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Boundaries and Border Wars: DES, Technology, and Environmental Justice

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According to a recent study, newborn babies in the United States absorb an average of 200 industrial chemicals and pollutants into their bodies via their mothers' wombs. The umbilical cord blood contains pesticides, consumer product ingredients (Teflon, stain and oil repellants from fast food packaging, clothes, and textiles), and wastes from coal, gasoline, and garbage.¹ Even in a highly polluted society, the extent to which newborns come into the world with a "human body burden" comes as disturbing revelation for environmental activists and health researchers. From a cultural perspective, these findings raise questions about the impact of industrial production on the human body, especially in pregnancy. That newborns enter the world marked by pollution highlights the contradiction between the idealized notion that babies are innocent and pure and the reality that they are born in and of the toxic soup that comprises the post-World War II landscape of pesticides, chemicals, and plastics. In other words, polluted babies are troubling creatures because they collapse the boundaries of the bodily and the natural with the technological, the man-made, and the synthetic.

Arguably, the first well-known example of the problems of synthetic intervention during pregnancy and childbirth arose with the widespread use of diethylstilbestrol (DES), a man-made estrogen created in 1938 by Englishman Charles Dodds. It was "a novel and a daring product" that produced the same feminizing effects as estrogens derived from plants and animals but was three times more powerful.² DES was a man-made version of a "natural" hormone presumed, because it was derived "from nature," to be beneficial. In reality, DES was toxic for the main populations to whom it was given: women and livestock animals. Between 4 and 6 million women in the United States from 1948 to 1971 were prescribed DES to prevent miscarriages.³ For women, it was promoted by pharmaceutical companies and prescribed by doctors as a "miracle drug," also used to treat menopause, to dry up breast milk in non-nurs-

ing mothers, as a “morning after” contraceptive, to prevent girls from growing “too tall,” and to aid male-to-female transsexuals before sex change operations.⁴ It was also standard practice for farmers to give DES to chickens, cows, and other livestock because they grew fat, their meat became succulent, and males were chemically castrated.⁵ Mothers given DES during pregnancy were later suspected of having higher risk of breast cancer, and DES-exposed children proved to have higher risks of various cancers and genital abnormalities, representing the first known human occurrence of transplacental carcinogenesis (cancer-causing effects) due to in utero exposure.⁶

How do human and animal bodies interact with technology, and how do these interactions illuminate the contested terrain between technology and environmental studies? The traditional opposition of technology/machine or environment/nature is explicitly rejected by Donna Haraway in her influential account of the cyborg.⁷ Building upon Haraway’s articulation of the cyborg as a cybernetic hybrid of organism and machine, this essay argues for an American studies analysis of DES and a revision of the cyborg concept through the framework of “technologically polluted bodies.” This analysis complicates hybridity, purity, and nature as cultural concepts in technological and environmental studies.⁸ If, as Jacques Ellul argued in 1964 in his influential *The Technological Society* that technology is the “stake of the century,” then the forms of the technologically polluted bodies (both women and animals) that I discuss are the stakes of this new century, and need serious cultural analysis from the perspectives of technology and environmental studies.⁹

DES offers a unique prism to understand nature’s social construction through technology and the human body, as opposed to the wilderness as the idealized site of “nature” in environmental studies. Environmental historians have questioned the centrality of the idea of “nature” as pristine green space absent of people, and the racial and gendered implications of this construction.¹⁰ The emerging social movement and academic field of environmental justice offers another challenge to the “nature of nature” as a category unmarked by race or class. At the core of the term *environmental justice* is a redefinition of the “environment” to mean not only “wild” places, but the environment of human bodies, especially in racialized communities, in cities, and through labor (exemplified by the movement slogan that the environment is where people “live, work, play, and pray”). Defining and redefining “nature” and “environment” are thus cultural questions, of which narratives and stories are a central part.¹¹ The explosion of research on environmental justice has taken place primarily in the social sciences, although it is increasingly being seen as an important area of humanities and American studies research.¹² Using the

environment and environmental justice to understand DES deepens the projects of denaturalizing nature and understanding the body's interactions with technologies in American political, cultural, and corporate contexts.

Using DES as the case study, I advance an understanding of technologically polluted bodies—not as Haraway's hybrid of organism and machine, but hybrids of bodies—*animals and human, and particularly female*, with nonmachine-based forms of technological intervention, such as the pharmaceutical, petrochemical, and livestock industries and the products they create and normalize through their production processes. DES is a rich example of how human and animal bodies interact with a variety of technological and environmental systems. Understanding DES bodies as technologically polluted is to argue, as Haraway suggests, against the purity and integrity of social, natural, and bodily categories, and in favor of what she calls “boundary breakdowns.” American studies offers an interdisciplinary focus on cultures of consumption, the politics of corporate practices, and their impacts on bodies and communities. My analysis also involves components that have been rarely used to understand DES, specifically literary analysis, and critical questions of race, class, and pollution. This approach to DES enables different epistemological and political questions about the nature of nature, the relationship between the technological and the natural, and between the environmental and human harms that result from particular technologies. Analyzing DES through the framework of technologically polluted bodies highlights how categories of race, gender, human/animal, and nature are unstable, shaped and contested by ideas and cultures, and through corporate industries, which actively shape these categories through their products and processes.

What do new forms of technology mean to our understanding of what it means to be human (or animal)? Crucially, how do these technologies emanate from particularly American values and views of nature, progress, control, and optimism? As a case study in polluted women and livestock (animal bodies), DES illustrates changes in the human relationship to nature and what these changing relationships might mean for the possibility of justice and ethics in a hyperpolluted, highly technological world of corporate concentration. If we are what we eat in food and medicine (DES in animal bodies consumed as food for humans, and given to women as medicine), then what we eat alters our body in a feedback loop that calls into question any idea of the body or nature that is pure or unadulterated. DES bodies, like the newborns, illuminate how we are already hybrid and that there is no nature or body that is not shaped by culture, technology, or medicine, no purity that we can stand upon to define concepts of nature, race, gender, or humanity itself. Those ubiquities of border

crossings, hybridity and cyborgian alterations, mean that the need for politics or philosophy of justice and/in technology becomes even more urgent.¹³

Female Bodies and Scientific Bodies of Evidence

DES, a man-made and nonsteroidal estrogen, was synthesized in 1938 by chemist-physician Edward Charles Dodds in London.¹⁴ Derived from coal tar, it differs from steroidal estrogen in that it lacks the four interlocking carbon rings that characterize natural steroid hormones and their derivatives. As Cynthia Orenberg explains, DES lacks the chemically distinct four-ring structure. DES is a “ringer” and “*fundamentally different*” in its chemical structure. Although it behaves empirically “like estrogen,” it isn’t. It is three times more powerful and not destroyed or affected by gastric secretions as is natural estrogen. For Orenberg, the central paradox is that DES was “accepted as the real thing” by physicians who “never thought that they might be tampering dangerously with nature.”¹⁵ Dodds “resolved to diverge radically from nature in order to mimic it.”¹⁶ He was also an inherently “conservative” physician, who rejected the idea of DES as a “miracle” cure. He expressed “humble” respect and awe for the female reproductive body.¹⁷ He saw its impacts when male workers in his laboratory who handled DES grew female breasts and became impotent (eventually DES was produced by women to avoid this problem).¹⁸ He also suspected other problems, specifically, that in being highly estrogenic, it was also carcinogenic.¹⁹ By 1939, forty articles demonstrated the carcinogenic effects of synthetic and natural estrogens in animals, including several that focused specifically on DES. By 1941, 257 papers demonstrated the value of DES for menopausal symptoms and other uses.²⁰

Although DES was first synthesized in London, its widespread popularity can be considered an American phenomenon stemming from the crucial role that U.S. doctors associated with elite medical institutions and pharmaceutical companies played. Although he conducted his research as part of the British system and was prohibited from taking a patent for DES, Dodds endorsed the idea that his invention stay within the public domain so that it could be used for the “greater good of humanity” (especially since he created DES in a wartime race with the Nazis).²¹ No restraints held back pharmaceutical companies who distributed samples widely and encouraged research on DES’s “miraculous effects.” The widespread use of DES during pregnancy began in 1947 because of a husband-and-wife research team at Harvard Medical School, George and Olive Smith. Her 1948 ground-breaking paper and their 1949 follow-up in the *American Journal of Obstetrics and Gynecology* encouraged the use of DES

to prevent miscarriages.²² According to their theory, elevated estrogen levels during pregnancy stimulate progesterone, which is essential for the uterus to receive and sustain the egg. Inadequate levels of either would lead to complications or failure of the pregnancy.²³ At a 1949 medical meeting, the Smiths announced that DES benefited *all* first-time pregnancies. In their words, DES seemed to “render normal gestation ‘more normal.’”²⁴ DES was considered benign because it was making a “natural,” “biological,” and “normal” process more effective.²⁵ How DES was relentlessly promoted exemplifies a utopian belief that technologies could harness and “improve” on nature itself. While this belief system was not unique to the United States, certain factors made it particularly dangerous, specifically the tactics of the pharmaceutical sectors in ensuring that the Food and Drug Administration (FDA) was a weak regulatory agency and in their marketing power.

The Smiths’ theory was refuted by a 1953 University of Chicago study by William Dieckmann, which definitively found that DES was *ineffective* at preventing miscarriages. However, doctors continued to widely prescribe DES in normal pregnancies like “vitamins” or “a little extra insurance.”²⁶ They continued because of the highly aggressive sales tactics of pharmaceutical representatives and because it was widely advertised in medical journals and the popular press. Influenced by the advertisements, and in their desperate desire to avoid miscarriages, women demanded DES. One such 1957 advertisement featuring a happy baby read, DES is “recommended in ALL pregnancies . . . desPLEX tablets also contain vitamin C and certain members of the vitamin B complex to aid detoxification in pregnancy and the effectuation of estrogen.”²⁷ Its use was unabated in pregnant women until a 1971 study that confirmed the link between in utero DES exposure and a rare vaginal cancer, clear cell adenocarcinoma, was published in the *New England Journal of Medicine*. Only then did the FDA issue an alert about DES use in pregnancy.²⁸ According to DES Cancer Network, none of the 267 pharmaceutical companies who produced and distributed DES have accepted any responsibility for DES’s health effects.

Reading DES and Gender

Existing histories of DES analyze it through the lenses of medical history and the history of regulation/ industry in the livestock or pharmaceutical sectors, and ignore certain cultural questions. There is, in other words, no parallel to Rachel Carson’s incisive critique of DDT and pesticides in postwar American culture as captured in her historic 1962 *Silent Spring*.²⁹ In contrast, what we

have is what science and technology scholar Joseph Dumit describes as a set of histories that detail “its incredibly tragic history within a kind of enlightenment narrative. They state that DES was not studied carefully enough at first, and those studies which showed problems were ignored by the medical community at large. When irrefutable proof of DES’s harm was provided in 1971 (the narrative goes) the medical community responded, the public was outraged, and more research was conducted.”³⁰ These accounts treat DES in animals and women alongside parallel tracks, making its time line difficult to decipher (DES was banned in chickens in 1958, while its use in cattle continued until 1979, and its use in women continued through the 1980s).³¹ They generally portray DES as a tragic or peculiar historical episode that tells a particular tale about medical knowledge or about the history of government regulation.³² For others, DES is “a modern meat production milestone, perhaps the most important single occurrence in the chain of events that culminated in the current methods of production.”³³

The particularly *American* aspects of DES tell a story about the relationship of production and dissemination that, as Alan Marcus suggests, emerge from a complicated dance between corporate and academic scientists and government regulators. The use of DES in beef came from a researcher at Iowa State, its use in chickens from the University of California at Davis.³⁴ The corporate-academic-government nexus in which DES emerged is specifically a U.S. model of research that flourished in the postwar era. How can the power of the pharmaceutical and agricultural lobbies and the inefficacies of the FDA and the U.S. Department of Agriculture (USDA) as regulatory agencies be compared against each other? These kinds of questions cannot be asked or answered using existing analytic frames. And one cultural question that is almost never asked is: how can we think about the relationship between women and animals through DES?

When DES histories focus on women, they tend to insufficiently consider gender with complexity. Popular and historical accounts on DES’s use in women deploy an early feminist framework that emphasizes women’s victimization.³⁵ Orenberg describes DES as “her story” as well that of her daughter exposed in utero. DES is “only one example of the consequences of thinking that modern medicine is infallible, that the physician is sacrosanct, and that the patient (particularly the *woman* patient) is an object to be ‘done to.’”³⁶ DES represents prevailing medical practices and the community’s attitude toward research on women without their consent, as shown by the “chilling number of trial-and-error medical experiments using DES on women.”³⁷ Personal narratives are gendered insofar as they focus on the perspectives of the women who took it

or DES daughters were exposed in utero, whose genitalia were arguably more altered than those of DES sons, and whose cancer risk was higher.³⁸ Lastly, the FDA's continued inaction on DES was successfully challenged by the women's health movement, particularly by DES-exposed mothers and their children.³⁹ Women's magazines, which had promoted DES earlier, later became effective venues for communicating its risks.⁴⁰

What these narratives and histories lack are a sustained consideration of how gender and sexual development as constructed categories can illuminate the cultural significance of DES. For example, in 1958, DES use was suspended in poultry when cases of early sexual development in young children in Puerto Rico and Italy were correlated with high chicken consumption.⁴¹ Also, male farm workers who fed DES to chickens and men who ate large amounts of chicken developed breasts, reported sterility, lost facial hair, and developed high-pitched voices.⁴² What made DES's use in chickens unpalatable (literally), was the way in which it visibly made men "women," and made children sexually mature. The "unnatural" sexual and bodily developments that DES triggered were visible, embodied, and therefore grotesque. When these categories of gender and sexual development were made manifest, DES was banned. Although the long-term harms of DES in other livestock and in women were as harmful, they were not visible in quite the same way, and not acted upon until there was a greater body of scientific evidence of DES's harms and changing political and cultural climates.

DES highlights how *female identity* itself was defined medically and socially through hormones. If being female and male can be defined through hormones, then a whole host of female and male "problems" could be solved. Throughout the twentieth century, female hormones were given to categories of women who were considered insufficiently female, such as menopausal women and lesbians.⁴³ The larger epistemological and cultural questions—why these "conditions" were considered a medical problem in the first place requiring medical intervention—have been explored by scholars in queer studies and intersex studies. This same line of critical interrogation has analyzed the parallel "problem" of the menopausal woman, since the first popular and regulated use for DES's "miraculous" effects was on menopausal women. The search for a remedy for menopause has been replete with cultural stigmas about female identity in postreproductive years.⁴⁴ As one popular book in the 1960s by Robert Wilson titled *Feminine Forever* stated, "a woman is not 'complete'" unless she takes hormone replacement pills, and will be "condemned to witness the death of her own womanhood."⁴⁵ National advertisements in the 1950s and 1960s for hormone replacement therapy were often openly sexist, depicting menopausal

women as “repulsive, witchlike . . . angry or depressed, menacing” and prone to violence once their reserve of estrogen was gone.⁴⁶

Lastly, the most obvious way in which gender shapes DES is through the critique of the gender normative definitions of a woman’s identity through pregnancy and childbirth. Miscarriage was to be avoided at all costs, at least in part because women defined their female identity with successful fertility, childbirth, and ultimately motherhood. Thus, with the goal of having a successful pregnancy and birth, millions of women took a drug derived from their natural hormones that ultimately led to their daughters having higher cancer risks and drug-altered uteruses that would make their own pregnancies difficult and dangerous.

Cultures of DES: Technology, Cyborg, and Hybrid Stories

In addition to rereading DES through critical frames of American values and corporate culture, gender construction and sexual identity, we need to consider it from the perspective of technology studies. Is DES a reproductive technology?⁴⁷ As one feminist critic notes: “technological interventions in the womb are extraneous parties (*objects or people*) that hinder, modify, or enhance female reproduction.”⁴⁸ Although most descriptions of reproductive technology do not include DES, it *does* fall under a broad definition of technology in general and reproductive technology specifically as an application of scientific knowledge to assist in making babies (or in this case, by supposedly preventing miscarriages).

Ellul’s definition of “technique” is illuminating in reframing DES vis-à-vis technology studies. He writes that although we automatically link technology with machines, “it is a radical error to think of technique and machines as interchangeable.”⁴⁹ Rather, “technique does not mean machines, technology, or this or that procedure for attaining an end. In our technological society, technique is the totality of methods rationally arrived at and having *absolute efficiency*.”⁵⁰ Broad definitions of reproductive technology that include attempts to “improve” pregnancy thus include DES under their umbrella. Expanding the definition of reproductive technology to include DES also draws the pharmaceutical sector into a history that predates in vitro fertilization and other more easily recognized reproductive technologies.⁵¹ DES is neither object nor person, but its function was indeed to “enhance” female reproduction. It was used, in the spirit of the Smiths and a generation of doctors treating pregnant women, as a tool to achieve “better,” more natural and normal, pregnancy—in Ellul’s words, the goal of *absolute efficiency* in pregnancy and childbirth. DES—as

technology and technique—complicates definitions of technologies as object or machine-based.

Reconsidering DES vis-à-vis technology studies also situates it within the framework of Haraway's influential cyborg theory. As a reconsideration of the cyborg, DES provides an ideal case study for understanding how to integrate cultural theory, pedagogy, and activism. I use Haraway's cyborg theory to suggest how to teach DES in a classroom using literary analysis. My chosen text is Ruth Ozeki's narrative *My Year of Meats* (1998).⁵² The novel is narrated by Jane Takagi-Little, a "DES daughter." Jane is a mixed race (Asian/white, Japanese/American) aspiring documentary filmmaker who begins her story as corporate tool for a Japanese TV show, *My American Wife!*, sponsored by an American meat export lobby to increase its sales in Japan. I focus on this novel because it resurrects the DES story long buried from popular consciousness. Like Upton Sinclair's *The Jungle*, it is a novel with muckraking intentions. It also brings up complex themes of hybridity and of the cyborg, which can illuminate larger questions about culture, technology, and the body, in an accessible text that is easily read and taught in an undergraduate classroom.

Haraway writes that cyborgs are a "cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction."⁵³ Her focus on the cultural production of the cyborg as a "creature of fiction," and our collective complicity in their existence, is to place agency, pleasure, and politics of their construction and existence into our own hands. As a creature of "fiction," the cyborg is located where the appropriation of nature in the production of culture meet and mesh, in which "the stakes in the *border war* have been the territories of *production, reproduction, and imagination*."⁵⁴ Her focus on these intertwined realms is echoed by Dumit in his call for an investigation of the epistemology of the "facts" of DES.⁵⁵ A fact is "a word used to describe the situation where (our) culture and nature agree. To call something a fact is to represent a cultural consensus on the nature of nature."⁵⁶ Dumit argues that drug-altered bodies, in particular DES bodies, are cyborg and that more research needs to be done on how and why original cyborgian alteration with drugs extends to further alterations with technologies.⁵⁷ If DES bodies are cyborgian, what are the politics of that identity? Haraway suggests that the cyborg myth is about "transgressed boundaries, potent fusions and dangerous possibilities which progressive people might explore as one part of needed political work."⁵⁸ Three boundary breakdowns are central to understanding cyborgs and the boundaries they transgress: the breaching of the boundary between human and animal, between animal-human (organism) and machines, and between the physical and the nonphysical.⁵⁹ Transgression enables freedom

from epistemological and historical constraints and dominations. Cyborgs complicate long-standing dualisms that have functioned to dominate women, people of color, nature, workers, and animals.⁶⁰ For Haraway, “cyborg politics is the struggle for language and the struggle against perfect communication, against the one code that translates all meaning perfectly That is why *cyborg politics insists on noise and advocates pollution, rejoicing in the illegitimate fusions of animal and machine.*”⁶¹

In thinking about how Haraway’s cyborg analysis can be used to understand DES, several questions emerge that confirm and possibly trouble her analysis. Are “illegitimate fusions” of animal and machines necessarily something to “rejoice”? Is the pleasure inherent in the transgression, in the border crossing, and in collapsing categories? Why do cyborg politics necessarily “advocate pollution”? What does this “pollution advocacy” mean, vis-à-vis the *actual* case of DES? Are technologically polluted bodies just a naive wish to return to a precyborgian, prehybrid state of the unpolluted body? What are the “dangerous possibilities” that cyborgian transgressions, boundary breakdowns, and rejections of dualisms represent, if we are to take up Haraway’s call as “progressive people” exploring “political work”? These are questions I now turn to through a close analysis of DES in *My Year of Meats*.

DES Narratives: Gender, Race, and Hybridity in *My Year of Meats*

As Haraway suggests, the “border war” between nature/culture and environment/technology is contested in the terrains of production, reproduction, and imagination. Thus, production, reproduction, and imagination are useful frames for analyzing cyborgs and, by extension, DES as cultural narratives. In photography collections, documentaries, and plays, DES has been a topic of cultural production.⁶² This focus is unsurprising, because the personal stories that these cultural productions reveal serve as important counternarratives to the overwhelming statistical and medical tone of dominant DES narratives.⁶³ What sets *My Year of Meats* apart from most DES histories is its dual focus on both women and animals. Takagi-Little is a “DES daughter” who works for *My American Wife!*, which highlights a variety of American women, their families, and their meat dishes from particular regional and ethnic subcultures in the United States. The aim of the show is to increase American meat sales in Japan by teaching Japanese women how to cook unfamiliar kinds of meat.

As a racially mixed DES daughter, Jane embodies Haraway’s critique of static categories of identity, specifically of racial and national identities. The author ties Jane’s mixed-race status to two key terms in the novel: hybridity

and sterility. As a person of mixed race and binational heritage, Jane acts as a cultural broker between two nations and cultures. As she explains, “being racially ‘half’—neither here nor there—I was uniquely suited to the niche I was to occupy in the television industry. . . . Although my heart was set on being a documentarian, it seems that I was more useful as a go-between, a cultural pimp, selling off the vast illusion of America” (9). While Jane’s mixed-race status gives her authority as a cultural broker between nations and races, Ozeki also ties her status to nonhuman (specifically plant) hybrids. Hybrids are clear rejections of “nature.” But this rejection is complex for Jane. Neither unproblematic nor idealized, hybrids stand as both a *warning sign* and an *opportunity* to escape a cultural past obsessed with notions of purity. Thus, race and culture are likened to native species that are increasingly moving to nonnative locales. For Jane, the cautionary tale of this crossing is in the story of kudzu, an invasive plant species that represents the dangers of careless botanic transplantation and “biological invasions.”⁶⁴ Kudzu is a Japanese plant that was touted as a “miracle plant” in the United States and brought to the South to “rescue” the depleted southern soil. But it soon overran more than 500,000 acres in the South, due to its “predaceous and opportunistic” and fast-growing nature (it often grows up to a foot a day). It echoes DES itself and thus represents the unforeseen consequences when miracles (whether technological or botanical) go awry. Jane explains that kudzu is used as a disparaging metaphor by American nativists for the economic “invasion” of the Japanese in the South (77). At the same time, the movement of plants and people represents an outcome that Jane welcomes. As she describes, “all over the world, native species are migrating, if not disappearing, and in the next millennium, the idea of an indigenous person or plant or culture will just seem quaint. Being half, I am evidence that race, too, will become a relic. . . . Some days, when I’m feeling grand, I feel brand-new—like a prototype. . . . Now, oddly, I straddle this blessed, ever-shrinking world” (15). Kudzu is an ambiguous metaphor for both Jane and the author, representing both freedom and danger in the flows and movements of peoples, plants, and cultures around and within the world.

Jane’s racial hybridity is also linked to her fertility, both actual and perceived, and like the discussions of human and plant hybrids in the novel, complex and ambivalent. On the one hand, as Joichi Ueno, the Japanese advertising executive in charge of the Beef-Ex account and the show says in a moment of drunken flirtation: “You, Takagi, are a good example of hybrid vigor We Japanese get weak genes through many centuries’ process of straight breeding. Like old-fashioned cows. Make weak stock. But you are good and strong and modern girl from crossbreeding” (43). Part of her perceived “strength” comes

from her height, as she is taller than most Japanese women; and she is more direct and a social nonconformist. “Hybrid vigor” is a well-known term used by breeders and farmers that applies to the “exceptional sturdiness” of the first generation of cross-breeds in animals and plants.⁶⁵ Thus, the author uses Jane’s racial hybridity to stand for agricultural and nonhuman “natural” ideas of fertility and strength. Jane’s “hybrid vigor” is contrasted with her narrative double, Ueno’s wife, Akiko. Their marriage is plagued with problems, in part because of Akiko’s infertility, as well as his “stony rage.” The irony is that Jane has more difficulties getting pregnant and carrying a pregnancy to term because of the structural changes in her uterus as a result of her DES exposure, which she discovers through the course of the narrative. Her infertility caused the fractures that led to her first divorce and is linked to her mixed-race status, because “like many hybrids . . . I was destined to be nonreproductive” (152), referring to the tendency of certain hybrids to be sterile, like mules.⁶⁶ Jane’s infertility is dually ironic: the internal tragedy and transformations of DES daughters (whose mothers took DES to help themselves be successfully fertile) and because of the external perception that her strength comes from her racial hybridity. Jane expresses the freedoms that come with hybridity that Haraway suggests for cyborgs. But with geographic, biological, racial, and national freedoms come dangers, ambivalence, and complexity. With hybridity, perceptions of hyperfertility and strength work alongside themes of infertility and sterility.

Technologically Polluted Bodies: We Are What We (M)eat⁶⁷

While Jane embodies Haraway’s notion of a racial and technological hybrid and cyborg, a close reading of *My Year of Meats* suggests that critiques of fixed categories of identity that cyborgs implicitly embody need not lead to a celebration of technologically polluted bodies. Haraway’s cyborg theory provides a crucial and important critique of fixed identities, but in doing so, may make it difficult to critique pollution, a stance that the novel explicitly challenges. The key to this challenge is how Jane is further shaped and altered through what she eats, specifically meat, and what she learns about the industry that uses hormones like DES to “improve” their product. In the novel, Ozeki connects women and livestock in a complicated stance that simultaneously embraces hybridity and rejects pollution.

Jane starts the book as the coordinator of the production team for *My American Wife!* and in that capacity interprets the directives from the Tokyo office on behalf of the show’s sponsor (Beef-Ex), to remember that “Beef Is Best.” As she writes in a memo describing the show,

Meat is the Message. Each weekly half-hour episode of *My American Wife!* must culminate in the celebration of a featured meat, climaxing in its glorious consumption. It's the meat (not the Mrs.) who's the star of our show! Of course, the "Wife of the Week" is important too. She must be attractive, appetizing, and all-American. She is the Meat Made Manifest: ample, robust, yet never tough or hard to digest.

Meat, in other words, is how ultimately one can make sense of DES's rise in the United States, both as *a symbol* connecting women and animals, and as a *technological process* to *control nature* and *maximize efficiency* through technology. Anthropologists have long analyzed meat's cultural and symbolic importance, arguing that it represents the domination of humans over nature and nonhumans.⁶⁸ Thus, it comes as no surprise that meat is so central to the novel because it acts as a rich signpost of cultural and moral values. As Jane, Ozeki describes the American wives on the show: "through her, Japanese housewives will feel the hearty sense of warmth, of comfort, of hearth and home—the traditional family values symbolized by red meat in rural America" (8).

But the darker side of the "values" of meat is also represented by DES. Thus, women and animals are linked in DES, not accidentally or incidentally, but through an American technological and medical culture that saw the improvement of nature through technology and increased efficiency as central to the larger cultural project of improvement and progress. Further, the links between reproduction and production and between animals and women perform and create *new kinds* of technological violence in the bodies they inhabit. These links between animals and women are not surprising, because, as Haraway notes, one of the key boundary breakdowns that characterizes the cyborg is through the human/animal breakdown. Further, the boundary breakdown between *woman* and *animal* has been a central feature of the history of hormone development, since animals have been central to the development of the birth control pill and reproductive technologies such as IVF and hormone replacement therapy, and as the sources of popular estrogen therapies.⁶⁹ DES was first used as a treatment for menopause, but it soon was supplanted by Premarin, the most commonly prescribed drug used to treat menopause introduced in 1942.⁷⁰ Because it is derived from a pregnant mare's urine during the third through tenth month of the equine gestational period (hence, the name PREgnant MAre uRINE), an estimated 35,000 mares stand in barns throughout Canada and parts of the midwestern United States for about six months out of every year with urine collection devices strapped onto them, and most of their foals sold for slaughter.⁷¹

In making animals, meat, and female reproduction increasingly efficient, DES stands not only as a symbol for pollution in the processes of meat and

baby-making, but for changing systems of production more generally. Meat functions as a larger symbol of forms of racialized American violence and violence against animals in meat production. Jane describes the well-publicized murder of a Japanese exchange student, Yoshihiro Hattori, shot to death by Rodney Dwayne Peairs when he rang a doorbell to ask for directions to a Halloween party. Jane notes that Peairs worked as a meat packer in Louisiana:

Hattori was killed because Peairs had a gun, and because Hattori looked different. Peairs had a gun because . . . we fancy that ours is still a frontier culture, where our homes must be defended by deadly force from people who look different. And while I'm not saying that Peairs pulled the trigger because he was a butcher, his occupation didn't surprise me. Guns, race, meat, and Manifest Destiny all collided in a single explosion of violent, dehumanized activity. (89)

Although numerous scholars have described how notions of the frontier, Manifest Destiny, and American imperialism were racialized, Jane adds meat and systems of its production and consumption to this cultural history with contemporary “real-world” implications for how people (especially disenfranchised people, such as people of color and immigrants) live, work, and consume meat.⁷² In this sense, the novel expands on Roger Horowitz's examination of race, gender, ethnicity, and technology in the American meat-packing industry. Horowitz asks, but does not answer, the question: is there a role for the household or the consumer in this story? *My Year of Meats* offers precisely that view, of race, gender, and ethnicity in the household and consumption aspects of meat production in the United States.⁷³

Individual violent acts like the Hattori-Peairs murder act as microcosms of larger cultural forms of systemic and technological violence enacted through meat production. The health effects of the hormones, drugs, and chemicals are countless, and the cruel conditions that the animals (cramming them into pens, cutting off chicken beaks) live in are well-documented. The conditions in which the animals live in the livestock industry are a logical outcome of the story that began with DES, in other words, the changing technologies of food production and consumption. As Jane describes: “DES changed the face of meat in America. Using DES and other drugs, like antibiotics, farmers could process animals on an assembly line like cars or computer chips. Open-field grazing for cattle became inefficient and soon gave way to confinement feedlot operations or factory farms, where thousands upon thousands of penned cattle could be fattened at troughs. This was an economy of scale. It was happening everywhere, the wave of the future, the marriage of science and big business” (125). Meat, in other words, became increasingly mechanized, animals became

things, economies of scale grew, and older forms of food production and consumption were abandoned.

Thus, the key cultural question that *My Year of Meats* asks is not “whether eating meat is natural/right/ethical,” but rather, how has meat been made *different* technologically, what kinds of food and social systems have developed in the last fifty years that are significantly different in scale and scope from older systems of production and consumption, and what do race and gender have to do with these changes?⁷⁴ What emerged was a production system that completely mechanized its product, in other words, taking animals away from nature and into technology. As Horowitz suggests, “convenience (in meat production) . . . rested on ever greater intervention into *nature*Implicit in the very notion of convenience was using *technology* to help mankind claim victory over the organic subduing of animals and their parts to the imperative of the human race. Altering animal biology and growth patterns, tinkering with forms of processed meat, adding chemicals to feeds, creating more automated production methods—all were elements of relentless efforts to turn *nature’s bounty into products that fit with the modern lifestyles of our civilization.*”⁷⁵ DES is just one particularly salient (salacious?) example of this tension between nature and technology, reflecting cultural desires of control and domination that shape the particular contours of production.

Yet another logical outcome of these changes in production and its utter moral bankruptcy is represented in *My Year of Meats* by Gale Dunn, the son-in-law of Bunny Dunn, a featured “Mrs.” on *My American Wife!* and wife of Colorado rancher-patriarch, John Dunn. Gale describes the cattle feed as “recycled” to Jane: “We even got by-products from the slaughterhouse—recycling cattle right back into cattle. Instant protein . . . the formulate feed we use is real expensive, and the cattle shit out about two-thirds before they can even digest it. Now there’s no reason this manure can’t be recycled into perfectly good feed . . . you should be really happy, ’cause this pretty much takes care of the ‘organic waste’ problemFeed the animals shit and it gets rid of the waste at the same time” (258). The process Gale describes is linked to mad cow disease. Although cows are naturally herbivores, the industry turns them into cannibals by feeding them meal ground from beef and beef bones.⁷⁶

At the same time that systems of meat production became increasingly mechanized, systems of consumption altered to create new markets for the global food industry. Beef-Ex, the trade group sponsoring *My American Wife!* does so explicitly to familiarize the Japanese housewives with meat and how to cook it, in a culture based historically on nonmeat food sources. The strategy was “to develop a powerful synergy between the commercials and the docu-

mentary vehicles, to stimulate consumer purchase motivation.’ In other words, the commercials were to bleed into the documentaries and the documentaries were to function as commercials” (41). The novel thus connects meat production with global consumption, including advertising, that functions to create and shape the needs and desires of individual consumers and in national and global markets. Whether that consumer is a housewife buying meat for her family’s table (in Japan or the United States), or a pregnant woman pressing her doctor to prescribe DES as a “magic” pill to prevent miscarriages, individual/group consumption and production are inextricably linked through cultural ideas and images, linked through the discourse of the wonders of technological progress and improvement.

DES and the Search for Environmental Justice

Reframing DES and meat as problems of technological production and consumption updates Haraway’s cyborg. She argues that “high tech culture’s challenge of existing categories and dualisms” is liberatory because these dualisms are challenged and because “it is not clear who makes and who is made in the relation between human and machine.”⁷⁷ But in using DES as a case study in technological culture, the maker and the made *are* clear. The pharmaceutical and livestock industries made DES, used and promoted it widely, made sure that regulatory agencies were ineffective at protecting the public interest, and altered women’s and livestock’s bodies in terribly troubling and culturally complex ways. To embrace the cyborg and the hybrid as emblematic cultural figures and to reject notions of bodily and environmental purity does not mean that we can’t have a *politics* and *ethics* of technologically polluted bodies. This accountability lies squarely with corporate polluters, weak regulatory agencies, and the consumers who depend on existing structures of production and consumption. Thus, I turn to the field of environmental justice to consider DES as a contemporary parable.

The connections between DES, *My Year of Meats*, and environmental justice can be seen in the topical links between the issues portrayed in the book and examples of current environmental justice activism, and in the expansion of definitions of environmentalism to include race, class, gender, and injustice frames—cultural questions in which narratives and stories play a central part. One link is in the struggles of Native women in the Arctic organizing against their exposure to environmental pollutants from persistent organic pollutants (POPs). In arguing that bodies are “first environments,” Native activists link reproductive health, environmental health, and cultural survival.⁷⁸ POPs are

a set of extremely toxic, long-lasting, chlorinated, organic chemicals that can travel long distances from their emission source (often thousands of miles away) and that accumulate in animals, ecosystems, and people. In the 1980s, scientists began to find high levels of toxic chemicals (pesticides, insecticides, fungicides, industrial chemicals, and waste combustion) far from the source of their production. POPs were discovered in the Arctic indigenous populations in the 1980s, when a Nunavik midwife in the Canadian North offered to collect local breast-milk samples. These samples were supposed to be control samples from a “clean” environment in a study of toxic breast-milk contamination. Researchers were astounded to find that Arctic indigenous women had POP concentrations in their breast milk five to ten times greater than in women in southern Canada, and among the highest recorded in the world.⁷⁹ Suspected health effects include higher rates of infectious diseases and immune dysfunction, negative effects on neurobehavioral development (adverse behavioral functioning, slowed growth rates and intellectual functioning), and negative effects on newborn height.

The POPs example raises questions of harms and injustices and rights and responsibilities, both for the local Arctic communities and in the global realm. Women struggled with whether to feed their babies contaminated breast milk, and the larger communities debated whether and how to hunt and consume traditional food. Native women, in other words, were cyborgs and hybrids, much like DES animal/female bodies and the polluted babies. Arctic women suffered the worst health effects of production processes that their culture did not create or condone.⁸⁰ Despite the unique technological and bodily problems that POPs presented, there have been successful developments aimed at addressing this particular problem. In 1998 and 2001, two binding international treaties were signed.⁸¹ Both ban or limit production, use, release, and trade of particularly toxic POPs, establish scientifically based criteria and specific procedures for establishing controls on additional POPs, and seek to prevent development and commercial introduction of new POPs.⁸² The agreements would not have been negotiated without indigenous activism. Sheila Watt-Cloutier, the chair of the Inuit Circumpolar Conference describes the indigenous negotiating position on POPs: “A poisoned Inuk child, a poisoned Arctic, and a poisoned planet are all one and the same.”⁸³ Indigenous activism, particularly by midwives and female tribal leaders, privileges the environmentalist trope and discourse of interconnection and web of life, especially between mother and child, culture and planet. Without sanctioning or celebrating the pollution that turns their bodies into paradigmatic sites of boundary breakdowns, between cultures of global production and local consumption, Arctic activists are engaging in

debates about the role of technology on female/indigenous bodies and the politics of what can and should be done in the face of the ubiquitous state of border crossings and cyborgian alterations that define our age.

Lastly, understanding DES through the framework of environmental justice allows us to understand and critique it as one of the three pathways that brought the environmental endocrine hypothesis to light (the other two were discoveries that wildlife reproductive disorders were linked to chemical effluents and pesticides and decline in sperm counts and quality).⁸⁴ The environmental endocrine hypothesis is the emerging scientific consensus “that a diverse group of industrial and agricultural chemicals in contact with humans and wildlife have the capacity to mimic or obstruct hormone function . . . by fooling it into accepting new instructions that distort the normal development of the organisms.” Synthetic organic chemicals have been linked to two dozen human and animal disorders.⁸⁵ By understanding how technologies are linked with bodies and nature, we can understand how to criticize the problems that come with synthetic organic chemicals, rather than accept their ubiquity as an acceptance of a hybrid, postnormal, and postnatural cyborgian state of the world.

Conclusion: Boundaries, Borders, and Blowback

As Aidan Davison suggests in his *Technology and the Contested Meanings of Sustainability*, the contest over “the ideal of sustainability is at once a contest over the future of technology.”⁸⁶ He describes human practice as the “drawing toward and into ourselves of worldly things: things living and nonliving, artefactual and ecological, human and non-human, earthly and heavenly.”⁸⁷ Technologically polluted bodies are a dark version of human and corporate practice, a fusion of things living (human bodies) and nonliving (chemicals, plastics, pesticides), human and nonhuman, earthly and a synthetic hell created out of our culture’s desire to engineer the natural through the technological. In telling truths that are fictions, in a narrative both documentary and fabulist, *My Year of Meats* and cyborgs, analyzed through an American studies framework, provocatively reframe DES as a story that continues to provide important insights about American values, corporations, and cultures. Although in one sense DES is “in the past,” its negative effects on the health and well-being of second and third generations of those exposed to DES remain relevant. DES is also a reminder of the continued dangers of chemical intervention on humans and animals, since it was immediately replaced by other estrogenic, growth-enhancing additives, as well as the widespread use of antibiotics.⁸⁸

Which returns us to the babies with whom we began. Clearly, the notion that babies are pure, natural, and outside culture is false. But perhaps the larger problem is what kind of culture we live in where babies are born with 200 chemicals in their bodies, and that level of pollution becomes acceptable, even as it becomes normalized. If pollution is ever-present, and we are already hybridized and cyborgian through our pollution exposure, what are the possibilities for cultural and environmental change? Knowledge, activism, and narrative make sense of technologically polluted bodies and perhaps help to remediate these health and environmental problems. Narratives by environmentalists and writers such as Ruth Ozeki and Sandra Steingraber have focused on issues of toxicity, gender, and breast milk contamination and are central to illuminating the stories of people, especially women, intimately shaped by corporate pollution.⁸⁹ Thus, I want to end by reframing hybrids and boundary crossings through the environmentalist discourse of interconnection and the “web of life.” In a testimony about a DES daughter who died from cancer, her siblings recounts that “one thing Betsy taught me is that the environment is a *complex web of life*; everything is *interwoven* . . . I think we need to use our best science with our best intuition to remember that everything is interwoven. If you make a disturbance, it can have consequences far beyond.”⁹⁰

Beyond knowledge and activism, we need a cultural and political analysis and a vocabulary that makes sense of DES’s roots and impacts, which American studies can provide. This analysis reveals what happens when we look closely at the interconnections, interweavings, and webs: of race, gender, and nature as constructed categories, the porous boundaries and borders between mother and child, between human (woman) and nonhuman nature (animal), between production and consumption, and between the environmental and the technological. Only through such intersectional and interdisciplinary analysis can we better begin to consider where and how justice is at all possible in our complex age.

Notes

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1. Environmental Working Group, “Body Burden: The Pollution in Newborns,” July 14, 2005; retrievable at http://www.ewg.org/reports_content/bodyburden2/pdf/bodyburden2_final-r2.pdf (accessed June 14, 2006).

2. Barbara Seaman, *The Greatest Experiment Ever Performed on Women: Exploding the Estrogen Myth* (New York: Hyperion, 2003), 36.
3. Roberta J. Apfel and Susan Fisher, *To Do No Harm: DES and the Dilemmas of Modern Medicine* (New Haven, Conn.: Yale University Press, 1984), 1.
4. Barbara Seaman and Gideon Seaman, *Women and the Crisis in Sex Hormones* (New York: Bantam, 1977).
5. Alan I. Marcus, *Cancer from Beef: DES, Federal Food Regulation, and Consumer Confidence* (Baltimore: Johns Hopkins University Press, 1994), 12–13.
6. DES daughters (females exposed in utero) have an increased risk for infertility, and are at a higher risk for ectopic pregnancy, miscarriage, and preterm labor and delivery. They also have an increased incidence of structural changes in their reproductive organs. DES sons face increased risk for problems with their genitalia. These include cysts, testicular problems, microphallus, testicular varicoceles, hypospadias, and meatal stenosis. A 1993 study of DES mothers confirms a 30 percent increased incidence in breast cancer. For a further explanation, see DES Action, a support group for those who took or were exposed to DES, retrievable at <http://www.desaction.org/>.
7. Ellul's discussion of technique, technology, and nature are also suggestive. In short, technique and technology stand opposed to nature. Jacques Ellul, *The Technological Society* (New York: Vintage, 1964), 79.
8. Donna J. Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991).
9. Ellul, *The Technological Society* (originally titled *La Technique: L'enjeu du siècle*, or *The Stake of the Century*).
10. William Cronon, "The Trouble with Wilderness, or, Getting Back to the Wrong Nature," in *Uncommon Ground: Rethinking the Human Place in Nature*, ed. William Cronon (New York: Norton, 1996), 69–90. See Carolyn Merchant's work, specifically "Reinventing Eden: Western Culture as a Recovery Narrative," in the same volume, 132–59. On the erasure of Native Americans from wilderness, see Mark David Spence, *Dispossessing the Wilderness: Indian Removal and the Making of the National Parks* (New York: Oxford University Press, 1999).
11. See *New Perspectives on Environmental Justice: Gender, Sexuality, and Activism*, ed. Rachel Stein (New Jersey: Rutgers University Press, 2004), and *The Environmental Justice Reader: Politics, Poetics, and Pedagogy*, ed. Joni Adamson, Mei Mei Evans, and Rachel Stein (Tucson: University of Arizona Press, 2002), as examples of the emerging literature of environmental justice arising from literary and cultural studies.
12. See Shelley Fisher Fishkin, "Crossroads of Cultures: The Transnational Turn in American Studies—Presidential Address to the American Studies Association, November 12, 2004," *American Quarterly* 57.1 (March 2005): 31, and George Lipsitz, "In the Midnight Hour," *American Studies in a Moment of Danger* (Minneapolis: University of Minnesota, 2001), 3–30.
13. Environmental philosophers and philosophers of technology, such as Andrew Light, have focused much effort on this line of analysis, as have environmental ethicists.
14. He first successfully removed the steroid nucleus to create a substance he called "anol" in 1936, but it was only weakly estrogenic. Dodds then worked with a competitor, Sir Robert Robinson at Oxford. Together, they isolated a white crystalline substance with roughly three times the effect of natural estrogen, which they called Silbestrol. It was a derivative of stilbene. Stephen Fenichell and Lawrence S. Charfoos, *Daughters at Risk: A Personal DES History* (New York: Doubleday, 1981).
15. Cynthia Orenberg, *DES: The Complete Story* (New York: St. Martin's Press, 1981), 11.
16. Fenichell and Charfoos, *Daughters at Risk*, 17.
17. He also called for limits and caution in the area of long-term hormonal treatment. *Ibid.*, 36.
18. *Ibid.*, 19.
19. His concern was demonstrated in a 1933 report to *Nature* titled "Sex Hormones and Cancer-Producing Compounds." *Ibid.*, 16.
20. However, their studies on DES's effectiveness during pregnancy lacked adequate controls, and were not double-blind. Despite inadequate research data, the FDA declared DES to be safe and no longer requiring annual approval in 1952, by administrative fiat. See Diana Dutton's "DES and Drug Safety" chapter in her book *Worse Than the Disease: Pitfalls of Medical Progress* (Cambridge: Cambridge University Press, 1988).

21. According to women's health journalist Barbara Seaman, Dodds was acutely aware of the larger political context of his discovery. The Nazis were seeking secrets to human reproduction, and their hormone research was part of their eugenic program. As Seaman recounts, in Hitler's Germany, "where eugenics and ethnic cleansing were primary goals," sterilization and contraception were "high priorities" toward the achievement of the master race. Seaman, *The Greatest Experiment*, 28.
22. For an extended discussion of the Smiths, see Fenichel and Charfoos, *Daughters at Risk*, and Orenberg, *DES: The Complete Story*.
23. Olive Smith, "Diethylstilbestrol in the Prevention and Treatment of Complications of Pregnancy," *American Journal of Obstetrics and Gynecology* 56 (1948): 821–34.
24. Dutton, *Worse Than the Disease*, 54. "More Normal Than Normal" is also the name of Seaman's first chapter in Seaman and Seaman, *Women and the Crisis in Sex Hormones*.
25. However, as mentioned above, the Smiths' studies on DES's effectiveness during pregnancy lacked adequate controls and were not double-blind. Nevertheless, the FDA declared DES to be safe and no longer requiring annual approval in 1952. Apfel and Fisher, *To Do No Harm*, 21.
26. This was research conducted by William Dieckmann from the University of Chicago's study. Later reanalysis of data found that it was actually linked to increased miscarriages, premature births, and higher infant mortality. Orenberg, *DES: The Complete Story*, 4.
27. Apfel and Fisher, *To Do No Harm*, 26.
28. Even after DES's link with cancer was shown, it was commonly used as a "morning after pill" on college campuses well into the 1980s, although the FDA never approved it for that use. See Dutton, *Worse Than the Disease*, 80–86.
29. Rachel Carson, *Silent Spring* (New York: Houghton Mifflin, 1962), 1–3.
30. Joe Dumit with Sylvia Sensiper, "Living with the 'Truths' of DES: Toward an Anthropology of Facts," in *Cyborg Babies: From Techno-Sex to Techno-Tots*, ed. Robbie Davis-Floyd and Joseph Dumit (New York: Routledge, 1998), 212–39.
31. DES was banned in chickens under the Delaney Clause, which prohibited the use of any carcinogenic food additive, but was not banned in sheep or cattle because no residues had been found. Its use in cattle grew exponentially, so that, by 1970, nearly 75 percent of U.S. cattle were given DES. Environmental groups revealed that DES residues were found in cattle, but that the United States Department of Agriculture had suppressed the results. Dutton's *Worse Than the Disease* is one of only a few histories that treat the DES story in women and animals together.
32. For Apfel and Fisher in *To Do No Harm*, DES is "a 20th century medical detective story." DES represents a "paradigm of the peculiarly modern phenomenon in which large-scale destructive consequences of a medical or technological innovation emerge unexpectedly as much as a generation after a benign or inconsequential beginning. A second, even more far-reaching aspect of the DES story is that it encapsulates in a quite remarkable fashion the whole complex history and structure of modern medicine in relation to modern life," 3.
33. For Marcus, the DES story reflects two themes, the late-nineteenth-century identification of science as expertise and the "reconceptualization" of the Progressive dream of experts as objective decision makers transformed into a regulatory and industry "alliance" of interests. *Cancer from Beef*, 1.
34. Marcus begins his story with Wise Burroughs, an Iowa State College ruminant nutritionist who discovered the hormone's cattle growth-promoting properties in 1954, as the founding father of his tale. Fred Lorenz, a professor of poultry husbandry at the University of California at Davis was responsible for DES in chickens. *Ibid*.
35. For example, "much of the DES story has been portrayed by feminist writers as an example of male doctors doing something thoughtless and harmful to women." Apfel and Fisher, *Do No Harm*, 40.
36. Orenberg, *DES: The Complete Story*, xiii.
37. *Ibid*, 28. This is also exemplified by one early promoter of DES, Dr. Karnaky of Houston, who gave it to dogs and found "the dang dogs were dying like flies." See Dutton, *Worse Than the Disease*, 48.
38. See Fenichel and Charfoos, *Daughters at Risk*; Orenberg, *DES: The Complete Story*; Deborah Davidson, "Woe the Women: DES, Mothers and Daughters," in *Gender, Identity and Reproduction: Social Perspectives*, ed. Sarah Earle and Gayle Letherby (London: Palgrave Macmillan, 2003).
39. In the 1990s DES activist groups successfully lobbied for federal funding for research on the health risks for DES mothers and children. The DES Research and Education Amendment was signed into law in 1992 by George Bush. It was the first federal legislation for DES research that ordered the

National Cancer Institute to study the long-term health effects of DES exposure. See Margaret Braun, *DES Stories: Faces and Voices of People Exposed to Diethylstilbestrol* (Rochester, New York: Visual Studies Workshop, 2001), xvii.

40. Dutton, *Worse Than the Disease*, 75–76.
41. Apfel and Fisher, *To Do No Harm*, 15.
42. *Ibid.*
43. Another influential, popular advice author-physician claimed that as estrogen decreases, women enter the “world of intersex” (quoted in Seaman, *The Greatest Experiment*, 51). The phenomenon of giving female hormones to lesbians to “improve” them by making them “more female” and, by definition, heterosexual has been recounted by other cultural historians. See David Serlin’s *Replaceable You: Engineering the Body in Postwar America* (Chicago: University of Chicago Press, 2004).
44. Despite the warnings about DES’s cancer-causing effects, the FDA approved the use of DES in 1941 for four specific uses (menopausal symptoms, gonorrheal vaginitis, senile vaginitis, and suppression of lactation after pregnancy).
45. Robert Wilson’s 1966 *Feminine Forever* (New York: M. Evans, 1966), as quoted in Seaman, *The Greatest Experiment*, 55.
46. *Ibid.*, 49.
47. Reproductive technology is most often described through a list that includes assisted fertility technologies, such as artificial insemination, artificial wombs, cloning, embryo testing, embryo transfer, in vitro fertilization (IVF), intracytoplasmic sperm injection, preimplantation genetic diagnosis (PGD), and sperm selection. Others include ultrasound, new contraceptives such as Norplant and Depo-Provera, and surrogacy or contract pregnancy as reproductive technologies. Helen Bequaert Holmes, ed., *Issues in Reproductive Technology: An Anthology* (New York: Garland, 1992), ix.
48. Nancy Lublin, *Pandora’s Box: Feminism Confronts Reproductive Technology* (Lanham, Md.: Rowman and Littlefield, 1998); emphasis added.
49. Ellul, *The Technological Society*, 7.
50. *Ibid.*, xxv.
51. *Ibid.*, x.
52. According to Ruth Ozeki’s online biography, “*My Year of Meats* was an international success, translated into ten languages and published in fourteen countries.” See www.ruthozeki.com. Accessed July 20, 2006.
53. Haraway, *Simians, Cyborgs, and Women*, 150.
54. For Haraway, cyborgs are a “condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation. In the traditions of ‘Western’ science and politics—the tradition of racist, male-dominant capitalism; the tradition of progress; the tradition of the *appropriation of nature* as resource for the *productions of culture*; the tradition of reproduction of the self from the reflections of the other—the relation between organism and machine has been a border war.” *Ibid.*, 150; emphasis added.
55. He analyzes the production of knowledge and “facts” about DES through “writing technologies” (popular pregnancy books and medical texts), or how and where meanings travel and circulate in texts, practices, and speech. Dumit with Sensiper, *Living with the “Truths” of DES*, 216.
56. *Ibid.*
57. He argues that DES children are cyborgs in five ways. First, their mothers are fusions of human hormones and DES, with known, profound, and “cascading effects” on the body. Second, new anatomical structures are created that are unique to those who were exposed in utero to DES (i.e., T-shaped uteruses unique to DES daughters, as well as other structural alterations of the cervix, described as “hoods,” “collars,” and “cockscombs”). Thus, DES is like an “additional, pharmaceutical parent.” Third, the children’s bodies, especially DES daughters, are under constant medical and technological surveillance when it comes to their health and illnesses. Fourth, DES daughters are dependent on the medical community to carefully monitor their own infertility problems and pregnancies. Last, there is a lack of knowledge of DES children about their exposure and a lack of knowledge of most doctors to the ubiquity of DES exposure in women. *Ibid.*
58. Haraway, *Simians, Cyborgs, and Women*, 154.
59. In particular, “the dualisms of self/other, mind/body, culture/nature, male/female, civilized/primitive, reality/appearance, whole/part, agent/resource, maker/made, active/passive, right/wrong, truth/illusion, total/partial, god/man” are challenged. *Ibid.*, 151.

60. Ibid., 177.
61. Ibid., 176; emphasis added.
62. As *DES Stories*, a photography book by and about DES survivors, notes, “every DES-exposed person has an important story to tell” (3). See Margaret Braun’s photographic essays in *DES Stories: Faces and Voices of People Exposed to Diethylstilbestrol*; *A Healthy Baby Girl*, directed by Judith Helfand, 1997; and *Philomela’s Tapestry*, a play by Alice Cohen.
63. Back cover of Braun’s *DES Stories*.
64. Biological invasion discourse has been tied to social ideas and anxieties about place, nature, and culture, particularly in the South. See Joshua Blu Buh, *The Fire Ant Wars* (Chicago: University of Chicago Press, 2004).
65. For a historical example, see the section on “Hybrid Vigor,” in *Technical Bulletin 52*, “The Cross-Breeding of Poultry,” published by the Agricutlural Experiment Station, Kansas State, October 1942, retrievable at <http://www.oznet.ksu.edu/historicpublications/Pubs/STB052.PDF> (accessed June 14, 2006).
66. The most well-known sterile hybrid is the mule, which is the product of a donkey and a horse (breeding a male donkey to a female horse results in a mule; breeding a male horse to a female donkey produces a hinny).
67. Ruth Ozeki, *My Year of Meats* (New York: Penguin, 1998).
68. Nick Fiddes, *Meat: A Natural Symbol* (London: Routledge, 1991).
69. For example, early pioneers of IVF, such as Jacques Testart (France) and Alan Trounson (Australia), began their careers as animal biologists, who often sexualized their control over female fertility. Janice Raymond, *Women as Wombs: Reproductive Technologies and the Battle over Women’s Freedom* (Melbourne: Spinifex Press, 1994), xxvii.
70. Seaman scathingly critiques hormone replacement therapy in *The Greatest Experiment* as an “experiment” done without people’s informed consent or knowledge. She argues that the history of estrogen therapies has been “shoot first, apologize later.” In other words, there is inadequate proof that the drugs work for what they are supposed to do, little research was done on appropriate dosages and potential short- and long-term risks and benefits, and their links to cancer have been ignored in the pursuit of profits at the hands of the pharmaceutical companies. See also Michelle J. Naughton, Alison Snow Jones, and Sally A. Shumaker, “When Practices, Promises, and Policies Outpace Hard Evidence: The Post-Menopausal Hormone Debate,” *Journal of Social Issues* 61.1 (March 2005): 159–79.
71. See United Animal Nations, Anti-Premarin Campaign at <http://www.uan.org/antipremarin/rxforcruelty.html> and http://www.pmuerscue.org/about_pmu.php (accessed June 14, 2006).
72. According to a 2005 Human Rights Watch report, meat-packing is the most dangerous industry in the United States, with few worker protections. It is also increasingly an industry populated by immigrant workers. See “Blood, Sweat, and Fear: Workers’ Rights in U.S. Meat and Poultry Plants,” retrievable at <http://www.hrw.org/reports/2005/usa0105/> (accessed June 14, 2006).
73. Roger Horowitz, “Meatpacking,” in *Gender and Technology: A Reader*, ed. Nina Lerman, Ruth Oldenziel, and Arwen Mohun (Baltimore: Johns Hopkins University Press, 2003), 267–94.
74. Feminist vegetarian critic Carole Adams connects animals to nonwhite populations and attitudes tied to colonialism and racism. Carol Adams, *The Sexual Politics of Meat: A Feminist-Vegetarian Critical Theory*, tenth anniversary ed. (New York: Continuum, 2000), 40–41.
75. Roger Horowitz, *Putting Meat on the American Table: Taste, Technology, Transformation* (Baltimore: Johns Hopkins University Press, 2006), 151–52; emphasis added.
76. Scott Ratzan, ed., *Mad Cow Crisis: Health and the Public Good* (New York: New York University Press, 1998); Sheldon Rampton and John Stauber, *Mad Cow USA: Could the Nightmare Happen Here?* (Monroe, Me.: Common Courage Press, 1997).
77. Haraway, *Simians, Cyborgs, and Women*, 177.
78. See *Undivided Rights: Women of Color Organize for Reproductive Justice*, ed. Jael Silliman, Marlene Gerber Fried, Loretta Ross, and Elena R. Gutierrez (Cambridge, Mass.: South End Press, 2004).
79. David Leonard Downie and Terry Fenge, eds., *Northern Lights Against POPs: Combatting Toxic Threats in the Arctic* (Montreal: McGill-Queen’s University Press, 2003).
80. Further research showed why and how these high rates of contamination were possible. First, there are the unique properties of POPs and organochlorines in the Arctic. These contaminants are released (low estimates are 70 percent from the United States, 11 percent from Canadian sources, and 5 percent from Mexican sources), then travel by atmospheric and ocean currents to the Arctic, where they are

deposited and enter the food chain. They are lipophilic (fat loving), which means they bioconcentrate in fatty tissues and biomagnify as they move up the food chain. Second, Arctic indigenous populations consume at the top of the food chain (particularly marine mammals), absorbing high levels of contaminants in traditional foods, such as narwhal, walrus, and beluga blubber.

81. The 1998 Aarhus Protocol covers North America and Europe and is part of the 1979 U.N. Economic Commission for Europe, Geneva Convention on Long Range Transboundary Air Pollution. The 2001 Stockholm Convention was the first global treaty that seeks to eliminate substances specifically toxic to the environment (by September 2002, 151 countries had signed and 21 countries had ratified it; a minimum of 50 country ratifications are necessary to enter it into force).
82. The Stockholm Convention in the Context of International Environmental Law—the agreement was a milestone in multilateral environmental law. In less than three years, a global treaty was negotiated, which focused significantly on implementation.
83. “The Inuit Journey to a POPs-Free World,” in *Northern Lights Against POPs*, ed. Downie and Fenge, 256–72.
84. See Theo Colborn, Dianne Dumanoski, and John Peterson Myers, *Our Stolen Future: Are We Threatening Our Fertility, Intelligence, and Survival? A Scientific Detective Story* (New York: Dutton, 1996), and Deborah Cadbury, *The Feminization of Nature: Our Future at Risk* (London: Hamish Hamilton, 1997). I am also indebted to historian Nancy Langston for her ongoing research on this topic.
85. Sheldon Krimsky, *Hormonal Chaos: The Scientific and Social Origins of the Environmental Endocrine Hypothesis* (Baltimore: Johns Hopkins University Press, 2000).
86. Aidan Davison, *Technology and the Contested Meanings of Sustainability* (Albany: State University of New York Press, 2001), 93.
87. *Ibid.*, 166.
88. Dutton, *Worse Than the Disease*, 80.
89. Sandra Steingraber, *Having Faith: An Ecologist’s Journey to Motherhood* (Cambridge, Mass.: Perseus, 2001).
90. This quote is from Susan Wood, talking about her sister, Betsy, in Braun, *DES Stories*, 60; emphasis added.