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Should Feminists Clone? And If So, How?

> For these are strange times, and strange things are happening.
>
> —ROSI BRAIDOTTI

> The idea is to build our own transporting machine and use it to get a relay going and to keep it going, creating ever greater and more powerful amalgamations and spreading them like a contagion until they infect every identity across the land and the point is reached where a now all-invasive positive simulation can turn back against the grid of resemblance and replication and overturn it for a new earth.
>
> —BRIAN MASSUMI

Several years back, I seriously thought about cloning myself, but only twice. I needed two duplicates, plus an original template, making for a total of three. The plan was that one clone could teach in a women's studies department and another clone could raise two young children. The third, the original me (the "template"), could take care of such pleasantries as writing this book. I, the template, would also be responsible for developing feminist STS practices so that the pleasures and dangers of new and emerging biotechnologies such as cloning would not go unexamined, as Rosi Braidotti put it, in these "strange times."

As a feminist scientist, I have been interested in developing projects in feminist STS through molecular politics. In their theory of becoming, Gilles Deleuze and Félix Guattari suggest that "all becomings are already molecular" and that on our way to becoming imperceptible, we must

"always look for the molecular, or even submolecular, particle with which we are allied."[1] However, this interest is not altogether detached from mainstream molar projects that may be more recognizable to women's movements or other identity-based social justice work. In fact, I argue that in many cases, without molecular projects that emphasize biophilosophies of becoming and advance an immanent ethics of matter, our biological bodies, organs, cells, and molecules can be made to work against the very molar projects that rely on stable categories such as that of "Women." As Deleuze and Guattari have stated, "it is thus necessary to conceive of a molecular women's politics that slips into molar confrontations, and passes under or through them."[2] This being said, molecular positions are often risky and can be potentially provocative, with the processes of becoming, from woman to animal to molecules, appearing foreign (if apparent at all) to more conventional molar projects or what Isabelle Stengers has referred to as "moral" projects.[3]

I have posed the question, and quite boldly I might add, Should feminists clone?[4] The first time I asked this question, I was sitting on a panel surrounded by other feminist scholars.[5] The looks of horror following my query told me that I had hit a nerve. Hadn't I read Gena Corea's *The Mother Machine*?[6] Wasn't I aware that women's bodies have historically been used to support new reproductive and genetic technologies? Didn't I realize that cloning was the latest iteration of a history of technologies and scientific knowledge-making traditions that worked to oppress women through their biology? What became obvious to me was that although this history and context was absolutely important to remember, as the only trained biologist on the panel, I was interested in pursuing a different kind of politics.

The question had come to me during a time in my PhD research when I was conducting experiments on an *in vitro* cell line of hypothalamic neurons, investigating the possibility of feedback regulation of these neurons by gonadal steroids and by the pineal hormone melatonin. My experiments involved using a molecular biology–based technology referred to as *subcloning*. I worried that using subcloning in my research, a technology that feminists on the panel were obviously opposed to, would disqualify me from being a feminist. Now, several years later, the question not only lingers in my mind but has in fact grown into a monster of sorts, feeding off technological, organic, and political fears and hopes.[7] Even back then,

however, I knew that in some ways my desires to participate in reproductive biology research and to use molecular biology–based technologies were somewhat "inappropriate" to some feminist ethical orientations. The ethical orientations I refer to here generally follow feminisms of equality that would rather focus on molar issues of being and identity and work toward treating women as liberal human subjects. Feminisms of equality aim to correct the conditions whereby women are considered less than human. Understandably, this ethical position—which strives to safeguard women, protect their reproductive rights, and fight for their equal rights—can be opposed to a great deal of molecular and reproductive biology research and technologies.

I believed then, and still do, that to deal with our posthuman living conditions, some feminists must express their energies and desires for change in different ways. Not everyone should or needs to work toward achieving subjectivity in that liberal humanistic sense. Instead, some of us must also turn our attention to developing molecular projects. Explaining what kinds of ethics are possible for postmodern subjectivities, Braidotti states:

> Ethics in poststructuralist philosophy is not confined to the realm of rights, distributive justice, or the law, but it rather bears close links with the notion of political agency and the management of power and of power-relations. Issues of responsibility are dealt with in terms of alterity or the relationship to others. This implies accountability, situatedness and cartographic accuracy. A poststructuralist position, therefore, far from thinking that a liberal individual definition of the subject is the necessary precondition for ethics, argues that liberalism at present hinders the development of new modes of ethical behaviour.[8]

I knew that by participating in the production of scientific knowledge on the body, I could use my micropolitics to new ends. I wanted to produce knowledge that addressed my concerns around contraceptives, hormone replacement therapies, and new reproductive and genetic technologies. This is why I decided to pursue a PhD in reproductive biology, why I worked with hypothalamic neurons of the brain in Petri dishes, and why I searched for the presence of estrogen receptor proteins using the technique of subcloning.

By thinking with molecular feminisms, molecular biology, and the question of cloning, my intention has never been to leave aside women, women's health, or reproductive justice issues. Rather, I have wanted to bring them into closer zones of proximity with the sciences and develop new forms of kinships with other actants—human, nonhuman animal, multicellular, and unicellular organisms—all of whom have a share in this biotechnological future. As a biotechnology, cloning is borne out of research in molecular, developmental, and reproductive biology, disciplines that have tried very hard to discipline biologies, bodies, and molecules. Dysfunctional as it may be, the culture of cloning has formed a new set of kinship arrangements, one that resembles a mess of growing crabgrass more than a neat and linear family tree and brings together disparate bodies starting from bacteria to plasmids, genes to eggs, uteruses to fetuses, humans to machines, and whole bodies to supposedly more identical whole bodies. Thinking through biophilosophies of becoming, this chapter considers the qualities of kinship and hylozoism more closely. It attempts to use these qualities to develop a strategy for feminist scientists to navigate their way through this strange era of cloning. It attempts to use the biotechnology of cloning to overturn itself, if not for a new earth, as Brian Massumi suggests is possible, then at least for a fresh set of politics.

What politics can emerge when we pay closer attention to the lab protocols involved in cloning? What happens when we learn to make kin with the nonhuman knowers and doers who actually carry out these biological processes for us in the lab? Building on the previous chapter, the skills of bacteria and bacterial plasmids are placed on an equal footing with human scientists, who have only recently learned how to recombine DNA in a lab. I apply a hylozoic view to the microorganisms and molecules that make molecular biology research and molecular biotechnologies possible in the first place. More important, I examine what happens when as scientists we become open to the push and pull exerted on us by our microscopic kin.

Tactical Recombinant Technologies

In his essay "Realer Than Real: The Simulacrum According to Deleuze and Guattari," Massumi tells us that according to Jean Baudrillard, "we breathe an ether of floating images that no longer bear a relation to any reality

whatsoever" and that this is "simulation: the substitution of signs of the real for the real."[9] According to Massumi, Baudrillard can be interpreted to be lamenting the loss of the real and figures the simulacrum as a copy of a copy without any reference to an external model. Massumi suggests that such sentiments can make sense if the only "alternative to representative order is absolute indetermination."[10] Massumi states:

> Baudrillard's framework can only be the result of a nostalgia for the old reality so intense that it has difformed his vision of everything outside it. He cannot clearly see that all the things he says have crumbled were simulacra all along. . . . He cannot see becoming, of either variety. He cannot see that the simulacrum envelops a proliferating play of differences and galactic distances. What Deleuze and Guattari offer, particularly in *A Thousand Plateaus*, is a logic capable of grasping Baudrillard's failing world of representation as an effective illusion the demise of which opens a glimmer of possibility. Against cynicism, a thin but fabulous hope—of ourselves becoming realer than real in a monstrous contagion of our own making.[11]

If one accepts the philosophical system of positivism and the possibility of achieving aperspectival objectivity, it follows that what biologists do while working in a lab somehow gives us access to a "real nature." This is perhaps why with the advent of molecular recombination and cloning techniques, many are lamenting the loss of this old reality and our grasp of "original nature" through biology. With recent developments in the field of synthetic biology, however, scientists have long moved away from efforts of preserving an "original model" to understand the molecular basis of "naturally occurring" life and have instead wholeheartedly embraced the idea of the simulacrum.

These scientists are more interested in what *biology can do*, regardless of being an original or a copy. They are not held back by the virtues of the authentic or the significance of a "real" in biology. Since the discovery of the structure of DNA by James Watson and Francis Crick in 1953 (made possible by Rosalind Franklin's work), scientists have witnessed the process of DNA replication and the endless winding and unwinding of the double helix. Perhaps for this reason they are perfectly at ease in grounding their scholarly and industry-driven biotechnological pursuits in a

world that deals entirely in the realm of the simulacrum, in a world inundated by copies of copies. DNA replication—this is what biology can do. Therefore, what does the significance of a copy of a copy matter when, for instance, a replicated DNA transcript of a previously transcribed and sequenced PCR product can be inserted into a plasmid vector and used to make an organism fluoresce green? Molecular biology, knowingly or not, is already deeply embedded in the hyperreality of simulation. It has moved beyond the "question of substituting signs of the real for the real."[12]

Given my interest in molecular feminisms and the question I posed regarding cloning practices, I am curious as to how, in this world of copies of copies, Massumi suggests we can we look for that "glimmer of possibility." "The challenge is to assume this new world of simulation and take it one step farther," he states, "to the point of no return, to raise it to a positive simulation of the highest degree by marshaling all our power of the false toward shattering the grid of representation once and for all."[13] In an effort to take on this challenge, this chapter makes the risky argument that recombinant DNA technologies such as subcloning may be used to dismantle the grid of representation and move us toward a playful proliferation of differences. Admittedly, I am drawn to thinking more closely about the radical potential of recombinant DNA technologies as tactical tools for feminist scientists, due to my own fond associations with bacteria, plasmids, and subcloning in the lab.

For me, the most pleasurable part of creating recombinant DNA was the polymerase chain reaction (PCR) procedure. I would begin by pipetting 5 microliters of mineral oil on top of the reaction mixture that contained the oligonucleotides, DNA and Taq polymerase, to avoid evaporation. The PCR machine would be warm to the touch, and the mineral oil flowed lightly and smoothly out of the micropipette tip into the tiny Eppendorf tubes (epis). Sometimes, I had a chance to add tiny drops of mineral oil into each crevice of the thermal cycler temperature block, watching the oil melt down into an even thinner form. From the warmth of my nonlatex gloved hands to the warmth of the thermal block, I imagined that each epi would be gently gripped by the mineral oil in the holes of the thermal block. I would bide my time through the steps of denaturation, annealing, and extension, knowing that the warmth would end abruptly once the PCR machine entered the cooling cycle and performed its final hold. Once the reactions had taken place and the temperature of the thermal block

had dropped to somewhere between 4°C and 15°C, I would remove the epis onto a plastic rack that was destined for the –20°C freezer. Although the contents within the Eppendorf tubes looked completely identical to how they looked before they were placed into the PCR machine, I knew that the DNA and enzymes, although thought of as "raw biological materials," had done their work. This idea that matter, as "raw" as it may be, is also capable of some form of expression or movement, defines the quality of hylozoism. In addition, similar to the production of simulacra, it was through these multiple processes of replication and repetition that the potential existed for something in the DNA to change, thereby introducing a "proliferating play of differences."[14]

I could tell that in the processes of cloning and repetition, there was not simply the lost air of simulation but also perhaps the opportunity for emerging breaths of difference. With this knowledge I went about amplifying DNA on a regular basis for years, wondering how to move from repetition to positive repetition, or the inhabitation of a dominant discourse in order to open up a new site. Recombinant DNA therefore might be thought of as a simulacrum that has successfully broken out of the copy mold. Made through a series of repetitions and slight modifications, it has acquired a new purpose and function. Like the simulacrum, recombinant DNA "is less a copy twice removed than a phenomenon of a different nature altogether" undermining "the very distinction between copy and model."[15] In a Deleuzian ontology, whereby repetition is associated with difference, recombinant DNA technologies may allow for the emergence of "new experiences, affects and expressions to emerge."[16]

Tropes and Turns

For some time now, in some areas of feminist theory, there has been a call for feminists to find their way back to the matters of the body and back to biology. Elizabeth Wilson, for instance, posed the following questions: "How many feminist accounts of 'the anorexic body' pay serious attention to the biological functions of the stomach, the mouth or the digestive system? How many feminist analyses of 'the anxious body' are informed and illuminated by neurological data? How many feminist discussions of 'the sexual body' have been articulated through biochemistry?"[17] Many feminists have answered this call by turning to the practice of re-reading

earlier scientific works, such as those belonging to Darwin and Freud, in order to diffract important biological theories for feminist purposes.

Although these re-readings and diffractions are important, a return to biology must involve more than the generous exploration of already established biological theories and their relevance to feminism. The "project of refiguring the biological" must also support the movement of feminists back into the laboratory for the production of *new* biological theories.[18] In order to be "informed and illuminated" by current neurological data or biochemistry in more than a cursory manner, feminists also have to actually learn the science and the scientific techniques, then attempt to make new scientific knowledges.[19] I have argued that to do this, feminists must learn how to face the nitty-gritty technical core of scientific knowledge production as well as all the contradictions, tensions, and dilemmas that come with carrying out scientific experiments. Part of the conversation that has been missing from this feminist call to return to the body and to biology, therefore, has to do with the lack of attention paid to developing feminist practices in the natural sciences. We need more ways to support feminists in the lab who can help us make this return to biology and give them the tools to deal with the dilemmas they will face upon this return. This is precisely why I posed my risky question regarding subcloning in the first place and why I return to it now. Despite its inappropriateness, I am interested in exploring the possibility that the scientific practices involved in the processes of cloning may be used to create new feminist politics.

Indeed, the idea of cloning can produce several discomforts for feminists. Some of this discomfort may be attributed to the fact that "cloning" serves as a particularly popular trope and is prone to metaphorical use. The use of metaphors, of course, holds an important place in scientific endeavors. As Donna Haraway has said: "A metaphor is the vital spirit of a paradigm (or perhaps its basic organizing relation). . . . It leads to a searching for the *limits* of the metaphoric system and thus generates the anomalies important in paradigm change."[20] I first posed my cloning question with the intention of finding out whether feminist scientists such as myself should conduct molecular biology experiments using the technique referred to as subcloning. As a biotechnology, subcloning has been used in the processes of directed evolution and has been integral to molecular biology research. The suggestion that metaphors lead to paradigm change is absolutely crucial to my project. Regarding the use of

metaphors, Joseph Rouse has stated: "When tropes work, they 'turn' us, cause us to attend to or respond to things differently. . . . Tropes stand out from other unexpected uses of words in the responses they evoke: they amuse, provoke, associate, resound, and so forth . . . but they can also be occasions for reconfiguring the connections among things, utterances, and other practices."[21]

My intention in this chapter is twofold. First, I want to use cloning not simply as an entertaining metaphor but as part of a molecular project that aims, for one thing, to provoke us into developing new feminist STS practices for the natural sciences. As a feminist scientist, I would like to pause on the idea of cloning in order to create new modes of kinship and zones of proximity between feminist politics and molecular biology. Using the qualities of kinship and hylozoism, I want to think differently about the role and contributions of molecular actants and thereby "reconfigure" some current connections between feminist theory and biology. By suggesting that we use cloning as a feminist practice in the natural sciences, I aim to describe some of the complexity that surrounds a feminist when they find themselves as a knower in the biological sciences. This practice may allow the feminist scientist to address the dilemmas they face in the lab and turn these dilemmas into micropolitical actions.

Second, by developing subcloning into a feminist practice, my intention is to create movement through a form of strategic mimesis. Referring to Massumi's work and the politics of identity, Braidotti states that "strategic mimesis [is] a positive simulation that does not essentialize an original. The point is to aim at the transformative impact of one's political processes."[22] Following Stengers, I also believe that the trope of cloning "belongs to the present as a vector of becoming or an experience of thought—that is as a tool of diagnosis, creation and resistance."[23] The reason for posing this risky question, then, is to situate myself as a feminist scientist and to "turn" our attention to new lines of flight that can come with cloning practices.

Cloning Subcloning

Subcloning is an integral part of molecular biology research. In this technology the scientist begins with a gene or gene fragment of interest that is most likely obtained by amplifying DNA through PCR. The scientist

then introduces or "clones" the gene of interest into a bacterial genome, typically bacteriophage lambda, which is also referred to as a plasmid or vector. Genetically engineered linear DNA is ligated into a plasmid and then placed back into a bacterial or yeast cell. As explained by New England Biolabs, a leading supplier of recombinant and enzyme reagents for life sciences research:

> Plasmid vectors allow the DNA of interest to be copied in large amounts and, often, provide the necessary control elements to be used to direct transcription and translation of the cloned DNA. As such, they have become the workhorse for many molecular methods, such as protein expression, gene expression studies, and functional analysis of biomolecules. During the cloning process, the ends of the DNA of interest and the vector have to be modified to make them compatible for joining through the action of a DNA ligase, recombinase, or in vivo DNA repair mechanism.[24]

Once the gene of interest has been isolated and then ligated (joined) to a vector, the next step in the molecular biology technique involves inserting the hybrid plasmid into "competent" *Escherichia coli* (*E. coli*) cells. Bacterial *E. coli* cells that are able to incorporate hybrid plasmids and successfully proliferate are referred to as being competent cells. Learning more about these competent *E. coli* bacterial cells is crucial to this chapter and to the process of becoming molecular.

To return to the subcloning procedure, the cloned vector is then inserted into the bacterial cells by heat shock and in this way *transforms* *E. coli* cells. Heat shocked and transformed *E. coli* cells are spread onto nutrient-rich LB plates and incubated overnight at 37°C to induce the growth of bacterial colonies. Of these colonies, about ten of possibly hundreds are selected for culture—a process whereby the plasmid DNA inserted within the transformed *E. coli* cells is amplified. As a colony of competent bacterial cells begins to replicate, it also replicates the genomic material of the foreign gene as if it were its own. The amplified plasmid DNA is then analyzed by restriction enzyme analysis and gel electrophoresis. In the final step of the molecular biology subcloning experiment, the amplified and cloned PCR product is analyzed by DNA sequencing. This is done to verify that the gene fragment of interest was obtained from

the appropriate gene. Several biotechnology companies have optimized the technology of subcloning. To simplify the experimental process, these companies sell "cloning kits" to scientists. These standardized kits include inorganic reagents such as salt solutions and buffers as well as organic materials such as nucleotides, segments of DNA known as primers, a heat stable DNA polymerase enzyme isolated from the bacterium *Thermus acquaticus* called Taq polymerase, and *E. coli* bacterial cells—all required for subcloning.

While conducting my own research in molecular biology, I always used the Invitrogen® pCR™8/GW/TOPO® TA Cloning Kit.[25] The glossy and user-friendly manual provided with the Invitrogen® kits made the experimental procedures easier. The "Never Clone Alone" slogan posted in our lab (a sense of humor that can only be cultivated by scientists) was intended to put me at ease, constantly reminding me that I should not be alone (even though much of the time I was alone, conducting experiments late into the night). Indeed, I did not feel alone, for I had developed a close and personal relationship with these Invitrogen® kits, carrying the pocket-size manual close to my heart, in the breast pocket of my lab coat. The Invitrogen® cloning kit manual left a deep impression on my lab coat pocket and on me, making me yearn for a cloning technique of a different kind. The manual outlined the subcloning technique in these easy steps: (1) produce your PCR product; (2) perform the TOPO® Cloning Reaction; (3) transform into One Shot® Chemically Competent *E. coli*; (4) select and analyze colonies; and (5) choose a positive transformant and isolate plasmid DNA.[26]

As I subcloned, I took to heart Haraway's project of queering or mutating the modest witness and knew that I needed to subclone my way to something or somewhere completely different.[27] Describing her dream, Haraway wrote: "My modest witness cannot ever be simply oppositional. Rather, s/he is suspicious, implicated, knowing, ignorant, worried, and hopeful. Inside the net of stories, agencies, and instruments that constitute technoscience, s/he is committed to learning how to avoid both the narratives and the realities of the Net that threaten her world at the end of the Second Christian Millennium. S/he is seeking to learn and practice the mixed literacies and differential consciousness that are more faithful to the way the world, including the world of technoscience, actually works."[28]

While I subcloned, I always felt an urge to reproduce (perhaps by parthenogenesis) a clone of subcloning.[29] What follows is my attempt to clone subcloning into a practice that the feminist scientist can use to face dilemmas in their research and transform these dilemmas into desires for new scientific knowledges. The feminist practice that I yearn to produce resembles the five easy steps to molecular subcloning outlined in the manual provided with the Invitrogen® pCR™8/GW/TOPO® TA Cloning Kit. This feminist STS practice, which I refer to as Sub/FEM/cloning, consists of five steps: (1) isolate your dilemma; (2) ligate the dilemma to vectors of figuration; (3) transform the dilemma; (4) select and analyze new connections; and (5) collect your reconfigured dilemma. By pausing on each mode, the feminist scientist can move more freely through complex relations and enter into deeper zones of proximity between biology and feminist politics. Sub/FEM/cloning draws from Haraway's theory of situated knowledges, is intimately connected to Chela Sandoval's methodology of the oppressed, and is inspired by Barbara McClintock's work on transpositions and the cytogenetics of corn.[30]

Step 1: Isolate Your Dilemma

In the first step of Sub/FEM/cloning, the feminist must articulate that question or issue which is at the basis of their dilemma in the lab. This dilemma may stem from tensions based on the epistemologies, paradigms, language, methods, or tools that a feminist scientist may use in their practice of science. Underneath it all, the dilemma may be borne out of stolonic desires to create connections between disparate groups of knowers. This dilemma is at first destabilizing and disorienting, but in this act of articulation the feminist scientist isolates the stabilizing element of what Sandoval refers to in her methodology of the oppressed as *differential movement*. As an insider/outsider, marginalized-knower, hyphenated-cyborg creature, Sandoval argues that a "split-consciousness" allows one to "see from the dominant viewpoint as well as her own."[31] Differential movement can move the feminist scientist from the confines of her lab bench toward more complex micropolitical positions.

In my case, by articulating the question "Should feminists clone?" I isolated a dilemma that stabilized me in my differential movement as a

feminist scientist working in a reproductive neuroendocrinology lab. During my PhD research I was interested in examining the regulation of hypothalamic neurons by gonadal steroids such as estrogen. I was also interested in examining the regulation of these neurons by the pineal hormone melatonin. I was most interested in searching for possible feedback control mechanisms in the hypothalamic-pituitary-gonadal (HPG) axis. In her book *The Woman in the Body*, Emily Martin provided ample evidence to suggest that in reproductive biology, the HPG axis had been depicted as a hierarchy, with the hypothalamus acting as the control center.[32]

Indeed, this understanding of the HPG axis has had a great impact on how scientists and doctors "manage" women's bodies, particularly in the treatment of menstruation and menopause. To counter this paradigm of a hierarchy and suggest the possibility of an alternative mechanism by which the HPG axis may function, such as feedback regulation, it first had to be established that estrogen and androgen receptors are expressed in specialized neurons of the hypothalamus. I was very excited to participate in one of my supervisor's research projects that investigated the possible neurological impacts of estrogen by examining its effects on an *in vitro* model of hypothalamic gonadotropin releasing hormone (GnRH) neurons. This research remains extremely relevant to women's reproductive health, particularly taking into consideration our lack of knowledge on the prolonged neurological effects of estrogen-based treatments such as contraceptives and hormone replacement therapies. In fact, this concern for women's reproductive health can easily be aligned with politics emerging from a molar position.

To do this research, however, I needed to look for the presence of an estrogen receptor gene and protein expression in these hypothalamic neurons—and to do this, I needed to use the molecular technology of subcloning. This was my dilemma. Even while I isolated my dilemma as a feminist scientist, the question of whether or not I should subclone, I also isolated total RNA from an *in vitro* cell line of GnRH neurons. I then synthesized first strand cDNA from total RNA using reverse transcriptase (RT) reactions. Using oligonucleotide primers (short sequences of DNA nucleotides) that were designed specifically for estrogen receptors and polymerase chain reactions (PCR), I amplified and obtained cDNA fragments of the estrogen receptor-alpha (ERα) and estrogen receptor-beta (ERβ)

genes from these hypothalamic neurons.[33] The following steps describe the process I used to bring together my molar and molecular politics.

Step 2: Ligate the Dilemma to Vectors of Figuration

Similar to the bacteriophage plasmids used in subcloning, in the feminist practice of Sub/FEM/cloning, the dilemma must also be ligated to vectors, but in this case, to vectors of figuration.[34] The vectors of figuration produce a particular cartography or a map of relevant spaces, inhabited in my case by the material and discursive practices of cloning. As Rosalyn Diprose and Robyn Ferrell explain in their introduction to *Cartographies*:

> A map does not simply describe what is. A map does not only set up a grid which determines what can be found by selection or omission. Nor is it merely a series of lines inscribed on a previously blank surface. There is an alterity which provokes the desire to map, to contain and to represent. . . . The political reality of the changing map of the world, its allegiances, exclusions and oppression, is testament to cartography as a relevant metaphor. Mapping, as representation, is inextricably caught up in the material production of what it represents. In the metaphor of cartography, to draw a line is to produce a space, and the production of the space effects the line.[35]

As an insider-outsider and implicated knower, the alterity experienced by the feminist scientist is bound to manifest itself in the form of a dilemma brought on by inhabiting a space constructed by dominant and traditional scientific practices. It is true that, in order for feminism to change science, feminists need to "inhabit" the sciences. Yet how is this space to be made somewhat hospitable? To play on Wilson's use of the breach, I suggest that the feminist scientist must engage in the practice of "interior reconfiguration."[36] They must take hold of their dilemma and use it to produce an alternate cartography that better reflects their politics.

While describing the principle characteristics of a rhizome, Deleuze and Guattari comment on the relevance of maps, suggesting that "the map does not reproduce an unconscious closed upon itself; it constructs the unconscious. It fosters connections between fields. . . . It can be drawn

on a wall, conceived as a work of art, constructed as a political action."[37] Cartography or mapmaking is hard work and constitutes the most time-intensive mode in the feminist practice of Sub/FEM/cloning. These acts of ligation can be thought of as being driven by what Sandoval has called *democratics*, the act of imagining social justice and positive change, and bringing into closer proximity particles that would otherwise wander without collision.[38] So the vectors of figuration that a feminist scientist encounters in order to create a new map are not simply figurative ways of thinking. This work is not destined to be muddled by relativism or idiosyncratic musings. Rather, these vectors of figuration provide a material mapping, allowing one to think with specificity.

For instance, in her later writings, it is through her practice of figuration that Haraway expanded on her model of situated knowledges. Using the idea of *stem cells* and *sticky threads*, Haraway states: "Objects like the fetus, chip/computer, gene, race, ecosystem, brain, database, and bomb are stem cells of the technoscientific body. Each of these curious objects is a recent construct or material-semiotic 'object of knowledge,' forged by heterogeneous practices in the furnaces of technoscience. . . . [O]ut of each of these nodes or stem cells, sticky threads lead to every nook and cranny of the world. Which threads to follow is an analytical, imaginative, physical, and political choice."[39] The marginalized-knower-feminist-scientist, also known as a cyborg in some circles, must recognize the value of their own specific analytical, imaginative, physical, and political choices in why and how they conduct their science. According to Haraway, the stem cells and sticky threads are the embodied consciousness of any given situated knowledge.

Embodied consciousness? Cyborgs? Allow me to flesh out this mess of stem cells, sticky threads, and ideas. As a six-year-old, I recall an incident that might very well have been my very first lived experience as a cyborg, or at least was a formative moment for my own personal "cyborg politics." Describing this incident may help to explain my difficult but intimate relationship with science and technology. It was Toronto in the late 1970s and I was walking home from school sometime in the early part of spring when the sidewalks were clear, but there were still patches of snow here or there. I was almost home when an older student started throwing snowballs at me from across the road. As he threw each ball of snow mixed with

rocks, he yelled the racial slur "Paki!"[40] At the time, as a six-year-old, I did not know what "Paki" meant and I did not know why he decided to throw snowballs at me. All I knew was that I was going to be able to run away very quickly from this bully. For what I knew, and he did not, was that I was *bionic*. Sure enough, having on my Bionic Woman running shoes helped, and so I was able to motor my way home.

Visions of biotechnological futures saved me that day. Very early on in my makings as a feminist scientist-cum-cyborg, I realized that I was going to face difficulties in being both "bionic" and "brown"—two of the many stem cells, or material-semiotic "objects of knowledge" that have since come to form my conception of the technoscientific body. Which figurations a feminist scientist brings into closer proximity depends on the stem cells and sticky threads that have come together to bring forward their dilemma. So being "bionic" and "brown" can be thought of as two stem cells that I acknowledge as playing a part in constructing my reality. As Haraway explains it, each stem cell is comprised of a "knot of knowledge-making practices" formed by such sticky threads as "industry and commerce, popular culture, social struggles, psychoanalytic formations, bodily histories," and more.[41]

In my scientific work, after the estrogen receptor gene fragments had been isolated from the cDNA obtained from *in vitro* GnRH hypothalamic neurons, these PCR products were electrophoresed in an agarose gel, stained with a dye called ethidium bromide and visualized under UV light.[42] The DNA fragments were then isolated and ligated to the pCR2.1-TOPO cloning vector (circular bacterial plasmid DNA) provided by the biotechnology company Invitrogen®.[43] While I was conducting this most problematic recombination reaction, in my own Sub/FEM/cloning experiment I was forced to ligate my dilemma to vectors of figuration. Through this process I became aware that my dilemma must be combined and connected to broader contexts. The vectors of figuration that I encountered while trying to make some meaning out of my dilemma of subcloning were obtained from my own analytical, imaginative, political, and physical senses of being bionic and being brown at the same time. There are a number of possible figurations to explore, but I will restrict the discussion of my particular dilemma in the context of three figurations: (1) Shulamith Firestone, (2) Rajasthani prints, and (3) Superman.

Step 3: Transform the Dilemma

In the Sub/FEM/cloning transformation process, the dilemma that has been ligated to vectors of figuration must be used to create a transformation. In this mode of a Sub/FEM/cloning experiment, the feminist scientist must take their isolated and ligated dilemma and move toward new scientific knowledges. Our hope lies with becoming like the competent *E. coli* bacteria, by gathering our strengths and harnessing our abilities to transform. This transformation in the feminist scientist reconfigures their outlook on the science that they practice. This new position can allow the feminist scientist to address their original dilemma and step in a direction that creates movement.

In her account of the life and work of Barbara McClintock, Evelyn Fox Keller brought to our attention the extraordinary story of a scientist who worked on the genetics of corn. By paying such close attention to the details of McClintock's life and her approach to scientific research, Keller revealed much more than this, however. Throughout her life McClintock had many scientific accomplishments, one of which was the discovery of transpositions—the movement of genetic elements spontaneously from one site to another. As described in a previous chapter, McClintock's work on transpositions came out of her scientific approach of developing a "feeling for the organism." McClintock describes how, while analyzing the chromosomes of maize through the eye of the microscope, she would travel deep into the cell and find herself in and among the chromosomes, almost becoming imperceptible. Keller describes this level of association with an organism as a kind of "intimate knowledge."[44] This expression of proximity most vividly exemplifies a microphysiology of desire.

As McClintock observed the phenomenon of transpositions, she came to realize that transpositions must happen, that organisms are not stable, and that DNA and chromosomal structures get mixed up. "In McClintock's system," Keller writes, "the controlling elements did not correspond to stable loci on the chromosome—they moved. In fact, this capacity to change position, transposition as she called it, was itself a property that could be controlled by regulator, or activator genes . . . no one was ready to believe that, under certain circumstances, the normal DNA of a cell could rearrange itself."[45] Referring to McClintock's work in relation to DNA and the function of transpositions, Keller continues: "Perhaps the

future will show that its internal complexity is such as to enable it not only to program the life cycle of the organism, with fidelity to past and future generations, but also to reprogram itself when exposed to sufficient environmental stress—thereby effecting a kind of 'learning' from the organism's experience."[46]

Through this transformation step in the feminist practice of Sub/FEM/cloning, the feminist scientist can attempt a transposition or "reprogramming" of their feminist politics. In the context of my dilemma, for instance, I was able to acknowledge that as feminists, we have been exposed to many new stresses in the past twenty to thirty years. We have been exposed to new biotechnologies, reproductive technologies, and molecular technologies, and these experiences have changed the way we live. The figurations that I describe below are meant only to serve as examples and are articulated through my own experiences of alterity. I share these thoughts with the hope of providing some snapshots of "the political reality of the changing map of the world, its allegiances, exclusions and oppression."[47]

While working in a reproductive biology lab, I knew that strange things were happening constantly around me, but I was determined to go deeper into the science that I practiced until I was able to find the molecular practices that would show me how to transform my dilemma. I studied in more detail what was known about the HPG axis and spent a great deal of time working closely with an *in vitro* cell line of hypothalamic neurons. It was here that I found a new space emerging for my feminist politics. I confess that I isolated fragments of estrogen receptor genes from hypothalamic neurons. I moved these DNA gene fragments, not spontaneously but rather through ligation techniques, into bacterial plasmids. I transformed competent *E. coli* cells with these plasmids and used their cell machinery in order to amplify estrogen receptor DNA. Each transformation reaction required several agar plates, a vial of *E. coli* cells, and a specialized media containing tryptone, yeast extract, glucose, and several salts.[48] The ligated vectors were added to the *E. coli* cells, placed on ice, heat shocked, and transferred onto ice again. The heat-shock process allowed the ligated vectors to enter through the membranes of the competent *E. coli* cells. A small amount of the transformed bacteria was spread over selective plates of agar and incubated overnight at 37°C. Just as the bacterial cells needed to incubate to transform, as a feminist scientist I also had to allow vectors of figuration to incubate for a while to form a rich array of connections.

Step 4: Select and Analyze New Connections

An efficient cloning reaction will produce nearly one thousand colonies of bacteria per transformation reaction. The ligation of the DNA fragment causes an interruption in a particular gene of the cloning vector. After a night of incubation, the agar plate containing the transformed *E. coli* cells will appear to have white colonies as well as blue colonies. Each white colony represents a single *E. coli* cell that was successfully transformed by a ligated vector and was able to multiply. If no ligation takes place and a particular marker gene on the plasmid is kept intact, this gene codes for a protein that can be made to react with another substance, turning the bacterial colony blue. Out of the nearly one thousand colonies that can grow on an agar plate, the scientist usually chooses a few of the white colonies or "positive clones" to examine. The colony of transformed bacterial cells is selected and amplified further in a broth of nutrient media. In my own experiments I often selected up to ten colonies for analysis. Using a sterile wire tip, I scooped up cells from the white colonies and added them to test tubes that were full of nutrient media. The transformed *E. coli* cells were left in a 37°C shaker for several hours. This constant movement and the connections formed by the collision of cells allowed the transformed *E. coli* cells to multiply even further. Having already ligated my dilemma to vectors of figuration, it is now time to select and tease out some of the connections created by my own Sub/FEM/cloning reaction.

Figuration 1: Shulamith Firestone

After the birth of my second child, I found myself in a curious predicament. I had to return to my teaching responsibilities after just six weeks of maternity leave (which was actually categorized by the institution as a disability leave). It was necessary for me to pump breast milk before and after teaching my three-hour upper-division women's studies course, "Science and Technology in Women's Lives." While I pumped in my office, the pile of books on my desk that I had been meaning to read stared at me, so I decided to multitask and catch up on some reading. At the top of the pile was the newly released 2003 edition of Shulamith Firestone's *The Dialectic of Sex*. First published in 1970 and considered an essential text of second-wave feminism, in this text Firestone put forward her feminist theory of politics.

"In the historical interpretation we have espoused," she wrote, "feminism is the inevitable female response to the development of a technology capable of freeing women from the tyranny of their sexual-reproductive roles—both the fundamental biological condition itself, and the sexual class system built upon, and reinforcing, this biological condition."[49]

Firestone was referring here to the advent of hormonal contraceptives and their potential role in the liberation of women. She was very clear in stating what she saw as the single most influential reason for women's oppression: their capacity for reproduction. She went as far as saying that "pregnancy is barbaric" and was in favor of using the power of technology to rid women of the burden of reproduction.[50] Sitting in my office, I used the technology of a breast pump, pumping with one hand and holding a book in the other. It seemed to me that it was not pregnancy that was barbaric, but rather the circumstances under which I was expected to function. In the state university system in which I was an employee at the time, my tenure clock was not stopped during my brief maternity leave; furthermore, I was expected to be able to lactate and teach only six weeks after giving birth. There was quite obviously an assumption made on Firestone's part, and echoed by other feminists at the time, that *all* women find motherhood to be a burden and experience oppression in the same way because of their capacity to reproduce. This assumption ignored the possibility that some women are not in a position to be able to afford to reproduce or are in fact forced into not reproducing. The erasure of issues pertaining to the intersections of race, class, disability, and sexuality and the bodily histories of marginalized others within this era of feminism became quite apparent to me while reading Firestone's work.

Despite this, most fascinating was Firestone's accuracy in predicting the direction that artificial reproduction would take from the period in which she was writing in the late 1960s. She even predicted the technology of cloning and was excited at its potential to liberate women. "[As] recently as five years ago," she wrote, "Professor F. C. Steward of Cornell discovered a process called 'cloning': by placing a single carrot cell in a rotating nutrient he was able to grow a whole sheet of identical carrot cells, from which he eventually recreated [*sic*] the same carrot. The understanding of a similar process for more developed animal cells, were it to slip out—as did experiments with 'mind-expanding' drugs—could have some awesome implications. Or, again, imagine parthenogenesis, virgin birth, as practiced by the

greenfly, actually applied to human fertility."[51] Firestone was not suggesting the use of a technology such as cloning without further examination. She was fully aware that in the wrong hands artificial reproduction would be dangerous. At the same time, she felt that artificial reproduction was inevitable. She believed that in order to deal with the inevitable, we would have to create a new culture based on a "radical redefinition of human relationships."[52] This radical redefinition, she believed, would force societies to destroy current class systems and ideas of family. Firestone did not think that artificial reproduction was inherently dehumanizing, and she believed in the potential of this technology in freeing women from their biology. At the end of *The Dialectic of Sex*, she lays down a "list of demands" for a feminist revolution. "The freeing of women from the tyranny of reproduction by *every means possible*," the first demand insisted, "and the diffusion of the child-rearing role to the society as a whole, men as well as women."[53]

Beginning with the ligation of my dilemma to the figuration of Shulamith Firestone is a difficult maneuver. It reveals several hidden patterns of molar politics that are present within a great deal of contemporary feminist discourse. For example, Firestone pointed out that there is a series of feminist ethical positions that fit into one another beginning with the belief that technology is inherently evil, followed by the belief that technology is bad for women, and lastly, that artificial reproduction is dehumanizing. She argued that artificial reproduction is not inherently dehumanizing by forcing us to reconsider what we know and believe to be "natural" and question our ties to a certain mode of reproduction. Her work challenges us to reconsider our relationship with, or in more accurate terms, our distrust of technology. Extending Firestone's assertion, many lesbian and feminist science fiction authors actually address the oppression of women in our societies by creating worlds where women and/or female bodies are no longer solely responsible for pregnancy, childbirth, breastfeeding, and childrearing. A common theme running throughout these science fiction and utopian novels has been that of supporting alternate models of reproduction, and these models always involve some form of genetic manipulation. Parthenogenesis and cloning are very popular in these works.[54] For many feminists the belief is that only men would want to design and control technologies related to reproduction. The figuration of Firestone exposes the idea that some women may also support

technologies such as cloning. Similarly, while commenting on some of the popular biological techniques used for reproduction in science fiction novels, feminist science fiction writer Pamela Sargent stated, "What is the extent of possible biological change? It can involve new ways of reproducing ourselves, a use of techniques such as cloning, ectogenesis (the use of an artificial womb), in vitro or 'test-tube' fertilization, hybridization of animal species and humans, and others. . . . Biological change could in time affect our notions of what a human being *is*."[55]

In the context of my dilemma of subcloning, the figuration of Firestone exposes several feminist projects such as those based on social struggles against traditional family structures. In order to gain entrance into a market economy, women have been forced into living as commodities by way of their reproductive potential. The most challenging connection that emerges from the ligation of my dilemma with this figuration, however, concerns the question of what it means to be "human." An analysis of Firestone's work and the lesbian and feminist science fiction inspired by her work also forces us to ask, What is natural? By problematizing the validity of a "natural" mode of reproduction and imagining biological change to the extent that we can no longer easily define what a human *is* (something that has already occurred through the use of transgenic technologies and bionic woman in my case), this figuration forces us to reconsider what it means to be human. A revised notion of "the human," or a posthumanist understanding of what it is to be human, may permit us to imagine the answer to this question to be a flexible amalgam of altered bodies, senses, and subjectivities.

Figuration 2: Rajasthani Prints

I include this figuration as part of my own analytical and imaginative mapping of a social reality because of its relevance to reproductive technologies and its deep impact on me as a brown child and later as a young brown adult visiting Rajasthan, India. Growing up in a home with parents who had immigrated to Canada from India, I was surrounded by explosions of color and texture from various Indian artworks and sculptures that decorated our home. One such work was a Rajasthani print displayed as a central piece in our living room, above the sofa. As a child, I would climb onto the sofa and carefully examine each minute detail of this print. What

fascinated me the most was the intricate design that served as a border. The hand-drawn border was comprised of a repetitive series of women dressed in identical clothing, with identical expressions on each face. As a child, I tried to find a woman drawn along that border that did not match, but I never could. The women depicted in the print were identical; they were clones.

Years later, as a once-removed NRI (nonresident Indian) on a trip to India, I had the opportunity to visit Rajasthan. It was 1994—the same year as the International Conference on Population and Development (ICPD) of the United Nations Population Fund in Cairo. In one village I saw an "epidemic" of small, square patches pasted onto the arms of poorer women walking in the streets. These real women in Rajasthan were not clones, but each bore the mark of what I think was a clinical trial for a new contraceptive on the upper outer regions of their left arms.[56] On this trip I was hosted by a generous woman and her daughter, who was fiercely independent. When I asked about the women in the streets whom I had seen participating in what I thought might be a contraceptive trial, I was made acutely aware of my position as a "Western" feminist in this context. As a diasporic Indian, I recalled the incident that I had experienced as a six-year-old—having been called a "Paki"—and realized that this was not the first time I was made to feel as though I did not belong to the space I inhabited. In any case, despite the anti-Malthusian arguments put forward by many local and national Indian feminist organizations, I was informed by my younger host that state-sanctioned family-planning incentive programs were beneficial to the poor and scheduled castes, and that the regulation and policing of reproductive bodies was necessary to better serve national economic interests.[57] Incidentally, this was also the year that Rajasthan began to implement a "two-child norm" policy for government employees; to date, this policy is still in effect.[58]

The women who were participating in what might have been a contraceptive trial in Rajasthan at the time are like many other women around the world, and not just those in so-called developing countries. All of these organic bodies function as commodities in the institutions of science, medicine, and the state. In many ways, women already exist as clones as their reproductive body parts are disassembled, traded, and reassembled in the technological production lines of scientific and pharmaceutical research. As a result of our expendability, women's whole bodies as well as

individual reproductive body parts have been used as test subjects in the name of scientific progress. When women are the subjects of scientific study, they generally come to exist through a process of standardization. The notion that "women" can exist as a single category of organic beings who contain reproductive body parts that simultaneously have specific yet transferable technical capabilities, is in itself a molar position that forces individual identities into a cloned existence. Much like the repetitive pattern of side-glancing women who served as a border in the Rajasthani print of my childhood memories, many women around the world already exist as clones.

Postcolonial and decolonial perspectives can help us to see that recent formulations of biocapital have created new forms of kinship between women, animals, and plants. They all share the experiences of forced modification and commodification. In India, where clinical trials for new drugs and contraceptives have been conducted, the Green Revolution also occurred, whereby several multinational corporations with the intent of colonization—albeit of plants and not of humans—entered into the country. Around the world, parallel patterns can be drawn between the production of reproductively modified women and the production of genetically modified plants and animals. Both are organic material necessary for progress in a culture of cloning. The ligation of my dilemma to the figuration of Rajasthani prints helps to make apparent the connections between women, reproductive biology research, pharmaceuticals, plants, genetic engineering, and multinational corporations. These newly formed sticky threads force me to trouble my practice of subcloning and consider more closely the impact that cloning technologies have had on the bodies of women of color, and how often they have served as material test subjects.

Figuration 3: Superman

This superhero first appeared in a comic strip in 1933, but since then, an endless number of incarnations have appeared on television, film, and even radio. The animated action hero easily materialized into a living and breathing character, first as George Reeves in the 1950s television series and later as Christopher Reeve, who took on the iconic role of Superman in the 1978 movie (just around the same time that I would have been at the peak of my

brown girl bionic fierceness). This latter materialization was quite convincing, to the extent that even today the identity of Superman is synonymous with the late actor. In the mid-1990s, when Christopher Reeve fell off a horse and severely injured his spine, part of me believed he would be the first human to walk again after a serious spinal cord trauma. After all, he was Super(hu)man. However, Reeve did not walk again. Following his accident, he became an activist and advocate for medical research to help people living with paralysis. Just days before his death in October 2004, one month before the US presidential elections, Reeve made his last public appeal on television for the support of stem cell research. From the likes of the actor Michael J. Fox, to the wife and son of the late Ronald Regan, Superman and his (super)friends from Hollywood, California, have taken their plight from the Hall of Justice to another legislative assembly, the US Congress. In as heroic a gesture as battling the Legion of Doom, superhero celebrity figures in the United States have made it their mission to garner support for human stem cell research, also referred to as human therapeutic cloning.

Unlike reproductive cloning, human therapeutic cloning does not attempt to reproduce an identical human. Rather, the "purpose of therapeutic cloning is to generate and direct the differentiation of patient-specific cell lines" that can be used for personalized medicine and involves the "transfer of nuclear material isolated from a somatic cell into an enucleated oocyte in the goal of deriving embryonic cell lines with the same genome as the nuclear donor."[59] Not surprisingly, a great deal of controversy has accompanied this biotechnology. Although in theory therapeutic cloning research can be conducted using either adult or embryonic stem cells, much of the controversy has been over the creation and use of embryonic stem cell lines. In a script that almost plays out like a superhero versus villain drama, the controversy continues to rage, with emotions flaring high for both those opposed to the technology on the basis that it is immoral and unethical, and for those who support the technology for its potential to cure diseases, as scientists have promised.

To summarize some key scenes from this stem cell drama as it has played out in the United States, we can look at the battle between the federal government and the state of California.[60] This story begins on August 9, 2001, when President George W. Bush announced that no further federal funds would be used to support human embryonic stem cell

research in the United States.[61] He made this decision on the grounds that stem cells obtained from human embryos at the early stages of development constituted the unethical treatment of human beings. Scientists argued that in order to proceed with research in a meaningful way, they needed to create new human embryonic stem cell lines and receive support, financial and otherwise, from the federal government.[62] No doubt with a keen eye to the lucrative potentials of this biotechnology, the state of California (a vortex in the universe where vectors of figuration perpetually hyperimplode) responded by passing a state proposition in 2004 supporting the issue of a $3 billion bond to fund human embryonic stem cell research for ten years at a staggering amount of $300 million a year.[63]

Enter stage left another super(hu)man: Arnold Schwarzenegger, then Republican governor of California but also once a cyborg action hero. If nothing else, this appearance makes clear that Hollywood superheroes support human therapeutic cloning research. Putting himself at odds with the Bush administration, Schwarzenegger endorsed the $3 billion bond measure in part to boost California's biotechnology industry.[64] In response, Bush exercised his first veto as president in 2006, rejecting legislation that would have increased the annual $25 million of federal funding for embryonic stem cell research. In 2007, California's $3 billion state bond program (referred to as the California Institute for Regenerative Medicine) approved the distribution of $45 million for embryonic stem cell research, promising to fund an additional $80 million to established stem cell researchers.[65] Two years later, in March 2009, President Barack Obama issued an executive order "removing barriers to responsible scientific research involving human stem cells," effectively lifting the ban on human embryonic stem cell research that the Bush administration had put in place.[66]

The back and forth of this script is almost comedic, yet it should come as no surprise that in 2017 conservative representatives once again urged for stronger restrictions on human embryonic research and are calling upon the current US president to fire Dr. Francis Collins, director of the National Institutes of Health, for his role in moving this research forward.[67] At the same time, ten years after starting up its initial stem cell program, California is ramping up yet again for an aggressive campaign on an upcoming state ballot (at the time of writing) that would put a funding measure in place to continue stem cell research. Although cures for Alzheimer's, Parkinson's, spinal cord injuries, and other diseases that the

program had envisioned have not yet been delivered, for many the recent success of treating a young girl from Corona, California, who suffers from Severe Combined Immunodeficiency or "bubble baby disease" is sufficient proof that the research is highly beneficial and desirable.[68]

Most governments around the world have placed a ban on human reproductive cloning, but their position on human therapeutic cloning varies. Those opposed to human therapeutic cloning research typically argue from the moral position that stem cell research violates the dignity of human beings. They are concerned with the rights of the unborn child, much like the line held by pro-life advocates in the abortion debate and argued in some cases with a similar evangelical fervor. Also of interest are arguments put forward by supporters of stem cell research, which includes several Hollywood stars. In the name of supporting our inevitable biotechnological destiny, stem cell research enthusiasts argue that this scientific research must be allowed to take place. In a typical humanistic vein, the argument put forth is that by denying stem cell research, not only are we depriving the quality of life for those humans who are currently suffering from diseases, we are also denying the "natural" process of human discovery, thereby denying human progress, and ultimately human life.

Those humans left off both the moralistic and humanistic radars of those engaged in the stem cell debate are the women whose bodies upon which this technology is to be developed. The discourses produced by both sides of the stem cell research debate fail to address any concern for the women whose reproductive parts—from ova to umbilical cords—are necessary for the scientific research. The attitude on both sides of the debate is based on a popular consciousness that allows us to believe that women are merely resources for biological material and that this technology can and will be developed on women's bodies. For instance, in light of legislation that would allow Australian scientists to move ahead with therapeutic cloning, Catherine Waldby pointed out concerns regarding the trafficking of ova and the exploitation of poor women around the world to support the rapidly developing market for human eggs.[69] Waldby's comments were dismissed by an Australian stem cell researcher who, failing to see her point, stated: "Waldby's concerns are of no direct relevance to Australia."[70]

This figuration presents yet another tension. In a most uncomfortable move, many feminists in the United States have found themselves in a

strange alliance with the religious right and with social conservatives by voicing their opposition to therapeutic and reproductive cloning research. A molar politics based on the assertion that human life is more important than animal life acts as a corollary to the established hierarchical frameworks in which our society operates. The political and religious right in the United States support patriarchy within this hierarchical structure, granting men a certain status and placing women below men. Following this logic, nonhuman animals fall below women, although perhaps not far behind. Many feminists, who are opposed to the patriarchal elements within this hierarchy, end up supporting this structure by also placing nonhuman animals below themselves, not recognizing the importance of kinship and hylozism. This allows one to oppose human stem cell research while ignoring or even supporting the cloning and/or genetic manipulation of animals for medical research, such as in breast cancer research. Feminists as well as members of the political and religious right, who are opposed to reproductive technologies, both conveniently ignore or fail to realize the decreased value they have placed on lives that are not human.

In March 2005 the United Nations General Assembly voted in favor of a nonbinding ban on all human cloning, which in less clear language also includes therapeutic human cloning.[71] In this UN ban on reproductive cloning, however, only human reproductive cloning is specified, therefore permitting reproductive and therapeutic cloning research on such animals as mice, cats, sheep, horses, monkeys, and cows. The United Kingdom and South Korean governments, for instance, have banned human reproductive cloning but do support animal reproductive cloning. As such, these governments have provided federal funds to scientists who have produced significant developments in animal cloning, the most famous of which includes Dolly the sheep.

Although much is known about the science behind the birth and death of Dolly the sheep, what is perhaps less well known is the namesake behind this first mammal that was produced through reproductive cloning. Dolly was named after the American country singer Dolly Parton because of a strange kinship relation based on mammary glands. The association between the two may not be immediately clear to many of us but is apparently based on the fact that the cloned sheep was derived from the nuclear transfer of an adult somatic mammary gland cell, and that the superstar Dolly Parton has large breasts. In another strange kinship

alliance made possible through reproductive cloning, grieving pet owners can now replace a lost pet by purchasing a reproductively cloned animal. Once again, from the vortex of stem cells and sticky threads that is California, the company Genetic Savings and Clone Inc., which was located in Sausalito, California, was the first to offer such services. The company closed its doors at the end of 2006, claiming that there was not enough demand for their product but directed anyone who was still interested in freezing their pet's DNA for future cloning possibilities to the Texas-based company ViaGen.[72] As of 2017, ViaGen offered several services, including genetic preservation, reproductive cloning, and express tissue banking. According to their website, the "total cost of dog cloning is $50,000 [USD]" and the "total cost of cat cloning is $25,000 [USD]."[73]

The figurations of Shulamith Firestone, Rajasthani prints, and Superman create cartographic connections between a lab technique and new micropolitical positions. After placing a spotlight on the entanglements between biotechnology, popular culture, art, women, and animals, I conclude with the last mode of the Sub/FEM/cloning experiment.

Step 5: Collect Your Reconfigured Dilemma

The reason that Sub/FEM/cloning may actually work is that the feminist scientist can use this reflexive feminist practice for the natural sciences to arrive at Sandoval's *differential consciousness* without ever having to leave their lab bench.[74] As a hyphenated creature, living on the margins, the feminist scientist will have already created a space for their survival and feminist imaginings in the more confined spaces of the scientific institution in which they operate. This space, inhabited by the marginalized and existing within a space that is marginalizing, is what some might refer to as cyberspace.[75] A *differential consciousness* allows the feminist scientist to enter into this cyberspace, where they can conduct their experiments and create new scientific knowledge.

During my own escapes to the space I occupied while a graduate student working in a lab, I was first confronted with the monstrous question, Should feminists clone? It has since occurred to me that as a feminist-scientist type of hyphenated creature, the questions that I pose might not be monstrous at all but that I may in fact be the monster, and thus my

attraction to these types of questions.[76] Drawing from Haraway, Sandoval describes a monster as "a creature who lives in both 'social reality' and 'fiction' and who performs and speaks in a 'middle voice' that is forged in the amalgam of technology and biology—a cyborg poet."[77] If I am a monster, or aspiring to become one, speaking in a middle voice places me in a favorable position to meta-ideologize.[78]

In an attempt to meta-ideologize, it becomes sensible and almost necessary to suggest that subcloning should become a feminist practice in the sciences. Describing *differential consciousness*, Sandoval explains that the "manipulation of ideology" is a necessary skill for the survival of the marginalized.[79] Which ideologies are manipulated, and in which direction to proceed, depends on one's context. "Such a differential force, when understood as a technical, political, aesthetic, and ethical practice," Sandoval states, "allows one to chart out the positions available and the directions to move in a larger social totality. The effectivity of this cultural mapping depends on its practitioner's continuing and transformative relationship to the social totality. Readings of this shifting totality will determine the interventions—the tactics, ideologies, and discourses that the practitioner chooses in order to pursue a greater good, beginning with the citizen-subject's own survival."[80]

The reason the feminist scientist is faced with a dilemma in the first place is in part due to their intimate relationship with science and technology. Is it possible for the feminist scientist to use their micropolitics to move toward a greater good and develop new knowledge without giving up their connection to science and technology? It is imperative that the feminist scientist continues to have this relationship, though strained, with the very science and technology that they wish to transform. My own intimacy with subcloning determined my intervention in the pursuit of creating new biological knowledges of the body. After ligating my question to vectors of figuration such as Shulamith Firestone, Rajasthani prints, and Superman, my dilemma was reconfigured. I became aware of recurring themes in the politics of cloning and this motivated a transformation in my research or a desire for movement in what already counted as established knowledge in the field. The molecular biology technique of subcloning allowed the isolation, the amplification, and finally the DNA sequencing of gene fragments that were of most interest to my research.

Subcloning allowed me to demonstrate the expression of estrogen receptor genes in hypothalamic neurons. The possible expression of estrogen receptors and the direct action of estrogen on hypothalamic neurons in this location of the brain had been dismissed prior to my research.[81] The significance of this finding, therefore, was that it contributed to new research on the HPG axis by providing evidence that the hypothalamus and gonads may interact through a series of feedback mechanisms rather than a hierarchical structure. Most important, I was able to bring molar and molecular politics to work together as my research contributions helped bring attention to the possible neurological effects of estrogen-based drugs, contraceptives, and hormone replacement therapies. I created a feminist account of the brain that was articulated through molecular biology.

As a feminist scientist, I have always been extremely appreciative of feminist critiques of science, but I have yearned to go beyond these critiques. During my PhD research, I wanted to engage with the biological sciences to produce a new feminist account of genes, hormones, receptors, and neurons. I had an opportunity to address my concerns for reproductive justice issues at a molecular level, which is why I subcloned. In her discussion of practices that can be used to approach and engage the sciences, Stengers reminds us that feminists may have to take the risk of "giving up the position of a judge."[82] To develop her ecology of practices, Stengers draws on Deleuze and his idea of "thinking par le milieu" and predicts some of the difficulties that may result from attempting to move from a majoritarian (molar) way of thinking to this minoritarian (molecular) thinking.[83] She suggests:

> I would thus claim that an important divergence between thinking in a major or in a minor key may well concern the relation between thinking and what we may call, in each case, ethics. The need and power to define a central stage is obviously determined by a political and also an ethical, project. . . . The problem, for me, is that such a characterization leads to identify the thinker's task as one of enlightenment, a critical and deconstructive enlightenment aiming to subvert the hegemonic languages and social structures, in order to free the constituent power which by right belongs to the multitude only. This is ethics in a major key since it implies and means to enact the great convergence between Truth and Freedom.[84]

Stengers explains in her ecology of practices that the difference between technology and the power of Truth is an ethical one, whereby technology is accompanied by a "sense of responsibility that Truth permits us to escape."[85] By engaging with the micropolitics of cloning, I have endeavored to work on the side of technology and not Truth.

Those who would answer my question regarding cloning with an immediate and resounding "no" may be doing so from a molar position that is bound to Truth. Molecular politics, however, can encourage us to engage with "a world that is technologically and globally mediated."[86] The purpose of having feminists enter into the sciences is not simply to keep the "women in science pipeline" piping. The goal instead is to create new biological knowledge that feminists desire. We want feminists to enter into the biological sciences. But once they are there, what should they do? Should they avoid the science and technologies that comprise the political economies of our time, or should they set up rebellion camps from within? Like it or not, encouraging feminists to enter into the biological sciences to produce new knowledges involves supporting them as they use the technologies that are crucial to their discipline.[87] As Braidotti warns: "What looks from one angle therefore as a potential threat of contamination of the minorities by the dominant norm or standard, from another appears instead as active resistance and innovation. This is not relativism, but the politics of location."[88]

I certainly would not have articulated my position this way while I was doing my PhD, but looking back now, I was driven by a sense that molecular politics were just as crucial as molar politics. My molecular position was absolutely necessary if I was to relate to the world around me as a feminist scientist in what I saw as being more productive ways. Subcloning became my transporting machine for spreading feminist contagion within the science that I practiced. What if the question "Should feminists clone?" were posed one last time? I hope I have made the case that if as feminists we are willing to get our hands dirty, and if we are prepared to extend kinship and hylozoic qualities to animals, plants, and even machines that have been created by the culture of cloning, it may be time to consider, even if just for a moment, that the answer to my monstrous question might be "yes."