the chief tool-metaphor of technoscience. “Mapping Terra Incognita (*Humani Corporis*),” the news story toward the less technical front of *Science*’s first special issue on the genome project, has all of the expected allusions to Vesalius’s Renaissance anatomy (Culliton 1990:210–12). This kind of ubiquitous new world imagery, like the extended propaganda for cybernetics in the United States in the 1950s and 1960s, indicates a “distributed passage point” through which many popular and technical projects get loosely associated with the high gloss of molecular biology and biotechnology (Bowker 1993). The second article on genome mapping in the special issue, “Mapping the Human Genome: Current Status” (Stephens et al.

1990) charts another kind of intersection, one Latour called an “obligatory passage point.”³⁷ This node represents the fruit of the mobilization of resources and the forging of alliances among machines, people, and other entities that force others to pass through *here* and nowhere else. The sociotechnical achievements of molecular biology are a node through which many *must* pass:



MAPPING THE HUMAN GENOME

Advanced by a diverse range of 8-Base Cutters from New England Biolabs

At New England Biolabs, we are dedicated to producing highly-pure restriction enzymes for the manipulation and analysis of genomic DNA. Our diverse range of 8-base cutters includes recombinant Not I, Asc I and Sfi I. And now, NEB introduces recombinant Fse I which offers both the exceptional purity and unmatched value essential for success in your genomic research.

Fse I	#588S	100 units	Pac I	#547S	100 units
	#588L	500 units		#547L	500 units
	5'-GGCCGGCC-3'			5'-TTAATTAA-3'	
	3'-CCGGCCGG-5'			3'-AATTAATT-5'	
Asc I	#558S	500 units	Pme I	#560S	100 units
	#558L	2,500 units		#560L	500 units
	5'-GGCGCGCC-3'			5'-GTTTAAAC-3'	
	3'-CCGCGCGG-5'			3'-CAAAJTIG-5'	
Not I	#188S	500 units	Sfi I	#122S	2,000 units
	#188L	2,500 units		#123L	10,000 units
	5'-GCGGCCGC-3'			5'-GGCCNNNNGGCC-3'	
	3'-CGCGGCGG-5'			3'-CCGGNNNNCCGG-5'	

For more information about 8-Base Cutters from New England Biolabs contact us at 1-800-NEB-LABS or via the Internet at info@neb.com.

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Circle No. 39 on Readers' Service Card

Figure 4.5 Courtesy of New England Biolabs.
Concept and design by Mycoff, Inc.

paleoanthropologists who wish to resolve evolutionary arguments, physicians who wish to diagnose and treat disease, developmental biologists who seek resolution of their questions, ideologists who proclaim legitimation for or exemplary condemnation of technoscience. Molecular biology does not just claim to be able to decode the master molecule; it installs the tollbooths for a great deal of collateral traffic through nature.

The human genome map inserted into the special issue of *Science* in 1990 inaugurated the practice of annually giving each subscriber-member of the AAAS a personal copy of the most up-to-date chart available. The practice reverberates with *National Geographic's* presentation to subscribers of the new Robinson projection map of the globe in its January 1988 issue, which featured on the front cover the holographic portrait of the endangered planet Earth at the dawn of the decade to save man's home world. (A holographic ad for McDonald's, with appropriate words from the transnational fast-food chain's founder, graced the back cover.) Just as all subscribers to *National Geographic* are automatically members of a scientific society, and so patrons of research, all subscribers to *Science* are members of the AAAS and share symbolically in its ideological and material privileges. As subscribers, "we" are the constituents of technoscience, a mapping practice of the highest order. With over 150,000 subscribers, *Science* reaches about three times the number as does *Nature*, its British sibling and nearest world-class competitor. *National Geographic*, of course, reaches millions.

In a mid-1990s ad for DNA-cutting enzymes, New England Biolabs astonishingly invokes the imploded global bodies materialized by both *National Geographic* and the Human Genome Project [Figure 4.5]. The Global Native embodies the Global Gene. Once more, difference is mapped and enclosed; art, science, and business join in the dance. From the left side of the page, against a black background the body of a beautiful young woman with generically (and oxymoronic) "indigenous" facial features flows forward. Her body is the mapped terran globe, shaped to her lovely female contours, and she is its soul. Of the earth, she moves through it as both its spirit and flesh. Arms raised in a dance gesture, the native woman is clothed with the tissue of the mapped planet, which billows out into a semicircle continuous with her graceful figure. Marked off by its geometric coordinates, the projection map shows the bulge of West Africa and the Atlantic Ocean. The seas are dotted with the great sailing clipper ships of Europe's age of exploration and marked with the fabulous Latin names bestowed by the navigators' culture. The map-woman is an animated Mercator projection.

The earth is both the woman's body and her dress, and the color-enhanced regions highlighting the beige tones of the swirling hemispherical corpus/fabric

are like style elements in a *United Colors of Benetton* celebration of global multiculturalism. To remember the slave trade and the middle passage across the region of the world shown on this lovely map seems a petty thing to do. The woman-earth's body confronts text at the middle of the page: "Mapping the Human Genome." The earth and the genome are one, joined in the trope of the technoscientific map. "Advanced by a diverse range of 8-base



"With 90% of the Vote Already In, It's A Landslide For the EC105 Power Supply!"

The people's choice for critical electrophoretic separations is the highly experienced and fully proven E-C line of Electrophoresis Power Supplies. 18 models on the ticket. With features and capacities—from 150 Volts to 6,000 Volts—to match any poll of preferences in Constant Power, Current, or Voltage. And the price range—from \$325 to \$2,795 should tax no one's budget.

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Circle No. 56 on Readers' Service Card

EC105 Minicell® Power Supply
250 Volts 500 milliAmps



Figure 4.6 Courtesy of E-C Apparatus Corporation.
Cartoon by Wally Neibart.

Cutters,” the new cartography will be enabled by New England Biolabs’ restriction enzymes. Map, woman, earth, goddess, science, body, inscription, technology, life, the native: All are collected in an aestheticized image like a Navajo sand painting that places the holy people inside the four sacred mountains. Who said master narratives, universalism, and holism were dead in the New World Order’s extended networks? Advanced by all of the code-analyzing restriction enzymes given by the globalized history of race and gender, naturalization has never been more florid. But I doubt that is what New England Biolabs meant to signify in its ad promising “exceptional purity and unmatched value essential for success in your genomic research.”

In short, biotechnology in general and the Human Genome Project in particular aim high. No wonder the Human Genome Project’s apologists have called it biology’s equivalent to putting a man on the moon. Where else could he go with all that thrust? The Human Genome Project is discursively produced as, once more, “one small step . . .” At this origin, this new frontier, man’s footprints are radioactive traces in a gel; at the dawn of hornimization, the prints were made in volcanic dust at Laetoli in Ethiopia; at the dawn of the space age, a white man, acting as surrogate for mankind, walked in moon dust. All of these technoscientific travel narratives are about freedom; the free world; democracy; and, inevitably, the free market.

Representation, Recursion, and the Comic

Under the signifiers of freedom and democracy, a third Neibart cartoon on this theme completes this comic chapter’s catalog of the savvy artist’s potent jokes. Two senior white male scientists in business suits, one the same successful fellow who acquired the technohumanist portrait of man in the form of a DNA separation gel, stand with their hands raised above their heads in the sign of victory on the stage above the cheering mob at a political convention [Figure 4.6]. The figures in the crowd wave the red, white, and blue banners inscribed with name of their constituencies: DNA, protein, ACGT, RNA, PCR, and all the other molecular actors in the genomic drama. “With 90% of the vote already in, it is a landslide” for the E-C Apparatus Corporation’s power supply. The joke makes the concretized entities of the biotechnological laboratory into the voters in the democracy of science. The molecules and processes—themselves the feat of the scientists in the scene we have learned to read through the pages of *Science in Action* (Latour 1987) and *Leviathan and the Air-Pump* (Shapin and Schaffer 1985)—are the actors with a vengeance. The sedimented feats of technoscientific virtuosity authorize their ventriloquists under the sign of freedom and choice. Clearly, this is material subject construction, Oedipal or not.

Jokingly ironized in the Neibart cartoon, this scene is also gene fetishism at its most literal. Literary, social, and material technologies converge to make the objects speak, just as Shapin and Schaffer showed us in the story of Robert Boyle's air-pump. In the culture of no culture conjugated with the nature of no nature, the objects speak with a withering directness. For all their inventiveness in making fabulous natural/cultural hybrids that circulate fluidly in vast networks, many actants in genome discourse seem "to be suffering from an advanced case of hardening of the categories."

It is not new to link the stories of science and democracy, any more than it is new to link science, genius, and art, or to link strange night births and manly scientific creations. But the interlocking family of narratives in the contemporary U.S. technoscientific drama is stunning. The Neibart cartoon must be read in the context of *Science* 85's cover of a decade ago, "The American Revolution." The magazine cover featured the chip and the gene, figured, as always, as the double helix, against the colors of red, white, and blue, signifying the New World Order, Inc., of nature "enterprised up" (Strathern 1992:39), where free trade and freedom implode. This warped field is where, to misquote the U.S. Supreme Court chief justice with whom I founded this chapter's juridical order, "Life Itself is always an experiment." It is, at the least, a real venture in marketing through the wormholes.

What, then, are advertisements in technoscience doing? Do the ads in magazines such as *Science* matter, and if so, how? Can I really make a case for reading these materials as even gently ironic rather than simply celebratory and instrumental in strengthening gene fetishism? Is anxious humor enough to force the trope into the open and disrupt literalism? Who besides me is anxiously laughing or crying at these ads? Fundamentally, these are empirical questions; and I do not know much about the many ways in which ad designers in technoscience produce their work, how graphic artists' views do and do not converge with scientists' or corporate managers' discourse, or how readers appropriate and rework ad images and text. I do know that the ads are more than pretty designs and helpful information.

Even though many of the ads contain considerable technical information, I do not think a very good case can be made for seeing these ads principally as sales strategies. The companies that supply the key equipment and products to modern biological and engineering labs have more effective mechanisms for informing and servicing clients. Company and product name recognition is enhanced, and I would not argue against modest functionalist economic readings of such ads. At the least, urged to find out more about potentially powerful tools, readers get toll-free phone numbers and reader-response cards for ordering catalogs.

At least as significantly, the readers of these ads taste the pleasures of narrative and figuration, of recognizing stories and images of which one is part. Advertising is not just the official art of capitalism; advertising is also a chief teacher of history and theology in postmodernity. The debates about historical and literary canons should be taking place in graphic artists' studios in corporations as well as in classrooms. The ads draw from and contribute to a narrative and visual world that activates the unconscious mechanisms that issue in the possibility of a joke. The joke is a sign of successful interpellation, of finding oneself constituted as a subject of knowledge and power in these precise regions of sociotechnical space. Whoever is inside that joke is inside the materialized narrative fields of technoscience, where better things for better living come to life. These ads work by interpellation, by calling an audience into the story, more than by informing instrumentally rational market or laboratory behavior. Such



"Here it is in Genesis: 'He took one of Adam's ribs, and made the rib into a woman.' Cloning, if I ever heard it."

Figure 4.7

© 1994 Sidney Harris. Cartoon from *Science* magazine March 1, 1991.

interpellation is the precondition of any subsequent rationality, in epistemology or in other such duplicitous free markets. In the Book of Life Itself, fetishism in all its flavors is comic to the end.

Finally, the Neibart cartoons critically comment on—or complicitously appeal to—the comic in quite another sense than “funny.” In the literary analysis of the comic mode in drama, “comic” means reconciled, in harmony, secure in the confidence of the restoration of the normal and noncontradictory. For example, Shakespeare’s comedies are not funny; rather, their endings restore the normal and harmonious, often through the ceremonies of marriage through which opposites are brought together. The comic does not recognize any contradictions that cannot be resolved, any tragedy or disaster that cannot be healed. The comic mode in technoscience is reassuring in just this way.³⁸ For those who would reassure us, the comic is just the right mode for approaching the end of the Second Christian Millennium.

Hardly surprisingly, edgy and nervous I have no choice but to end by jokingly repeating myself in a comic recursion that restores few harmonies. In a March, 1991, *Science* cartoon by Sidney Harris, a white male researcher in a labcoat reads out loud to a white female scientist, similarly dressed, both surrounded by their experimental animals and other equipment: “Here it is in Genesis: ‘He took one of Adam’s ribs and made the rib into a woman.’ Cloning, if I ever heard it” [Figure 4.7]. WomanTM cultured from the osteoblasts of ManTM: This Genesis replicates salvation history compulsively, repeating *in saecula saeculorum* “a few words about reproduction from an acknowledged leader in the field.”³⁹

Figuring the implosion of informatics and biologies, this bastard scriptural quotation comes from a Logic General Corporation ad for its early 1980s software duplication system [Figure 4.8]. In the foreground, under the earth-sun logo of Logic General a biological white rabbit has her paws on the grid of a computer keyboard. The long-eared rodent is generally a cultural sign of fecundity, and “breeding like rabbits” is a popular figure of speech. But Logic General’s hare evokes especially the pregnancy-test bunny made famous in the history of reproductive medicine. Like Du Pont’s OncoMouseTM, who is climbing toward the blindingly bright open shutter of a camera, this rabbit is peering at a luminous icon of technoscientific illumination, but with Logic General we are not in a biological laboratory. Looking into the screen of a video display terminal, the organic rabbit faces its computer-generated image, who also locks its cybergaze with the reader of the ad. In her natural electronic habitat, the virtual rabbit is on a grid that insists on the world as a game played on a chesslike board, or Cartesian grid, made up of a square array of floppy disks. The disks constitute a

kind of Mercator™ projection at the end of the Second Millennium. The replication-test bunny is a player in SimLife. Returning to the opening epigraph to this chapter, I remember its version of the injunction to be fruitful and multiply: “Give life to different species in the Biology Lab and customize their look with the icon editor.”

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CIRCLE 106

Figure 4.8 A Few Words about Reproduction. Courtesy of Logic General Corporation.

Like OncoMouse™, both the pregnancy-test and the replication-test rabbits in the Logic General ad are cyborgs—compounds of the organic, technical, mythic, textual, economic, and political—and they call us, interpellate us, into a world in which we are reconstituted as technoscientific subjects. Inserted into the matrices of technoscientific maps, we may or may not wish to take shape there. But, literate in the reading and writing practices proper to the technical-mythic territories of the laboratory, we have little choice. We inhabit these narratives, and they inhabit us. The figures and the stories of these places haunt us, literally. The reproductive stakes in Logic General's text—and, in general, in the inscription practices in the laboratory—are future life forms and ways of life for humans and nonhumans. The genome map is about cartographies of struggle—against gene fetishism and for livable technoscientific corporealizations.

Where else is there to go from here in the net the *Modest_Witness@Second_Millennium* has been surfing but to another haunting cyborg, which also troubles copying practices in the gravity well produced by the implosion of informatics and biologics, that is, to that *neuvo huevo*, the fetus?