Biological Relatives
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As the introduction to this book outlined, IVF can be understood both as a technologization of substance and as a substantialization of technology, and thus as a lens that allows us to reconsider the meanings of both technology and biology. By tracing this argument through a series of frames, and drawing on a range of theorists to examine IVF as a stem technology, I have asked how we might understand the retooling of reproductive substance and its institutionalization as both new kinds of making life and new ways of living the remaking of life. As chapters 5 and 6 have suggested, there are many ways to investigate the condition of being after IVF, including the perspective offered by experiencing it directly as a patient or provider, and the more distant, but increasingly explicit, encounter with it in mainstream popular media as a representation, and now generic imagery, of embryo retooling as an open door. In both of these cases, which I suggest have important structural parallels despite their differences, the retooling of reproductive substance appears, among other things, to exceed the frames of existing understandings of sex, biology, kinship, technology, and even life itself. At the same time, I have also argued that the logics of IVF both belong to and extend familiar ideas and conventions associated with reproduction, science, and technology, as well as parenthood, the family, and kinship. In my previous work (Franklin 1997) I have used the idiom of hope to describe this convergence between the known and the unfamiliar, suggesting, as many others have also done, that the discourses of both hope and progress act as powerful forces extending reproductive technology, and the biosciences more generally, continually into unknown territory—or out of the frame. As noted in chapter 3, this is why both reproduction and technology are often envisaged, celebrated, and defended as frontiers, and why those who inhabit this territory, be they
clinicians, scientists, or patients, are similarly described, and may experience themselves, as pioneers.

However, it is worth returning to the concept of the frontier once again, and for the same reasons it was discussed earlier in this book—namely, its analytic value in staging and refiguring from another angle the question concerning technology for which it is often an analogy. As noted in chapter 3, the frontier is a familiar but strange concept—at once describing a border between states and open-ended, unknown terrain. It at once provides an idiomatic figuration of opportunity and reward, and, in the discourse of the New World frontier at least, recalls a place of reversion, lawlessness, mutability, and conflict. Contradictory as well is the dual association of frontier life with movement and settlement, catastrophe and rebirth, wilderness and domestication. It is both an idealized concept and a temporary place or setting. Both practically and ideologically, the frontier signifies exploration, and thus transition, as well as conversion. The forward, or facing, orientation of the exploratory frontier idiom has its temporal equivalent in futurity: it is encountered by going forward.1 But by definition the frontier is eventually left behind in both time and space.

What is left behind in the advance of the frontier line, or the edge of the frontier, is a zone of hybridity, in which settlement and domestication are entangled with the unknown or wild elements—a mix of agencies, entities, and forces. The labor of the frontier is one of ordering and imposing control, often imagined as seeding the growth of civilization through technologies of cultivation, epitomized by agriculture, which pave the way for a more elaborate social infrastructure. In this chapter, I begin by returning to the concept of the frontier in order to revisit the question of how this idiom models, or mirrors, technological evolution or progress. Drawing on recent anthropological and archaeological theory, I borrow from models of agriculture and domestication as frontier zones to suggest yet another perspective on the endless frontier of technology. In turn, this brings us back to the question of technology as evolution or natural history—for in all of these contexts (and perhaps especially that of domestication) explanatory models have shifted toward more hybrid, contingent, nonlinear accounts of interaction (Haraway 2008). Such a shift, I suggest, is consistent with what we might expect from the frontier idiom—with all of its magical conversion abilities—and also, if perhaps less obviously, of science, and in particular embryology.

As well as being important to what is changing within the biology lab, where the role of tools increasingly troubles the frontier between the organic
and the inorganic, the analogy to frontier culture remains a useful trope for considering what is going on outside the lab as well, in the border zones of waiting rooms and clinics. The second part of this chapter thus returns to the in-between of the IVF–stem cell interface. Crossing over to the IVF side of the hole in the wall connecting the stem cell lab and the assisted conception unit (ACU), I follow the development of a permanent art installation inside the clinic produced by photographer in residence Gina Glover. This major installation of artwork, *The Art of A.R.T.*, represents the IVF encounter from both patients’ and clinicians’ points of view. Something of an ethnographer herself, Glover in her installation offers a visual logic of IVF that is an alternative to that described in chapter 6, as yet another window on the topsy-turvy world of IVF. One way to interpret her installation, I suggest, is as frontier bioart.

It is here, in an encounter with an artist’s depiction of the future of kinship that is also the rendering of an encounter with the reproductive frontier, that I want to sketch some of the ways we might imagine a sociology of technology that is more robustly sociological—that is, which offers us a more fully sociological model of technology and technological change. As we have seen, the hole in the wall of the lab is itself a frontier line of sorts, not only demarcating a space of pioneering science, but dividing the space of frontiers between those who inhabit one kind of work space in the ACU, and another where reproductivity itself is being explored and domesticated. Always a problematic idiom, and not necessarily one whose mock heroism we want to reclaim, the frontier concept is nonetheless useful, I suggest, as itself a kind of artifice—a representational apparatus that performs a distinctive kind of work converting meanings. In other words, the idiom of the frontier is itself a conceptual tool. In this chapter I suggest that it can be used to investigate what is going back and forth through the hole in the wall, and indeed why the hole is there at all.

**Frontiers of Knowledge**

On the cover of the 1925 American Library Association pamphlet *Frontiers of Knowledge* is reproduced an engraving of a man reading a book at a desk under a starry sky. Looming above him is the headless, winged statue of Nike, the Olympian goddess of victory, the remains of which were found in Greece in the late nineteenth century, and are now prominently displayed at the Louvre in Paris (figure 7.1).

This American frontier image combines classical antiquity and European culture, set against the backdrop of the universe, with the figure of a reader,
or thinker, in the foreground. Written by Jesse Lee Bennett, a journalist and popular writer, *Frontiers of Knowledge* is aimed at a general audience and intended to explain the origins and functions of knowledge and to make it more available to all. A practical guide, and part of a series titled Reading with a Purpose, it is dedicated to “those who, wishing to educate themselves over a lifetime, desire a broad perspective of the whole field of knowledge” (Bennett 1925: 5). In his brief didactic treatise, Bennett uses the idiom of the frontier both as an analogy to knowledge, and as a synecdoche for American pragmatism and self-improvement. He writes, “There are now only a few unexplored parts of the earth on which we live. But there are such great unexplored portions of the universe that the little world of knowledge we now possess must rather be thought of as a clearing in a wilderness with frontiers steadily advancing into the mystery of what mankind does not yet know than as a complete thing like our planet” (1925: 17). At once a concrete geographical comparison intended to convey the difference between an expanding clearing in
the wilderness—of unknown proportions—and the finite, known, and complete size of planet earth, Bennett’s analogy is also more abstract, and magical, in its invocation of the “mystery” into which frontiers advance, against the realm of “what mankind does not yet know.” In this description, the conventional movement of the frontier (steadily advancing) appears as a self-acting force of expansion, set against a void (the universe), while simultaneously the frontier is also depicted in terms of actual historical events, manual labor (clearing), and human progress. Developing the frontier analogy in a more explicitly American vein, Bennett continues: “Today the frontiers of knowledge appear very, very far removed from the simple questions which originally sent intelligence ranging far afield seeking answers, just as the coast of America seemed very remote from the little villages where the sailors of Columbus grew up and from which they set out to see what lay beyond the western horizon” (31).

This analogy, between frontiers of the mind and exploration “beyond the western horizon” recalls the blurred line between what Gell (1988: 8) called the “merely real” and the imaginative reach of exploration, while seamlessly also inserting Old World civilization into the New World trajectory made famous in Frederick Jackson Turner’s depiction of westward expansion on the American frontier as manifest destiny—the same idiom later invoked by Roosevelt, and now ubiquitous in science policy in Europe and many other parts of the world. Like Roosevelt and his advisors, whose inspiration may well have come from writers such as Bennett, Frontiers of Knowledge proposes an inexorable advance of civilization in the wake of such heroic American pioneers as Daniel Boone. “Only a few people were out on the frontiers of civilization with Daniel Boone; only a few people were near Peary at the North Pole or with any explorer or adventurer in wild, remote places. But today great cities exist in the place which was a frontier in the time of Daniel Boone. Soon airships will be going regularly across the North Pole” (Bennett 1925: 31). At work in this generic description of manifest destiny and the inevitable march of progress are the familiar coordinates of time and space associated with the frontier—its forward expansion in the past transforming over time into a settled place in the here and now of the contemporary, epitomized by the rise of cities out of what were once “wild, remote places.” Prominent in this passage, however, is also an account of modern technology—analogized to the progress of “great cities” by reference to what has become taken for granted, or regular—in much the same way Stewart Brand refers to IVF babies having become more regular over time. Thus the analogy of the frontier that was initially a depiction of space becomes one of time—“the place which was a fron-
Having vanished, its very existence having been eclipsed by the transformation its advance has brought about.

The logic of these analogies may be so familiar as to appear in need of no further comment, so established is the frontier narrative still in the account of the growth of human civilization, technological advance, and scientific progress. However, it is precisely the magical logic of the frontier that invites further scrutiny because of its deeply paradoxical composition—a mix of historical fact, nationalist fiction, mythic allegory, and colonial propaganda. The problem here is similar to that often described for the evolution of technology—that of mistaking the consequences for the cause, as if airplanes evolved by themselves. This is the intransigent problem Habermas describes as the “thesis of the autonomous character of technical development” and dismisses as “prescientific” (2010: 174). Also known as technological determinism, the attribution of an autonomous character to technical advances is further denigrated by Habermas as a ruse: “in the end,” he asserts, such an attribution ultimately “serves to conceal preexisting, unreflected social interests.” After all, as he notes, “the pace and direction of technical development today depend to a great extent on public investments: in the United States the defence and space administration are the largest sources of resource contracts” (174).

The extensive debate over the extent to which Marx attributed too much neutrality to technology and not enough politics to the evolution of technics (other than the interests of the ruling classes and the needs of capital) has long remained unresolved in part as a result of this either-or approach to the question of technological autonomy. What the idioms of the frontier and the “self-propelling” model of technology have in common, in other words, is the neglect of their specific mechanics—or as it may turn out, their organics. As Raymond Williams (1990) also points out, it is as if the only critical question to be asked of either of these idioms, or of the manifest destiny ethos that suffuses both of them, is whether they are, as Habermas puts it, “a mere extension of natural history” (2010: 87).

Indeed, both Marx and Engels did conceive of technology as an extension of natural history—so much so that Bernard Stiegler (1998: 2) suggests Engels’s account of the coevolution of tool and hand “troubles the frontier between the organic and the inorganic” to such an extent that it all but constitutes a new theory of life itself. Such a view invokes yet another model of the frontier, as well as of natural history, which is in Stiegler’s account reimagined as a genealogy of technics. Whereas for Habermas mere natural history implies a lack of explanation, or even a convenient deceit, another approach can
be arrived at by assuming that natural history itself is undertheorized. Thus, as noted earlier, when Marx cites Darwin’s model of the evolution of organs in order to explore the increasing differentiation of tools and technique, he need not be read as either naturalizing or neutralizing technology, but instead as proposing a more complex mechanism for technological development, as well as for human evolution — indeed that these are at one level isomorphmic.

It is no surprise that the models of both the frontier and technology (as well as evolution) most similar to those of Marx and Engels have long been found in both archaeology and anthropology — where for over half a century the human-tool relation has been theorized, to repeat Engels’s language, as a frontier. The frontier model of the archaeologist of early agriculture today, for example, is likely to be more similar to contemporary nonlinear, symbiotic accounts of evolution, domestication, or speciation than earlier, quasi-Darwinian narratives of human emergence driven by steady cultural or technological advance, such as those of Lewis Henry Morgan (1877), Leslie White (1959), or Lewis Binford (1965). Paralleling developments in science and technology studies more widely, the analysis of human technological development advocated by anthropologists such as Pierre Lemonnier favors not only the view that “techniques are first and foremost social productions” (1993: 2) but that “the logic and coherence of . . . technological knowledge . . . are not related solely to the physical phenomena that are set in motion by a particular technique. Social representations of technology are also a mixture of ideas concerning realms other than matter or energy” (3, emphasis added). Thus, for example, in his account of early agriculture (neolithicization), the archaeologist Marek Zvelebil argues against any simple equation of technological development with cultural or economic change. Summarizing the view that has increasingly come to dominate the effort to model both local and general patterns of agricultural experimentation in the evolution of settlement culture, Zvelebil emphasizes the importance of complex interactions rather than functional causality:

Ostensibly, the transition to farming is an economic process involving a shift from dependence on biologically wild to biologically domesticated resources. However, the process cannot be separated from the cultural, social and historical contexts in which it occurred. The change in economy may be a cause of, or perhaps a consequence of, changes in ideology, material culture or the social organization of participant groups, changes often referred to as neolithicization. It is not clear whether these changes were broadly simultaneous or whether, in Europe, the
shift from dependence on undomesticated local resources to agro-pastoral farming can be regarded as a signature for the sociocultural developments of the Neolithic [more generally]. (1994: 323)

To analyze in more regional specificity a process of transition (e.g., to agropastoralism) that is less likely to have involved singular stages or direct causes than a series of overlapping, repeated, and nonlinear events, Zvelebil employs the concept of an agricultural frontier zone to describe a context of exchange, of to-ing and fro-ing, including the cross-transfer of genes as well as of languages, material culture, and other resources. An advantage of such models, according to the author, is not only a “finer resolution” but a larger scale: “The agricultural frontier is more than a boundary. It is a far-reaching phenomenon, covering a wide geographical space, within which contacts between foragers and farmers occur, and which is occupied by communities in different stages of the transition” (Zvelebil 1994: 328). This archaeological model of the frontier as a contact zone, allowing for a much wider range of types of interactions, exchanges, and transfers, as well as a larger pool of active variables shaping technological change, typifies the shift within archaeology and anthropology generally toward a more mixed picture of the emergence of both agriculture and domestication.¹⁰ In contrast to the progressive linear models of influential twentieth-century archaeologists, such as V. Gordon Childe (1952), who painted a picture of early farmers similar to that of Jesse Lee Bennett—pursuing avenues of progress out of their wilderness clearings toward a more civilized society—more recent theories have, for example, concluded that mobile subsistence farming may well have been compatible with livestock domestication, and that one need not have preceded the other. Indeed, it now appears increasingly likely that a wide range of strategies were employed simultaneously even within specific regions—as the very term “agropastoral farming” suggests.¹¹

These shifts have been strongly reinforced by work in social and cultural studies of science, where, as the work of Haraway (2008), among others, clearly demonstrates, the idea, for example, of nature as a mixed, hybrid zone of contiguous agencies is, if anything, now the dominant approach in social theory. The identification of what the anthropologist Rebecca Cassidy describes as “porous, culturally-variable distinctions between wild and domesticated” (2007: 3) that have increasingly dominated the retheorization of agriculture and human evolution have important implications for understanding the history of technology as well. The fact that Darwin based much of his research into the concept of natural selection on domesticated ani-
mals, as well as artificially housed or contained animal specimens, becomes increasingly significant in the context of the resurgent epigenetic paradigm within developmental biology, suggesting, among other things, that, as Darwin speculated himself in his much-discredited thesis of pangenesis, the flow of inherited substance is neither strictly one-way nor entirely independent of environmental influences. (Indeed it was precisely this theory Walter Heape was testing in his original embryo transfer experiments of the late nineteenth century, prefiguring the increased significance reproductive biology has acquired in the context of remodeling developmental genetics.) In retrospect, what is so suggestive within Darwin’s discredited model of pangenesis is the possibility that artificial and natural selection interact. To the extent that it foregrounds how organisms interact in the context of a technological culture, the petri-dish model of tooled life appears less and less specifically modern, and indeed more like a neolithic frontier.

Contemporary theories of biological development have been radically altered by the possibilities that learned behavior may become heritable, and that terminal differentiation can be reversed (and that human embryonic stem cells are themselves “an epigenetic adaptation to the ex vivo environment” [Smith 2008]). In turn, new possibilities are opened up for redesigning whole organisms and their parts—including both the generation of new cellular applications and the production of new cellular tools to enhance not only genetic but epigenetic control (Smith 2008: 453). That genes are no longer “one-way” but can be “told what to do” is reinforced by the unorthodox discovery that a relatively small number of genes can reset a cell’s developmental clock, rendering it newly embryonic, by inducing pluripotency. Thus the importance, noted earlier, of the induced pluripotent stem (iPS) cell (named for the iPhone), which can now be used in many experiments that previously required difficult-to-source human embryos. The Loebian concept behind the iPS cell is that fundamental biological processes can be retooled to access a different part of their structural memory. This technology has precisely the magical reach we would expect from a frontier science that is developing new horizon applications.

This magical reach also appeals well beyond science. New concepts such as epigenetic reprogramming, induced pluripotency, and gene transfer have begun to travel more widely, and have been adopted as learning aids by leading biofuturists such as Stewart Brand, who urges (much as Firestone once did) that evolution must be “taken in hand” in the name of a survivable human future. The turn to in vitro models in Brand’s influential publication Whole Earth Discipline thus extends his analogy to IVF discussed earlier, by annexing
it to the language of molecular and synthetic biology: “Thanks to horizontal gene transfer, microbes have developed astounding skills. Tiny as they are, microbes can learn. . . . Microbes do complex quorum sensing, both within species and between species. . . . They make rain on purpose” (2010: 175). The new reeducability and skill of the complex microbe described in this passage exemplifies how such models themselves have become, like IVF, more regular. The astounding powers of these complex microbes and their potential to cross species borders appear to offer a new theory of biopower, according to which biological substances can become versatile and powerful tools in the effort to reverse engineer evolutionary change. Now that we know how adaptable genes are in taking, as well as giving, instructions, they can be retrained to make smarter tools. This is the same “biology is technology” model discussed in chapter 1, and it is the promise of this same logic that leads Brand to cite IVF as the big example of why we need to learn to live by remaking life, by tooling up biology, as it were. Alongside the work of leading synthetic biologists such as Craig Venter, Drew Endy, and George Church, Brand cites the Princeton physicist Freeman Dyson’s claim “that the domestication of biotechnology will dominate our lives during the next fifty years at least as much as the domestication of computers has dominated our lives during the previous fifty years” (Dyson quoted in Brand 2010: 179). In vitro fertilization is the regularizing analogy by which these possibilities are tamed through the now familiar facts of technologically assisted parenthood.

As noted in chapter 3, Hannah Landecker (2007) has insightfully documented how “biotechnology changes what it is to be biological” in the context of cells that become “living tools.” As that chapter argued, it is now increasingly evident that the working up of biology through techniques such as IVF is also changing what it means to be technological. In the increasingly quotidian crossover between the languages of natural history, evolution, and biology with those of technology, redesign, and engineering emerge exactly the same porous distinctions described by Cassidy in the context of the relationship between domestication and agriculture (distinctions that were already porous, as we have seen, in the writings of Marx and Engels, as well as Darwin). Now that biotechnology itself is being described as the object of domestication, it is worth returning to the question of what evolution and natural history refer to, exactly—for example, from the point of view of IVF.

Through the lens of the frontier idiom, we might describe the relationship between biology and engineering in the early twenty-first century as a classic example of a hybrid contact zone, primarily characterized by exchange, mixtures, and trading. Like the frontiers of old, the contemporary biofrontier
is a zone of exploration, of domestication, and of prospecting for new substances—now also including living tools. As in the case of the British parliamentary defense, twice in the last twenty years, of the nation’s right to new human embryo tools to improve the health of the population, the prospect of “walking hopefully into the foothills of a gigantic mountain range” is increasingly seen to be of significant economic and political importance—and not only in the United Kingdom. Few national governments appear to be in any doubt today concerning the substantial economic importance of the bio-frontier—and the imperative to accelerate the domestication of new species of biotools and bioproducts for the benefit of the biopolity. The age of biology, as The Economist magazine has dubbed it, is today substantially manifest as the effort to domesticate biological substance by making it more technological, while at the same time this merographic analogy returns to redefine technology as more biological. To describe biology as a frontier today essentially means describing it as a tool future. This view of the technological vitality of biological innovation in turn suggests a different model of kinship as it becomes substantialized not only through biological relations but through their identity with technology. If it is the case that modern human reproductive substance has never been strictly biological—in the sense of being independently biological, naturally biological, or biologically automatic—since it is organized through a selective reproductive apparatus, then this biology must “always already” have incorporated the technicity of its environment (which not only humans have introduced) since—well, more or less since it started. Such a hypothesis—of a physical chemistry between the organic and inorganic that is exaggerated by in vitro life—would offer yet another looking-glass perspective out of the world of IVF, and onto its future. 

Cabin Fever
Given these complex imbrications linking biology and technology with the prospect of reengineering human futures, it is fortuitously apt that it is the sculpture of the Winged Victory of Samothrace that appears on the cover of Frontiers of Knowledge, looming behind our lone frontier everyman at his desk—as she too has a special relationship to the future of technology, as well as its perils. This sculpture from approximately 200 bc depicting the goddess Nike is thought to have been commissioned to commemorate a naval battle, and to have been installed on the island of Samothrace in Greece in such a manner as to suggest she was standing on the prow of a ship. She leans forward, and her missing right arm was once cupped to her missing mouth in a
cry of victory, inspiring her crew to triumph over adversity. Much admired, she is considered to be one of the masterpieces of Hellenic art and one of the Louvre’s greatest treasures in part because of the powerful sense of movement she conveys—not only in her posture, but in the finely wrought ruffling of her gown, as if facing into a gale. The sense of her movement into open-ended space is furthered by this active stance—her wings fully outstretched, as if addressing fate itself.

In addition to physical momentum, she thus evokes a sense of spirited engagement (indeed perhaps with the spirits themselves). In the imagined space ahead of her lie the obstacles to be overcome, and in her eagerness to confront them she both embodies and inspires progress. She thus evokes in her entire (sculptural) figure the magical reaching out of the frontier, the child as airplane, and the future of airships regularly traversing the North Pole. Thus her incorporation into the Rolls-Royce “flying lady,” the figurine also known as the Spirit of Ecstasy introduced at the Paris motor show in 1904 and still a feature on the hood of these iconic cars. As if embodying, then, the transfer of the frontier analogy not only to knowledge, but to technological advance, as well as the military origins of this idiom, we see in this statue’s role as the mascot to elite machines both the sense of hopeful inspiration and the recurring themes of conflict and of confrontation that have defined the modern technological age.

As Ulrich Beck (1992) has argued, the equation of technological innovation with progress characteristic of the postwar period, during which the frontier idiom guided the establishment of large-scale publicly funded institutions such as the National Science Foundation, became increasingly strained toward the end of the twentieth century, burdened by what Beck describes as “an anarchy of side effects” (1992: 214), and characterized by increasing political conflict. Far from enjoying automatic public consensus, faith in progress becomes, in his view, something that must be enforced, thus inaugurating a countermodernity equivalent to a secular religion over which battles are increasingly fought. Unguided by democratic deliberation, and yet enforced as a government economic priority, the automatic policy of pursuing scientific and technological progress creates “a blank page as a political program, to which wholesale agreement is demanded as if it were the earthly road to heaven” (214). Unequivocal on this point, Beck identifies late twentieth-century faith in progress as an inversion of the very modernity it created. Indeed, he writes, progress “can be understood as legitimate social change without democratic political legitimation. Faith in progress replaces voting. . . . The fundamental demands of democracy have been turned on
their heads by the model of progress. . . . Progress is the inversion of rational action. . . . It is the continuous changing of society into the unknown without a program or a vote” (214). In addition to the more well-known cases of nuclear power and genetic engineering, Beck describes the introduction of IVF and embryo transfer as an example of the “free pass” (207) handed over to science in the name of progress, resulting in what he describes as “an avalanche of problems” (206). In addition to the question of whether IVF will lead to “completely new types of social relationships, whose consequences cannot be predicted,” he notes that “deep-frozen embryos could be stored and sold,” thus “provid[ing] science with long hoped-for ‘experimental objects’ . . . for embryological and pharmacological research [as well as] genetic diagnosis and therapy on embryos, with all of the associated fundamental questions [including] what constitutes a socially and ethically ‘desirable,’ ‘used’ or ‘healthy’ genetic substance? Who will perform this ‘quality control of embryos’ . . . and by what right and with what standards? What will happen to the ‘low quality embryos’ which do not satisfy the requirements of this prenatal ‘entrance examination for the world’?” (206, citations removed). Like both Hannah Arendt and Jürgen Habermas, Beck interprets the birth of IVF as a “secret farewell to an epoch in human history” that has transpired without public, political, or parliamentary consent. “How is it possible,” he asks, “that all this can happen and that only subsequently the questions regarding the consequences, goals and dangers of this noiseless social and cultural revolution must be pursued by a critical public against the professional optimism of the small clique of human genetic specialists, without real influence of their own and fixated on scientific conjecturing?” (206–207, emphasis removed).

Published in Germany in 1986, and widely hailed for its introduction of the concepts of the risk society and reflexive modernization, Beck’s analysis in some ways closely resembles those of (the somewhat less widely admired) feminists concerned with reproductive technology in the mid-1980s discussed in chapter 5, who similarly emphasized the lack of sufficient public debate of the introduction of IVF, and who interpreted this lack of deliberation as a measure of the counterdemocratic hegemony of the medical profession, as well as the emergence of conflict in the wake of a more reflexive technological ambivalence. Beck’s claim that IVF conveniently establishes a reliable source of human research embryos has also long been a feminist concern, as described, for example, by Gena Corea in her 1985 critique of reproductive technologies as “the application of animal husbandry to human beings” by an elite “power structure” lacking any “conscious policy”:
Th[e] language of therapy used in describing IVF obscures the fact that medicine is not just a healing art but is also an institution of social control. IVF gives the power structure potent tools for such control. It makes a certain scenario possible: the application of animal husbandry to human beings in processes that will reduce women to breeders and offer a centralized group of white men control over who is born into the world. This would not necessarily be a conspiracy or even a conscious policy. The efforts of diverse men to create technologies that will increase male control over women and reproduction may be unformalized and intuitive, but nonetheless effective. (1985: 123–124)

Here, then, in reverse composition, is the relation of domestication to technology described earlier, once again on the reproductive frontier, but much less optimistically so. Where both Beck and Corea point to the dehumanizing, antidemocratic, and subjugating legacies of the potent tools made available via human IVF, others, such as Brand, now argue the human condition has not been so different from animal husbandry all along, and that more advanced human husbandry is no longer an optional extra, but must instead be intensified.

And yet! (as Heidegger would say) whether or not its introduction was democratic or consensual, or its risks were sufficiently debated in advance, IVF has become, since the 1980s when its introduction might still have appeared to affect only a tiny minority of citizens, a vast and well-established global industry—indeed one that is not only as regular as air travel over the North Pole, but increasingly reliant on the airline industry to connect consumers with the reproductive products they require. The project of taking biology in hand is now more than ever one that is consciously, politically, publicly, and consensually annexed to an expanding biomedical, biopolitical, and bioeconomic future of cultured biology. To argue that IVF should not exist may be credible for the same reasons organ transplantation is still objected to by some. Or Facebook. But the time has passed for such objections to have any likelihood of abolishing this technology. Ethical and political concerns are not gone, but they have migrated, have been sidelined, or, as in the case of Cardinal Keith O’Brien’s objections to embryo research described earlier, have become the object of ridicule. Direct opposition to either IVF or embryo research is now confined to a small minority in global terms. And although calls such as Beck’s for a more meaningful public engagement with scientific innovation continue to emphasize the importance of moving it fur-
ther upstream (a goal that to a degree is manifest in the context of new initiatives such as synthetic biology), the logic of IVF, as discussed in chapter 1 of this book, is now both publicly celebrated and irrevocable. Dissenting concern has moved elsewhere—for example, to humanizing animals, nanotechnology, and the regulation of trade in human tissues, cells, and organs. Far from being banned, or even curtailed (or, for that matter, even meaningfully monitored in most parts of the world), IVF, as Brand notes, has become taken for granted. The “avalanche of problems” anticipated by Beck may indeed be manifest as an ongoing debate over stem cells, embryo research, cloning, and designer babies. But these concerns do not appear to have substantially undermined either continuing public support of research to develop new biological tools such as iPS cells, nor to have diminished popular or philanthropic endorsement of such endeavors. Indeed, as chapter 5 has shown, IVF has become not only normal but normative.

In retrospect, the case of IVF suggests that insofar as people are voting with their feet by queuing up for an ever-widening range of almost entirely privatized reproductive services, this technology is supported by a widespread, diverse—and increasingly global—public consensus. Whether or not IVF was foisted upon an initially naive and unconsenting public, as Beck alleges, and regardless of whether it increases male control of reproduction, as Corea predicted, the progress of IVF since the mid-1980s (as a science, an industry, and a market) can hardly be described as either slow or hesitant. It is no longer even significantly controversial. Five million miracle babies later, IVF looks like other frontiers that are already behind us.

But as chapter 6 has also shown, the rise of IVF has not been unaccompanied by the ambivalence Beck described and the expansion of technological control of reproduction Corea more unambivalently predicted would be subordinating. What the case of IVF thus also foregrounds is the need for more complex models of technological change, and a wider conversation to address the sociological character of these changes. This is one reason I have argued that the feminist debates over reproductive technologies in the 1980s, and in particular the effort to integrate the understanding of IVF technology with the analysis of technologies of gender and kinship, offers a perspective that is of increasing value to understand the evolution of the biosciences more broadly. The fact, for example, that engagement with both the promise and the practice of IVF turns out to be much more complicated than it might initially appear yields a powerful insight not only into the question concerning technology more generally, but the ongoing difficulty of how to analyze the current question concerning biology that this book attempts to explore.
Arguably, what the feminist analysis of IVF reveals with especially significant implications for the future of the biosciences is the absence of adequate attention to reproduction not only in the analysis of technology, but in the effort to theorize social and political structures in general. The difference between Beck’s account of new reproductive technologies and those of feminists in the same period lies mainly in the feminist emphasis on the extent to which reproduction was not included within the public political process to begin with. Moreover, what feminist analyses have demonstrated is that if the explicit technologization of reproduction has made this absence in social and political theory more visible, it has not made it more legible or tractable. Had Foucault observed the emergence of a complex worldwide debate over the relationship between IVF and regenerative medicine, or had he followed the debate over designer babies in Le Monde, he might have been inspired to revisit the “strangely muddled zone” of reproductive technology and its significance to biopolitics. No doubt Marx would have been a profuse commentator on the rise of biocapital in the context of stem cells and regenerative medicine. And even Lévi-Strauss must have been tempted at times to consider the complex exchange of gametes that is now a routine procedure in the heart of Paris as a new mythic paradigm, or even grammar.

What the absence of such contributions reveals in retrospect is precisely what the feminist analysis of reproductive technology has shown all along, namely that the scope and depth of biopolitics has only just begun to be revealed or charted, but also that from the point of view of gender politics this is hardly novel. In the same way the meaning of “biopower,” as Foucault rightly argued, has been hampered by too narrow a definition of politics, so too was his expansion of the term “technology” to encompass the discursive process of subject formation a feminist theory manqué (pace Rubin 1975: 185). Missing from its remit was not only an adequate account of gender but, more surprisingly, of sex, and in particular of the heteronormative apparatus through which sexual reproduction is both organized and channeled. Much as the introduction of IVF may have been imagined as a means of facilitating normative heterosexual, conjugal, and familial ties—and much as it may have been seen as analogous to biological reproduction in vivo—it has turned out, as Strathern predicted, not quite to reproduce these preconditions exactly. Instead, this technology occupies a parallel universe that now supplements an imagined original to which it is never entirely resolved.

That this process of supplementation has itself been replicated in the new traffic connecting biology and technology more widely—in which one is at once synonymous with but exceeds the other, just as the tools of the micro-
manipulator exceed the frame of cellular reconstruction—only reveals more clearly why IVF was never a simple case of giving nature a helping hand to begin with. Repositioning this technique within the longer history of retooling reproductive substance, and especially the effort to include within this history the recognition that conventional gender and kinship structures are as much part of this retooling as hand-beveled pipettes, opens a new window onto the question of what “biotechnology” actually means.

It turns out to be in the dehyphenated space of this now familiar neologism that biotechnology, like biopolitics, or for that matter biology, still has much to reveal. So far, what the lens of IVF reveals is both that we already have a more contingent understanding of biology, and a more biological model of technology. So much has already been argued throughout this book, and accounts for its title. In turning, then, in the second part of this chapter to a more concrete engagement with the new reproductive frontier opened up by IVF, and to the ongoing effort to domesticate biology as a technology, as well as the new kinship and gender norms this technology relies upon for its own reproduction, it is once again the view up close to the encounter with IVF as both a technology and a way of life that is explored. The aim of this section, which returns to the question of the frontier, is mainly to view this problem from another angle—again from another technology, namely photography. Shifting, then, as in the last chapter, into a different kind of culture medium, we turn to the British artist photographer Gina Glover and The Art of A.R.T.

In the following tour of an art installation in an ART clinic, we encounter the reproductive frontier as a highly political space, but one that, for all of the reasons discussed in the first section of this chapter, as yet lacks a very precise political, sociological, or philosophical analysis. In the newly normative space of an IVF waiting room, we also reencounter the ongoing ambivalence toward technological possibility so consistently described in the feminist literature on IVF. Indeed a “strangely muddled zone,” to reinvoke Foucault’s description somewhat differently, the space of reproductive pioneering is both anxiously and intimately ambivalent—while remaining ripe with possibility and exerting a curious allure. Here, in closest contact with the process of retooling reproductive substance, is also a space of careful thought and extended imaginative reach conjoined with a queer sort of human husbandry. It is to the lessons we can learn from this space of biological relativity, as depicted by an artist in residence, that we now turn to reconsider the open-ended questions of how the futures of new tools and new kinships are conceived by those who are living with them closest to hand.
Art in the Age of Reproductive Technology

Having worked with the Guy’s and St. Thomas’s ACU since the late 1990s, I was already familiar with the award-winning installation the British artist Gina Glover had completed in the Guy’s Hospital Genetics Clinic in 2002–2003 before I learned that she had been commissioned to create a second exhibit in the new IVF–stem cell facility, The Art of A.R.T., completed in 2008. From my previous ethnography on preimplantation genetic diagnosis, which was partly based in the Guy’s Genetics Clinic (Franklin and Roberts 2006), I was familiar with Gina’s most famous hospital installation piece—Chromosome Socks (figure 7.2). When I arranged to interview Gina about her new installation, in the autumn of 2009, we thus agreed to meet in the Guy’s clinic foyer where her previous work remains a favorite talking point.

As Gina explained to me while standing beside her signature photo light box, Chromosome Socks emerged from a year-long residency in the Guy’s cytology lab and came to be the centerpiece for the installation not only because it worked visually, but because it was the process of making this piece that enabled Gina to clarify her artistic method: “I mean how it originated was that what I observed when I was working in cytology, where they were looking at chromosomes, was their sensibility to have stripy scarves, stripy socks, stripy this, stripy that. Everywhere I looked there was all this stripiness. People [had them] had on their notice boards, the men were wearing stripy ties. . . . It was extraordinary, the stripiness of everything.” This stripiness—the sartorial sign of cytology, based on the banding of chromosomes that is cytology’s

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**Figure 7.2.** Chromosome Socks. Reproduced with permission of the artist, Gina Glover.
stock in trade—was both visually and symbolically suggestive. It was also an idiom that was ready to hand both in the lab and at home—indeed it established a connection between these two different parts of the cytologists’ lives. In the same way that the cytologists’ socks traveled with them from home to work, so too were socks a naturally striped pair of familiar objects used in the translation of genetic diagnosis to patients. For her artwork, Gina sought to exploit these connections by asking the geneticists to donate their socks for her project. “And then I would talk to people and they would talk about socks in a washing machine, or spaghetti, and things like that, and so the idea of socks was originally formulated from remarks they made. And so I collected, and they gave me, [their socks]. This is a geneticist’s child’s sock [pointing to the smallest pair of socks]. And so all the socks were donated to me, but I didn’t have quite enough so I bought a few more at Brixton market, just to top it up a bit.”

Knitting together, as it were, the public and the private lives of the geneticists, their own biological relations, as well as the domestic and commercial economies, the socks proved to be an ideal artistic medium. To enhance their “socks appeal,” Gina photographed the socks against a bright white background, later Photoshopped to form a halo around each pair. She then mounted the glowing socks on a pearly gray backlit grid, each pair itemized with bright orange numbers to create an oversized glowing montage mimicking, but mutating, the screens used for diagnosing chromosomal disorders. The use of bright color animated the pairs, while the halos enlivened them with light. The effect is not unlike a sock party piece—perhaps a disco. “I kind of wanted them to look a bit psychedelic. I think chromosomes should dance,” Gina explained.

This was not the first incarnation of the socks piece, however. For her first shoot Gina had photographed the socks in a domestic garden, in what she describes as a more “documentary” style—a style, as it turned out, the cytologists found hard to follow (figure 7.3). Pinning the socks to a laundry line, Gina had originally imagined the elementary units of cytology crossed with the familial associations of a garden, a home, and housework. This pastoral, Edenic, yet domestic and ordinary location, however, proved too generic an image. The addition of a dog running under the hanging socks only made it more closely resemble a bucolic ad for laundry detergent. “Originally I didn’t understand about a karyotype. So I put the socks on a washing line. Which I was very proud of, and it had taken me a whole day to arrange them, and to get a dog to go through, and get the garden looking okay, and to be the right kind of garden to put them in, and of course came back and was told very, very
firmly that that didn’t work, and that wasn’t right, and it was totally meaningless.” In retrospect, Gina agreed the garden setting wasn’t quite right: “What didn’t work with the washing line was that it was in a back garden. It almost needed to be a washing line in Venice.” The socks needed to be somehow out of place to show up: the image needed to be incongruous, but with a point to the mismatch between object and place. The bright socks needed to be backgrounded, she felt, against something more rectilinear, more contrasting, and less like where socks might be found ordinarily. But most importantly, she realized, she had not paid adequate attention to the work of the cytologists: the image did not connect with them in part because it was too removed, too superficial, too untranslatable. Estranged from their donated socks by Gina’s initial stab at re-presenting them artistically, the cytologists failed to comprehend her image. There was not enough affinity to pull them in.

What Gina next created drew less on the pastoral image of the domestic garden than on a different home ground for the cytologists: the primal scene of medical genetic screening—their own professional domestic window—the light box. By cutting, pasting, and rearranging the vividly banded pairs of stripy socks into a kind of table (just as a cytologist would), and mounting them in illuminated gridlike squares, Gina reproduced one of the defining
visual technologies of cytology, the karyotype, which is used to match pairs of chromosomes and thus to detect genetic abnormality. As in a scientific karyotype, her image is both standardized and individual. Each pair of socks repeats the general pattern, but not consistently, as each chromosome, and pair, is unique. There is variation in the color and shape of each sock, and each pair is shot against a slightly different background—resulting in a series of portraits that make up a population, defined by their similarity, but also by their serial uniqueness.

In both its mode of production and its final form, then, the resulting image is itself an imitation that is defined by both its similarity and uniqueness. It is at once a faithful depiction of a karyotype and a clever masquerade, a pastiche, and a torque of a familiar technics: *Chromosome Socks* is an imitation of a karyotype that is more dramatically dressed up, and in fact not a karyotype at all, but a comment on one. Clearly, it is an artist’s representation of a karyotype. It relies on the visual pun of socks that look like chromosomes arranged into a karyotype-like grid, but one that has been enhanced even beyond Kodachrome brightness, as if it is a karyotype on steroids—enlarged, vivid, and theatrical. A translation of technique that doubles back on its makers in the labor of its making, its remade-ness becomes akin to homegrown methods, while introducing a new way of seeing them. At the same time that the image relies upon conventional and familiar mechanisms of scientific display, it re-presents them by putting a mundane domestic object center stage, the humble sock. One need not know that most of these socks were donated by people working in the clinic to recognize that they are ordinary domestic objects that would have belonged to someone. It does not matter whether or not they have been worn, or by whom, for these socks to epitomize everyone’s everyday ordinary, as well as the personal and the individual, and the quirky.

Similarly, although they are systematically arranged and displayed in numbered rows, from largest to smallest (as would be a proper karyotype), the overall image is noticeably asymmetrical. Only one row of socks is complete—the rest have gaps. In between the dancing pairs of psychedelic socks are blank empty squares—at once relieving the eye from too much vivid, in-your-face stripy sockiness, but also subtly suggesting the unseen, the unseeable, and the unknown—the incomplete. The way of seeing this piece of artwork thus establishes fuses the professional bioscientific gaze with the daily familiar of the domestic routine: it offers us a picture of clinical genetics as nonthreatening, familiar, and somewhat comical. Adult and child socks share a kinship of technology—literally banded together as a stripy group of individuals and pairs united under the glare of exactly the surveillance Foucault
described as a new, disciplining norm of genealogy as technics. Knowingly ironic, and an obvious caricature, the witty image nonetheless retains a mildly pedagogical flavor, recapitulating the ubiquity of domestic analogies used in the context of genetic counseling, where DNA is commonly analogized to such familiar images as beads on a string, an alphabet, a book, or a recipe, and the mixing together of genes is compared to spaghetti, or socks in the washing machine.

In her discussion of “the biological gaze,” such as that practiced by clinical geneticists in the lab, Evelyn Fox Keller (1996a) emphasizes its interdependence with touch, as well as its ethos of action, through which sight is allied to the handling of objects to investigate the causes of things. This feature of the biological gaze can also be understood diagnostically, for example, in the use of tracers to identify genes for specific diseases, in order to prevent the establishment of a pregnancy using an affected embryo. Indeed, the agency of the biological gaze — its attachment to the identification of causes through intervention, in order to achieve greater control over outcomes — is arguably the whole point of clinical genetic applications such as preimplantation genetic diagnosis. As in Gell’s account of technological reaching, Keller notes that “the history of the biological gaze . . . has become increasingly and seemingly inevitably enmeshed in actual touching, in taking the object in hand, in trespassing on and transforming the very thing we look at” (1996a: 108). The probing, imaginative eye, she argues, requires the probing hand to enquire more fully into the mechanisms that make things work:

The fact is that scientists have found a way to walk up to the object and touch it; no longer do they peer through the microscope with their hands behind their backs. This in fact was the great contribution the rise of an experimental ethos brought to nineteenth century biology: the desire — and increasingly the skill — to reach in and touch the object under the microscope, and thereby “to make it real.” In other words, once the microscope was joined with the manual manipulations of experimental biology — marking, cutting and dissecting under the scope . . . the microscope became a reliable tool for veridical knowledge. By the close of the nineteenth century, hand and eye had begun to converge. (1996a: 112)

It was in experimental embryology, argues Keller, that the union of “representing and intervening,” as Ian Hacking describes it (1983: 189–190), became most prominent. Citing the classical experiments performed by Speemann that are discussed in chapter 3, Keller notes:
At first with relatively crude instruments—perhaps a glass rod drawn very finely, or a hair from a baby’s head—and later, in the twentieth century, with carefully machined microtomes and micromanipulators—researchers could not only represent but actually intervene in the choreography of the minute primal stages of life. They could isolate the fertilized egg, watch it divide, gently mark one of the cells with a dab of dye and follow it as it continued to divide . . . or they could carefully separate the cells . . . to see if the two halves of the young embryo could independently form whole bodies. (1996a: 112)

It is by these means, she argues, that the biological gaze evolved from a practice not unlike astronomy into a hands-on science seeking to identify the causes of development (or, in Spemann’s case, the source of organization) by separating out and testing the very smallest units of life—that is, by manipulating them. In this way, the gaze became a probe searching for the fulcrums of action, and aiming to identify the fundamental units that would, in turn, offer greater biological control. Linked to this change in the gaze was thus also a shift in what was being looked for—no longer mere classification, as Foucault described it, but instead, as Keller notes, “the means to alter—to induce a change in—the course of natural phenomena” (1996a: 115). It was by this means, she claims, that scientists such as H. J. Muller, the classical geneticist trained in T. H. Morgan’s lab in New York, were led to envisage a future in which control of genetic mutation would “place the process of evolution in our hands” (Muller cited in Keller 1996a: 116).

As Gina Glover’s image demonstrates, by imitating with her artist’s hand and eye precisely the touching and probing that motivate the scientists’ way of seeing, the biological gaze conveys more than just looking—it is also about touching, selecting, manipulating, and recomposing its objects. A highly skilled practice, acquired only through prolonged training, it is not surprising that the biological gaze, and its contiguous logics of clinical surveillance and therapeutic intervention, as well as of biological causality, are not always legible or obvious to the nonspecialist eye—for example, to patients in the Guy’s Genetics Clinic, to whom the glaringly visible signs of a positive or negative diagnosis that are like billboards to the cytologist or clinician may be literally invisible. This same process of translation is the object of Glover’s work, only altered by introducing yet another way of seeing, in the form of the artist’s handiwork, which retouches the karyoscape, rerendering it through the ordinary idiom of stripy socks. Differently trained, and differently focused, the eye of the photographer-artist is skilled in the process not only of
seeing, but of seeing how things are seen, and of revealing new ways of seeing both at once—the sight itself, and how it is composed. Like the experimental embryologist, or cytogeneticist, the photographer is also an adept practitioner of the arts of seeing, as well as the use of technology to probe and manipulate the object under observation or to frame and reframe events (now especially possible in the highly manipulable digital media). For an artist such as Glover, whose work involves both photography and the manipulation of photographic images, often by manually cutting and pasting them into larger compositions (such as Chromosome Socks), the language of cytogenetics is, in a sense, already second nature.

The biological gaze that Glover imitates—namely that of the cytogeneticist—is thus powerfully reinhabited by the artist, who has opened this gaze up to the viewer, in part by reconstituting it as identical in form, and labor, but not in content. As a result, the image offers a way of literally seeing through science, and yet also beyond it, as Chromosome Socks is not so much a scientific image as an image of science. Glover’s art is thus doubly translational: it both complements and decenters the highly technical scientific work of karyotyping by producing an image that resembles genetic counselors’ analogies, while inverting their epistemological gravity. At the same time, by supplementing the biological gaze, which is itself a supplement to its objects, Glover introduces once again the relativity that now accompanies spectatorship of the biological—be it as a patient, a clinician, or as a viewer of the evening news, where digitally recorded clips of micromanipulation accompany descriptions of stem cells, cloning, and regenerative medicine.

**THE ART OF A.R.T.**

Following its award-winning success in the Genetics Clinic, the method Glover devised for Chromosome Socks was translated into a different context in order to complete the project in the new ACU at Guy’s, opened in the spring of 2009 by Robert Edwards. Overseas at the time, I was unable to attend the opening, and did not view the finished installation until the following autumn. Visiting it for the first time, I immediately recognized some of Glover’s familiar themes as soon as I got out of the elevator on the eleventh floor on my first visit to the new lab. Under the title The Art of A.R.T., just opposite the elevator doors was a series of digital images of embryos arranged in a traditional developmental sequence, only now enhanced: Glover had in-filled the cells of a developing blastocyst with pink cherry blossom, using Photoshop.

When I interviewed Glover she explained that the photographs of a blossom had been taken near her London home, and had become a central theme...
in the installation as a whole, elsewhere reshaped as giant floating chromosomes, and recurring as a motif across several of the collage images. As well as symbolizing springtime and renewal, the pink blossom set against the blue background was suggestive of the conventional color coding of sex. Significantly, the pink cherry tree blossom also transformed the signature blue of micromanipulation imagery into open sky, while also thus inverting the viewers’ gaze upward: whereas an embryo observed through the lens of the micromanipulator is below the viewer, who is looking down, Glover’s embryo blossoms appeared to be floating in the sky above, their faint white aureoles like the wispy edges of clouds.

A similarly celestial theme is evident in Very Small and Far Away (figure 7.4), also in the central elevator waiting area opposite the clinic’s main entrance, where the title of this permanent installation The Art of A.R.T. is prominently displayed in large letters, announcing to the viewer that this exhibit is fully part of how this clinic understands its work. This giant galactic Photoshopped collage of cellular and celestial orbs drawn from inner and outer space is backgrounded, like Bennett’s frontier thinker, against a starry night sky. While referencing the ancient tradition of comparing embryology to star gazing (Gilbert 1994), these astronomical images also index the artist’s playful interpretation of scientific
imagery—repeating a signature theme in Glover’s work as a whole. Commenting on the overlapping languages of astronomy and embryology—such as the birth and death of stars, and the aureoles and coronas of cells—Glover noted the striking visual similarities between the orbs of inner and outer space, while also revealing, as she put it, the varied ways of being round: “They are all round but they are different kinds of round.” It had been important to enhance these effects of similarity and difference, she explained, not only by making the tiny cells bigger, and the giant stars smaller, but by making the entire image very large—upwardly imitating, again, the sky itself—as a galaxy. “I have this on a postcard at home,” she said. “It just doesn’t work when it is that small.”

Just inside the clinic, in a place of suitable prominence, stands the companion piece closest to Chromosome Socks in the Art of A.R.T. installation, in this case featuring enlarged, Photoshopped ties to represent the diagnosis of sperm morphology (figure 7.5). Once again the ties have been donated and subsequently posed (tied), then shot, cut, reshaped, composed, and further manipulated using Photoshop. Like the socks, the ties are displayed to resemble biological entities as they would be viewed scientifically in the context of clinical analysis. Again, the ties are vibrant and colorful, seeming to squirm against their clinically white graph-paper background. Like Chromosome Socks the image is both comical and instructive, scientific and domestic—an imitation of diagnosis and a re-creation of diagnosis as art. Once again, too, in the cutting and pasting of the photographs to create a disciplined montage of selected elements, Gina’s labor as an artist reproduces that of the scientists whose work she is depicting.

Directly opposite the ties is Eggs Donation (figure 7.6)—a neat, orderly display of eggs donated by female members of the clinical staff, who are named and commemorated in the tiny museum-like labels underneath each individual specimen. The eggs vary slightly in size but greatly in appearance

**Figure 7.5.** Sperm Morphology. Reproduced with permission of the artist, Gina Glover.
and the wide range of materials out of which they have been fashioned—
some painted, some made of stone, some that are real (birds’) eggs, that are
now (Photoshopped) egg specimens on display. At once depicting order and
variety, the eggs contrast with the sperm ties opposite in being set against a
stately black background, much as they might be in a museum display. Thus,
again, while a quasi-scientific idiom is being imitated, it is also being reinhab-
ited by donated personal objects.

A slightly different take on eggs animates Ex Ovo Omnia (figure 7.7)—a
collection of more than one hundred hens’ eggs dressed in colorful knitted
cozies. In contrast to the formal curatorial, faintly Victorian, table of donated
eggs, this egg population appears ready to go: they are out of the box and on
the move. The sense of animation is enhanced by the cartoonish assemblage
of characters depicted in a palette reminiscent of children’s toys or TV pro-
grams. These eggs are interactive and sociable, some appearing to converse
in pairs, share a hat, or glance at one another. They are variously positioned
standing, sitting, and lying down—together conveying a sense of a commu-
nity. By their very nature they could be described as culinary, domestic, and
companionable. They are also cute and their tone is far from clinical, or even

Figure 7.6. Eggs Donation. Reproduced with permission of the artist, Gina Glover.
serious. At the same time, the reference to the cozies having been bought on the Internet, and the presence of price tags, carries a less comical implication of a market in eggs—the eggs themselves also commodities purchased by the artist, no doubt in a supermarket. Similarly, one might wonder whether some of the eggs lying down are dead, or duds—perhaps hard-boiled, past their shelf life, or struck down by salmonella.

In describing both of these pieces, Glover comments on her growing obsession with eggs during her residency (figure 7.8). “It is the same thing that happens when you go through IVF treatment,” she said. “You become obsessed with eggs. It got so that I was seeing eggs everywhere.” We spent a long time in front of a collage titled Seeing Eggs Everywhere, made up of several hundred round objects resembling egg cells collected throughout Glover’s various travels. For Glover this piece explicitly engages with her sense of entering into a kind of parallel universe to that of the IVF patients and the staff of the clinic in their obsession with eggs (which in humans are, like embryos, round). Echoing her galaxy of orbs is this busy “obsessive” concentration of “shots that have come from everywhere,” including a shopping trip with her daughter, also an artist, who lives in New York. “It is as much about what is going on here [she points to her head] as the process [of IVF] I’m describing.”

**EMBRYOS AS WINDOWS**

Gina Glover is not the first artist to investigate IVF as a way of seeing, nor is she the first to envision the embryo as window on new life. These themes have been taken up by other artists, many of whom are included in Suzanne
Anker and Dorothy Nelkin’s (2004) *The Molecular Gaze*, including Anker herself. Among the best-known prior art in this field was produced by the British conceptual artist Helen Chadwick during the 1990s—coincidentally in the lab of one of the embryologists who now works at Guy’s, Virginia Bolton (Franklin 1999).

Like Glover, Chadwick immersed herself in the technique of **IVF**, and became fascinated by the culture of embryo culture. She too used photography as a medium and repeated the seeing-and-touching work of the embryologists’ biological gaze to prepare her images, responding with her artists’ hands and eyes to the powerful visual aesthetics of embryology and its still-artisanal sense of craft. For her series *Stilled Lives* in 1995, Chadwick created large Plexiglas sculptures of jewelry—a ring, a brooch, a necklace—in which she embedded photographic images of eggs and embryos derived from her work in the lab. Her hands-on training with embryologists had taught Chadwick how to grade embryos for clinical use, much as a jeweler would assess a precious gem. In her artwork, Chadwick built on these associations—not only in terms of the precious value of embryos, but in terms of the delicate manual skills needed to handle and manipulate them (Warner 1996). Chadwick, whose art frequently concerned her own body, became fascinated, for example, by the way lab technicians would use suction pipettes—incorporating their breath
into the process of creating new life. Similarly, she was captured by the drama of life’s delicacy in the petri dish, where some eggs developed beautifully, but others, inexplicably, failed to thrive. Much of Chadwick’s embryo art was focused on the proximity between life and death in the context of IVF, and how this tension was repeated in her own art through photography. Her title Stilled Lives captures this ambivalence, since the photograph at once entombs its dead image in emulsion and animates it as a photographic image simulating real life.14

Like Glover, Chadwick was struck by the power of the embryological gaze to redefine the world around her. Perhaps affected by the same “eggs are everywhere” obsession described by Glover, Chadwick frequently depicted embryos in the company of seeds, flowers, eyes, hair loops, and air bubbles, suggesting a shared kinship of form, as well as natural history. This kinship of form is extended in Chadwick’s work, like Glover’s, to stars and the galaxy, as in Chadwick’s piece Nebula. But whereas Chadwick’s experience of IVF was based largely in the lab, Glover’s artwork combines the experiences of patients, scientists, and clinicians—attempting to give voice to the world of IVF they together inhabit—in part through transformative ways of seeing that become a shared language in pursuit of a shared goal. Repeatedly she depicts both the strangeness and the ordinariness of the world of IVF in her photographic compositions, which attempt to translate these experiences into a visual vocabulary. Thus, for example, in Yes!—Glover’s calendric imitation of counting the days of an IVF cycle—she uses rows of pregnancy test wands to translate the experience of waiting for results during the process of IVF into a stylized, repetitive sentence of images ending in victory (figure 7.9). At times she employs the actual voices of both clinicians and patients, collected during her residency, by superimposing their words over composite images she has made to express them visually. Hence in Nigella she has incorporated extracts from transcripts from her local interlocutors, much as an ethnographer might (figure 7.10).

This sense of the social fabric of relationality contextualizing everything about the often fraught and inevitably highly charged emotional experience of undergoing IVF is not easily captured visually, and this may be one reason Glover uses the medium of fabrics extensively throughout her work. These fabrics include not only socks and ties, or cozies, but quilts and also Suffolk Puffs, a distinctive fabric construction created by gathering cloth into stylized bunches, shaped like buds, and used in quilting, upholstery, and home decorating. The incorporation of this traditional domestic craft into Glover’s artwork draws associations not only with homemaking, but with female labor,
FIGURE 7.9.
Yes! Reproduced with permission of the artist, Gina Glover.

FIGURE 7.10.
Nigella. Reproduced with permission of the artist, Gina Glover.
expertise, and manual skill—the domestic arts. Glover’s photomontage of a quilt made of Suffolk Puffs in petri dishes captures the social role of fabric in her wider aesthetic vocabulary, suggesting the extent to which people’s entire lives are, in a sense, stuffed into a tiny glass world as they make their passage through the ordeal that is IVF (figure 7.11). At the same time, the clustering of so many tiny worlds together as a patchwork quilt evokes the sense of solidarity often forged among couples undergoing IVF, and conveys the collective effort involved in such a project, including the professional IVF team moving things forward. Indeed from this point of view, the quilted quality of so many of Glover’s Photoshopped compositions might also be seen to define her role as a residential, translational, frontier artist—knitting together the fabric of the IVF world into photomontages that are at once beautiful patchworks, finely crafted objects, composites of a myriad domestic bits and pieces, and necessary means of keeping out the cold.

THE REPRODUCTIVE FRONTIER
The art of quilting, one of the traditional feminine domestic crafts celebrated by Judy Chicago in her landmark installation piece The Dinner Party, is suggestive not only of feminized labor, or art, but also the frontier. In its associations with the economical reuse of leftover fabric, the practicality born of necessity, the provision of much-needed protection against the elements, and
the crucial importance of neighborly assistance (the quilting bee being the feminine equivalent of barn raising), the quilt continues to evoke a frontier heritage. In addition to the sexual division of reproductive labor referenced throughout Glover’s *Art of A.R.T.* is thus a longer inheritance of the gendered norms of both domestic labor and technology, evident, for example, in the use of Suffolk Puffs. In turn, these legacies evoke the familiar interiority of domestic worlds, be they the delicate china collections of middle-class Victorian dining rooms, or the busy kitchens of suburban housewives in present-day London.

Writing of the American frontier, the literary theorist Annette Kolodny (1975, 1984) describes a gendered space, in which cultivation acquires contradictory meanings of both harmony and destruction. On the one hand a space of promise, hope, and future fulfillment, the expanding westward frontier also left in its wake a trail of environmental pillage that early commentators such as the naturalist and explorer James Audubon described as an abuse of the land. Guiding the westward expansion, Kolodny argues, were familiar gendered archetypes of reproduction, sexuality, and marriage, ultimately manifest as a defining ambivalence toward “the lay of the land.”15 Citing Frederick Jackson Turner’s famous 1893 frontier hypothesis, she notes that he “made explicit what had always been the experiential truth of the American continent: the West was a woman, and to it belonged the hope of rebirth and regeneration” (Kolodny 1975: 137). “European men, institutions and ideas,” wrote Turner,

> were lodged in the American wilderness, and this great American West took them to her bosom, taught them a new way of looking upon the destiny of the common man, trained them in adaptation to the conditions of the New World, to the creation of new institutions to meet new needs; and ever as society on her eastern border grew to resemble the Old World in its social forms and its industry, as it began to lose faith in the ideal of democracy, she opened new provinces, and dowered new democracies in her most distant domains with her material treasures. (Turner cited in Kolodny 1975: 137)

Such a vividly gendered description, argues Kolodny, cannot be dismissed as merely metaphoric in its language, for the gendered polarities evident in this passage are too ubiquitous to ignore, and too structurally prominent in frontier life to overlook, complex and contradictory though they may be. These gendered images she suggests, are crucial to understanding the postfrontier colonial ethos Turner described as the founding basis of the American char-
acter and nation—an ethos that has now been transferred, with equally complex implications, into the pursuit of scientific and technological frontiers, such as reproductive biomedicine:

Colonization brought with it an inevitable paradox: the success of settlement depended on the ability to master the land, transforming the virgin territories into something else—a farm, a village, a road, a canal, a railway, a mine, a factory, a city, and finally, an urban nation. As a result, those who initially responded to the promise inherent in a feminine landscape were now faced with the consequences of that response: either they recoiled in horror from the meaning of their manipulation of a naturally generous world... or they continue[d] pursuing the fantasy in daily life. (1975: 7, references removed)

In labeling this phenomenon the “uniquely American pastoral impulse” (1975: 8), and claiming that it is a defining legacy of ambivalence formed in the context of frontier experience and mythology, Kolodny’s analysis raises important questions about the transfer of the American frontier analogy into science. Indeed, nothing about her attention to the formative roles of gender polarity, the sexual division of labor, the imagery of rebirth, or the idiom of conjugality in the making of the American frontier ethos would be unfamiliar to feminist theorists of science more generally, including Evelyn Fox Keller, who points out in her analysis of gender and science:

Of course, not all scientists have embraced the conception of science as one of “putting nature on the rack and torturing the answers out of her.” Nor have all men embraced a conception of masculinity that demands cool detachment and domination. Nor even have all scientists been men. But most have. And however variable the attitudes of individual male scientists toward science and toward masculinity, the metaphor of a marriage between mind and nature necessarily does not look the same to them as it does to women.... In a science constructed around the naming of an object (nature) as female and the parallel naming of a subject (mind) as male, any scientist who happens to be a woman is confronted with an a priori contradiction in terms. (1996b: 174)

The implications of both Kolodny’s and Keller’s arguments in the context of a new scientific frontier that is premised upon ever greater control of the female reproductive system are precisely those mapped out so powerfully in the feminist literature on new reproductive technologies discussed in chapter 5. And it is no wonder that these implications have been the subject of
strongly worded and often passionate feminist writing, as well as ongoing feminist debate. If, as also noted earlier, the dominant turn in this literature has been away from a more archetypal or categorical analysis of patriarchy versus women’s bodies and instead toward the contradictory, ambivalent, equivocal, and often unresolved worlds of the people who inhabit this new frontier zone, with all its porosity and indeterminacy, the question of how technologies of gender both make and are remade upon the reproductive frontier remains a necessarily prominent one. Arguably, in fact, it is what the lens of gender or sex as technologies reveals about the development of IVF that we have yet fully either to perceive or articulate.17

In her description of her monumental feminist artwork, The Dinner Party, celebrating the regendering of artistic creativity, Judy Chicago (1996) describes not only her attempt to recover lost and undervalued feminine art forms, such as embroidery and ceramics, but also her effort to reclaim public space for these woman-identified, and often privatized, artisanal arts. Across her immense triangular (vaginal) table, Chicago deploys various media to produce a celebration of female artistic achievement, using the thirty-nine place settings commemorating goddesses and important historic women to showcase forgotten and marginalized feminine domestic arts, such as china painting, lace making, and needlework. Her “organic iconography” of plates derives from her own personal struggle to express herself as a female artist (memorably recorded in her autobiography, Through the Flower, 1977), and is intended to inspire women to create images of themselves “as subjects rather than as objects” (1996: 5). Decrying the “absence of public monuments,” the “absence of political leaders,” and the “absence in our museum of images” (1996: 5), Chicago sought to reclaim public space for female self-expression as well as to inspire women to produce more assertive imagery of themselves.

A significant part of the development of The Dinner Party project from its inception was an emphasis on teamwork. Initially with a few friends and supporters, and later with large teams of up to thirty people, Chicago attempted to integrate a sense of group process into the finished work by encouraging dialogue about the piece as it developed. At evening potluck dinners every Thursday, discussions were held to address both technical problems and the broad philosophical and political issues raised by the piece. These conversations, which punctuated the process of completing The Dinner Party project, are described by Chicago (1996: 8) as “sometimes confrontational” and “often emotionally draining,” but above all as crucial to the work, and to the ability to integrate dialogue and process into the finished piece.

Indeed, The Dinner Party project has continued to generate debate—it re-
mains a talking point; it continues to stimulate conversation; and it continues to inspire criticism as well as praise. Like the contemporaneous feminist debates about reproductive technologies, it continues to evoke a sense of collectivity, as well as division. In its material form the project remains didactically curatorial—reminding viewers of the narrow definition of high art and who has been excluded from this tradition. Overall it succeeds in its original aims—of publicly exhibiting the world of female art, of putting women’s experience on display, and thus creating an artistic soil out of which other similar projects can grow in the future.

Sitting in the waiting room of the Guy’s ACU, surrounded by Gina Glover’s artwork, it is clear she has accomplished a similar task. By reflecting the experiences of IVF patients back to them through her Art of A.R.T., she too has used artistic form to stimulate dialogue and to uncover the emotional realities of assisted reproduction. By visualizing women’s (and men’s) experience of IVF, and hanging it on the wall, she has transformed the often uncomfortably public experience of this technique into a new form of kinship. By incorporating her own autobiography as a woman, a mother, an artist, a traveler, a tourist, a photographer, a shopper, a collector, and a Londoner into her work, she has infused her images with the ordinary business of living a life—thus integrating herself into the sociality she is depicting as an invitation for others to do the same. As I have often observed myself while visiting the clinic, the images become interactive windows for the assembled members of the waiting room—not all of them patients, some being children or relatives of individuals or couples having treatment. Similarly, the staff members in the clinic and the lab take considerable pride in the presence of Gina’s work, which they describe as both an inclusive aesthetic and a constructive visual presence that assists them in the work they do.

The atmosphere of the clinic is noticeably different because of the presence of the installation as a whole, fused as it is with the clinic’s architecture, thus signifying not only an interest in patients’ lives, emotions, and labor, but the desire to recognize and include these nonclinical aspects of patients’ lives in the daily working life of the clinic. The prominence of artwork in the elevator exit area, before visitors have even entered the clinic, sends a powerful message about what kind of clinic it sees itself to be: it is not a clinic that shies away from the struggles that living IVF involves, the questions it poses, the hurdles it presents, or the doubts it may raise. It is a clinic that hangs on its walls questions that do not have easy answers.

This is another reason why The Art of A.R.T. is a distinctive window onto the culture of embryo culture and the world of IVF. The work of bioartists
such as Helen Chadwick and Gina Glover, along with many others, such as Suzanne Anker, enable us not only to contemplate, but to reinhabit the biological, molecular, and embryological ways of seeing that define the remaking of human reproductivity in the context of contemporary bioscience. They effect an artistic translation of translational sciences such as IVF and stem cell research, providing the basis for reflection, conversation, and dialogue. On display in the Guy’s ACU is an installation that highlights the constitutive ambivalence of IVF — its “curiouser and curiouser” character posed as a series of re-presentations of its artifice, and as a series of questions about living the remaking of life. Skillful bioartists are making these questions, reflections, and ambivalences more prominently visible as works of art, and thus as windows onto the question concerning technology as this question becomes ever more intimately biological. By exploring not only the biological gaze of the scientist but the biographical ways of seeing of those who live in closest proximity to biotechniques, artists such as Gina Glover have imaginatively transformed the scientific lens into a window through which to observe and contemplate the looking-glass world of IVF. From this vantage point, it becomes possible to reconsider what kind of frontier territory is being inhabited, or domesticated, in the context of new reproductive technologies on both sides of the hole in the wall, or open door, connecting them.

Although her work does not explicitly concern human embryonic stem cell derivation, Glover’s art is nonetheless helpful as a means of exploring the IVF–stem cell interface, as throughout her installation are reminders of the work that is involved in handling life as well as the emotional and physical demands of treatment. Inside the lab, biologists are making human cellular models in order to see into the workings of human biology: these new human tools, including IVF itself, comprise a way of seeing that is based on replicating the object being investigated — imitating it with a purpose, we might say. This is, at the most obvious level, the whole point, for example, of a dish model of disease: it has advantages over animal models not only because it is human, and accessible, but because experimentally it can be manipulated and observed more directly — it is “the best tool you can get.” This way of seeing through the synthetic and the bespoke is how IVF was first developed — as a handmade model of human conception in glass.

Outside the lab are the IVF patients who are engaging with the retooling of reproductive substance in the most intimate and personal way — by attempting to achieve a successful pregnancy. And yet, like the experimentalism of science, this attempt to move forward often fails, and even when it succeeds may lead in unexpected directions. At once guided by the biological gaze,
this way of seeing is also blind in many of the most important respects. What it can see is dependent on what becomes its background, but even the very best visual tools of science are often deceptive in what they show—as both patients and clinicians are well aware. And there is of course a whole world that is never the object of the scientific gaze to begin with. Following the path of scientific progress requires becoming literate in these gaps and ambivalences, as well as learning how to read a karyotype.

As Anker and Nelkin (2004) note in their important analysis of bioart, artists have to a certain extent turned the logic of the instrumental biological gaze on its head—or inside out. The handmade synthetics that artists see through are their own creations and are dedicated to human artifice in, of, and for itself—often using their own bodies, biologies, and autobiographies as resources for what Beatriz da Costa and Kavita Philip (2008) describe as “tactical biopolitics.” As Anker and Nelkin point out, the tools, materials, and techniques used by scientists and bioartists increasingly overlap—indeed they are frequently identical.18 But as Anker and Nelkin also note, “ultimately the images generated by scientists and those provided by artists are based on quite different epistemologies. . . . They represent quite distinct ways of knowing the world” (2004: 189).

For anthropologists of science too, this conceptual difference holds an important methodological lesson, particularly perhaps for ethnography, which also relies on imitation as a learning tool, and writing as a technology, or art, of creative revealing. As it turns out, the anthropology of the life sciences is also a lens for seeing the remaking of biological life, using well-worn techniques for depicting social relationships—such as collecting observations and writing about them. Similarly, in Gina Glover’s artwork is evident the importance not only of new biological tools, but of living with them—ambivalently, emotionally, and physiologically. Her artwork demonstrates how these biological and biographical relations to technology are knitted together on the frontier of reproductive pioneering—a frontier defined by the coupling of substance and tool. As well as revealing the art of art, Gina Glover’s artwork depicts a new frontier of biological relativity in which the social, the biological, and the technical are lived ambivalently together.

In this way, Glover’s artistic insights are similar to those produced by Rayna Rapp (1999) in her ethnographic description of the moral pioneering engaged in by women in the context of new reproductive technologies. As Rapp notes, the advent of new reproductive technology also creates “moral pioneers” situated on “a research frontier,” where women being offered difficult and unprecedented decisions and choices are also “making concrete and
embodied decisions about the standard for entry into the human community” (1999: 3). Contesting the privatization and invisibility of this context of moral pioneering, she argues, “A classic feminist analysis might begin by noting that women have long been relegated to the sociocultural domain of the family, intimacy and the private; thus important cultural and political tensions concerning the limits of individualism, privacy and bodily integrity have been played out by our potentially reproductive bodies. . . . Multiple iterations of our sex/gender system index our medico-legal system. . . . Women are thus culturally positioned to think about their reproductive capacities, desires, and decisions as a private dimension of public life” (306). Rapp, like Strathern, describes the emergence of new reproductive technologies such as amniocentesis as “an impromptu and large-scale social experiment” (309), adding that the work of moral pioneering is one of reshaping “a more social terrain” in which these technologies can be more consciously and ethically inhabited. The exclusion of reproduction from the public sphere, and its relegation to the privatized and feminized world of personal reproductive decision making, deprive the larger society of a crucial resource, she argues.

Arguably this privatization of reproduction, reproductive ethics, and reproductive politics is one of the conditions that is changing after IVF. One of the consequences of the rapid expansion of IVF over the past thirty years, and its expansion into stem cell research, in labs such as the one at Guy’s, has been to make more publicly visible the political importance of a highly feminized and privatized reproductive frontier. Indeed, Rapp’s use of the terms “pioneering” and “frontier” encourage such a change, invoking as they do idioms more traditionally associated, as Kolodny argues, with a masculine realm of exploration and discovery. Somewhat unexpectedly, perhaps, the hole in the wall puncturing the border between IVF and stem cell research is thus also a window connecting one definition of the political in the past with another that is already taking shape in the present—under a very different definition of biopolitics that has more in common with reproductive politics. In the same way we may be cautious about adopting the idiom of the frontier at all, given its militaristic and colonial origins, so too we would rightly be wary of overestimating the influence of the way of seeing introduced by the newly porous and hybrid relationship between bioscience and reproductive biomedicine. To pursue this effort further, it will be necessary to understand and depict with greater clarity the extent to which experimental science is never separate from the experiment of being social at all.