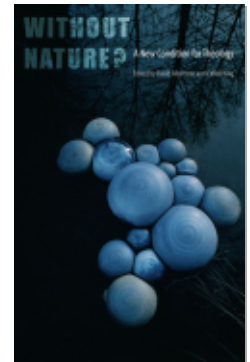# Without Nature?

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Emergent Forms of Un/Natural Life

Michael M. J. Fischer

Nature is an ambivalent term meaning both what is other to us and what is essentially ourselves. Even as our selves (our characters, our bodies, our selfhoods), nature is often "other," that from which we attempt to separate ourselves and upon which we are dependent, which we attempt to control but which always escapes our reach.

Four kinds of nature defining self and other seem to have risen to the top of political, philosophical, and moral agendas in the past quarter century: (1) so-called "natural" catastrophes and the problems traditionally associated with the "control of nature" (ecological nature); (2) "industrial" accidents and the unintended negative consequences of new technologies associated with first-order industrial processes and the military-industrial complex as well as with renewed calls for deliberative democracy, social accountability, and environmental justice related to older environmental interests in remediation, preservation, and conservation (environmental nature); (3) contestations over agricultural and medical biotechnologies (and the life sciences more generally), and their potential for reorganizing conceptual categories of life, the viability of human beings and their habitats, as well as more targeted concerns about genetic and pharmacological enhancements and inequalities (nature in the life sciences); (4) shifting relations with companion species, both domesticated (including modified

organisms for medical research) and wild (particularly viruses, such as avian flu strains that map the changing relations among species and habitats) (coevolutionary nature).

We live (again) in an era in which new ethical and political spaces are thrown up that require action and have serious consequences but for which the possibilities of giving adequate reasons quickly run out.[1] Traditional ethical and moral guides seem not always helpful, particularly when some of the very categories of discussion (such as "nature") have morphed, disaggregated, and become distributed. We are often left to negotiate multiplicities of interests and trade-offs in serial legal battles or other tournaments of decision-making over time. As an anthropologist, I am interested in the ways emergent forms of life embed institutional and ethical orientations, inventions, and productivities and how these vary or contrast in different places and times. Are there pressures toward new "reflexive" or "second-order modernization" institutions, or do we fail to learn from one crisis to the next, allowing involution of institutions, hierarchies, and sanctioned behaviors? What social, literary, and material technologies are used to frame and negotiate trade-offs, crises, and dilemmas? I take it as given that "one cannot change only one thing"; interconnections are interesting, puzzling, surprising, and they spur us to reframings and new institutions. This might be called the "ecological rule."

Narrating First Nature: Catastrophe, Deep Play, Repetition, and Social-Ecological Learning

As the devastation of Hurricane Katrina unfolded in 2005, I mused over whether it was surreally following a radio script of 1931 by Walter Benjamin, "*Die Mississippi Überschwemmung 1927*" ("The Flooding of the Mississippi 1927").[2] Benjamin did a series of radio "children's stories" on catastrophes, the Lisbon earthquake of 1753 being another celebrated one.[3] Both tales continue to have resonances for today. In the Lisbon quake tale, Benjamin asked if new predictive technologies (seismology for earthquakes, satellite monitoring for hurricanes) would successfully enable the avoidance of future crises. In the Mississippi River tale, Benjamin directly addressed social failures.

The 1927 flood, caused by heavy rains from August 1926 through the spring of 1927 displaced over 1 million people from the Lower Mississippi River region (from Cairo, Illinois, to the Gulf Coast). Some 23,000 square

miles flooded from Virginia to Oklahoma. People took refuge on the tops of levees. Some 660,000 were fed by the Red Cross.[4]

The impact of the heavy rains was exacerbated by poor engineering decisions to improve the flow of the Mississippi River. At issue was not only the struggle against the meandering of the great river to make it stay in its banks and flow "efficiently" from north to south; more to the point for Benjamin was the dynamiting of the dikes that protected rural regions, making vulnerable the land and the homes of the rural poor for the interests of New Orleans. Troops were called out to suppress threat of civil war. As in 2005, St. Bernard Parish was flooded, but in 1927 the breaking of the dikes was neither a natural nor a necessary event but a political decision to send a message to the New York and Chicago financial institutions that measures would be taken to protect the city of capital, the *Hauptstadt*. New Orleans was not only the great port for agriculture but also the banking center for the sugar and cotton interests of the Mississippi Valley. Despite these measures, the New Orleans banks were nonetheless wiped out, and agriculture already in depression in the Mississippi Valley was further devastated.

Poor African-American sharecroppers in Greenville, Mississippi, and elsewhere were prevented from evacuating (lest they leave for good) and were pressed into rebuilding the levees at gunpoint (albeit paid a dollar a day). Echoes might be heard in the 2005 Bush administration's lifting of the rules on paying workers the going rate. Instead of either employing local labor at the legal rate or giving work to the many local illegal Mexican immigrants hiding from the authorities in the devastated city and surrounding areas, the Bush administration brought in fresh Mexican labor from Texas.

Benjamin commented on the destruction of the electronic communications system that ran along the levees. In 2005, again, one of the system failures was our much-vaunted communications networks, hampering first responders and rescue workers.

As a coda, Benjamin added the story of three brothers stranded on a roof. Despairing that any rescue boats would stop for them, one jumped to his death just before the other two were rescued. This figures as a miniature to the larger story and is part of Benjamin's polemic against techno-optimism. Catastrophes, Benjamin says, blast us out of the continuum of history and provide illuminations of different orderings of nature, history, limits to strategic planning, cost-benefit accounts, and other claims of rational prudence. They function analogously to traditional theological parables of human beings' best-laid plans gone awry due to inevitably partial knowledge.

The 1927 flood was a transformative event in a number of regards. First, it dramatically changed the way Americans thought about the federal government's responsibility for its citizens.[5] Previously the federal government had felt little obligation to provide food or shelter to disaster victims. President Coolidge refused to visit the disaster areas but did send Herbert Hoover, empowered him as a cabinet-level officer, and put him into the military chain of command. Hoover coordinated relief efforts of the Red Cross and other agencies. The newsreel imagery of the disaster and Hoover's coordination of relief propelled him into the presidency. Some of this footage can be seen in the documentary *Fatal Flood* produced by Chana Gazit and released in 2001.[6]

Second, the 1927 floods changed race relations in the Delta and across the United States. Three times as many African Americans migrated to Chicago, Detroit, Houston, and Los Angeles in the wake of the flood as would do so during the Depression of the 1930s, which is usually counted as the cause of the Great Migration. Previously, because of labor shortage, the laborers and sharecroppers had been treated relatively well, but after the prevention of evacuation and forced labor in the immediate aftermath of the flood, patrimonial relations with plantation owners were broken.[7]

Third, the 1927 flood changed the way in which the Army Corps of Engineers attempted to control the river.[8] Rather than work against the river's momentum, containing the river within narrow banks to increase the speed of water flow, and self-dredging for navigation (the so-called "levees only" strategy), the Corps moved to a strategy of working with and leveraging the flow of the river, directing it via "outlets" and Eads' jetties, named after the engineer James Eads. In 2005 a design flaw eerily similar to the "levees only" strategy operated: canals built in the 1960s to speed shipping funneled Katrina storm surges from the Gulf of Mexico into Lakes Pontchartrain and Borgne and on into the city.[9]

The 1928 Flood Control Act initiated the United States' largest civil engineering project (Project Flood) and shifted relations between the federal government and the states, constructing safety valves, controlled spillways, and fuse-plug levees. In the 1940s the Mississippi Basin Model, a forty-acre physical model of the river, was built by German prisoners of war. It was used as an experimental system for testing large floods and control systems until 1973.[10]

Whether Hurricane Katrina in 2005 will have some similar transformative effects remains to be seen, but a number of features articulate even broader concerns than those of 1927. There are suggestions of connections with anthropogenic climate warming, not just with civilian addiction

to fossil fuels but possibly with Cold War military experiments disrupting the chemical and electromagnetic circuits of the planet.[11]

I want to pose three kinds of analytic frames here: deep play, the balance between decentralized and centralized control systems, and reflexive social institutions and dialogic narrative capacities.

DEEP PLAY

Catastrophic events and their associated political contestations often become deep play: sites where dynamically a number of meaning structures "implode" or intersect and where society dramatizes to itself the meaning of its own representations about the moral order. It is said from various "rational" and "cultural" (e.g., Cajun backcountry) points of view that controlling the Mississippi River in whole or in some of its parts (e.g., destroying wetlands along its banks) is hubristic and self-defeating. Yet, as with many death-defying sports (and some dangerous and death-challenging technologies), the struggle with the Mississippi has also been seen as the grandest of human agons: the Corps of Engineers against nature.

The struggle with the Mississippi is a deep play in the Geertzian sense,[12] giving meaning to endeavors to define human nature against its others. Overinvestments of money, passion, and political resources constitute a nexus in which multiple registers of meanings are densely knotted. New Orleans, after all, is the great port of Midwestern agriculture, a great transshipment port of oil and petroleum, and the cultural entrepôt of French, Cajun, African-American, and Southern cultural distinction. But in a Benjaminian flash of catastrophic illumination, it also reveals the irrationalities of class and racial inequality, of the ethical (or social justice) unconcern on the part of political and financial elites, of bureaucratic fiefdoms, and of technological decay and miscalculation.

The cost-benefit calculations of 1965, for instance, remain unchanged forty years later. Cost-benefit analysis itself might be challenged as a questionable methodology when lives are at stake. A measure of unconcern might be the only token funding for the 1998 plan to save wetlands and rebuild the Louisiana coast (the Louisiana Coastal Area Project, or Coast 2050). This play of plan and underfunding is a deep-play demonstration of meaning and values, dramatized, televised, and for a time put out for public discussion. One might narrate these meanings, as is usually done in the press, as a play of "indictments" and "defenses," in a mock-litigious, American-style shadow play of skeptical "civic epistemology," where "truth," "fact-finding," and "meaning" are said to be established through

adversarial contestation, but where testimony under oath cannot be sub-poenaed or compelled. The existential and ethical deep-play agons are refracted as well in plays, in music, and in debates about how much aid and succor should be provided by the government and how much by civil society and "faith-based" organizations.[13]

BALANCE BETWEEN DECENTRALIZED AND CENTRALIZED
CONTROL OR GOVERNANCE SYSTEMS

This second set of questions about alternative social organizations has become "mission critical": What sorts of centralized or decentralized governance might be most effective in dealing with future hurricanes or similar events, including the building and maintaining of seawalls, levees, and wetland defenses, but also the prepositioning of emergency supplies, the bolstering of local responders, shelters, and evacuation facilities. Walter Benjamin's question resonates: What use are our predictive abilities if the social institutions exacerbate the damage?

The comparative case of the seawall in the Netherlands, built after the devastations of the 1953 floods, has been primarily discussed in technological terms, but an anthropological science and technology approach should also turn attention to the political and organizational robustness required. The 1953 floods killed almost two thousand people and forced the evacuation of seventy thousand. It could have been much worse. Half the country, including Amsterdam and Rotterdam, is below sea level. Dramatically, a Dutch sea captain sank his boat in a widening breach to protect Rotterdam. The project to improve the sea defenses with a new design that allows water through to maintain the wetlands in at least a portion of the coast caused a huge domestic debate. The new design and the debate also shifted the relations between the central state and local water councils.

Decentralized water councils have long been connected to Dutch democratic and self-reliance organizations. Over the course of the twentieth century, the state water-control authorities created a symbiotic system of state planning and the outsourcing of construction and maintenance to private sector companies. The new effort required new organizational forms, both in negotiating the new plans and in construction and maintenance.[14] In the end, a compromise in the new design was dictated by the politics of budgets, as described in Wiebe Bijker's 2002 article. One leaves Bijker's account worried with the Dutch about how secure the system is, even though it currently seems to be functioning well.

The Dutch debate continues as to whether one can hold the sea back as the land sinks. Perhaps, it is debated, one ought to invest in floating

cities; indeed, in parts of the Netherlands new construction is required to be on pontoons. Other experiments for comparative attention are the floodgates on the Thames, those on the Adriatic to protect Venice, the superlevees being built in Japan, the concrete shelters on stilts in Bangladesh built in the aftermath of the 1991 hurricane and storm surge, and California's "smart" levees using "time-domain reflectometry" sensors to monitor whether the dikes are weakening.[15]

The loss of life and livelihood in these comparative cases of the Netherlands and Bangladesh should refocus attention on deep play structures of meaning embedded in modalities of social organization. An estimated eight hundred to a thousand lives were lost immediately in the Hurricane Katrina flooding (not considering excess mortality figures in the ensuing years), and almost immediately questions were raised about how many of these were from the poor, disabled, and minority communities and what would happen to these communities and people as the city rebuilt and perhaps in the process gentrified. Kerry Emanuel, one of the scientists studying the connections of hurricanes with climate warming, pointed out in an interview that "tropical depression Jean the previous year—it was just a depression—killed almost 2,000 people in Haiti. Hurricane Mitch in 1999 killed 11,000 people in Central America. And a decade before that, a hurricane in Bangladesh killed 100,000 people."[16] Emanuel suggests that the United States is relatively lucky in having been able to prevent loss of life, that people should be encouraged to stop building along vulnerable coastlines, and that the differences between the vulnerability of the poor and rich are replicated in international comparative terms as in class terms within New Orleans. Charles Perrow, a sociologist of vulnerabilities in high-risk technologies, argues that New Orleans should be maintained at about one third its pre-Katrina size—large enough to sustain the vital port functions, but small enough to be defended with Dutch-style technologies against future storms and sinking coasts.[17] New Orleans is already at two thirds its pre-Katrina size.

Even more went wrong in the New Orleans case with the breakdown of evacuation and relief preparedness. A previous evacuation effort in 2004 had resulted in gridlock on the highways. The repeat highway problems in 2005 indicate a certain failure in social learning. As Katrina approached, newsmen prepared reports on the 1965 Hurricane Betsy disaster, when eighty-one people died, 250,000 were evacuated, the ninth ward was flooded, people had to be rescued from their rooftops, and rumors flew that water was pumped out of the mayor's Lake Vista subdivision into the Ninth Ward and even that the Industrial Canal was deliberately breached

to flood out black people. Worst-case scenarios, with computer-generated Sea, Lake and Overland Surges from Hurricanes (SLOSH) models (run by the National Hurricane Center) had long been in circulation.[18] One wonders if any of the modelers or first-responder agencies had thought much about Charles Perrow's models of "normal accidents" (as he titles his book on managing risk in high-tech industries). It was reported that a $1 million hurricane simulation exercise in New Orleans in 2004 exposed many communication and logistical problems that remained unfixed.[19] Speculation began about what the long-term effects of the trauma would be on those who would remain separated from their social networks in the Ninth Ward and elsewhere—whether we would see, for instance, a spate of suicides (two suicides were reported among the police during the storm). In sum, governance questions regarding the balance and integration of regional plans (such as Coast 2050) with decentralized local initiatives and knowledge, ecological planning for cities such as New Orleans, and federal level coordination remain deeply problematic. "Learning from catastrophe" is a social institutional issue par excellence. It is also a cultural arena of "deep play" in which multiple interests, strategies, passions and investments interact, often in unacknowledged ways, in planning documents and bureaucratic politics.

REFLEXIVE SOCIAL INSTITUTIONS AND DIALOGIC NARRATIVE CAPACITIES

The third set of questions, therefore, has to do with the creation of flexible and reflexive social institutions of second-order modernity that can make use of a rich interchange of communications and dialogue between decentralized capillary powers of decision-making and central nodes of macro-coordinated support. Despite the multidimensionality of the deep play surrounding a catastrophe and the following reconstruction, restitution, and rehabilitation, planning tends to elicit from government and major relief agencies a monological rather than dialogical form of mapping complexity within a semiclosed world of expertise that assumes everything can be viewed from a commanding height: the Mississippi Basin Model that was used from the 1940s to 1973; a FEMA office in Washington; a simulation model in a university. One of the interests of comparison with the Dutch case is to probe the possibilities of on-the-ground community involvement and investment in complex sociotechnical systems, particularly under long-term anticipated changes such as climate warming and rising sea levels.

From a hydrological point of view, both the 1927 floods and the 2005 hurricane flooding, despite their quite different causes and directionality, are part of a long series of Mississippi floods (1858, 1862, 1867, 1882, 1884, 1888, 1890, 1927, 1965, 1993, 1995, 1997, 1998, 2001). In 1965 Hurricane Betsy flooded New Orleans as Katrina did in 2005, and it was in 1965 that standards were last set for the strength of the levees on a dubious basis of cost-benefit analysis. The most significant of these floods in recent memory were the 1993 floods (both the fourth "hundred-year flood" in eight years, and a "five-hundred-year" event, causing some $12 billion in damage). The causes of the 1993 flooding included an unusual shift in the jet stream that blocked a cold front and kept heavy rains over the Mississippi for six weeks. By August, 1,083 levees had failed.

This 1993 flooding stimulated some changes in floodplain management, reinforced by the Upper Mississippi floods in 2001. Instead of rebuilding in the floodplain, houses and even whole towns (e.g., Valmeyer, Illinois, in 1993; parts of Davenport, Illinois, in 2001) were moved away from the floodplain. Federal incentive programs for restoring wetlands began; an estimated half of all wetlands of the Mississippi Basin are said to be gone, and in the Delta some of the farmland, now used for catfish farming, gets its water by pumping from the aquifers below. One study found that 40 percent of flood insurance payments go to repeat victims, who represent 2 percent of policyholders; one house worth $114,000 received payments worth $806,000 for sixteen floods over eighteen years.[20]

Apart from these ecological, technical, and social management problems, there has been speculation about the role of climate change (as well as murky questions about the impact of military experiments on the atmosphere).[21] While no direct correlation between individual events and climate change can be established, it is statistically the case that we are in a warming phase and that there is a correlation between warming waters and the energy that goes into more intense hurricanes. The 1940s and 1950s were a period of intense and strong hurricanes, followed by a lull in the 1970s and 1980s, and we appear to be in another upswing. From the statistics of the Atlantic storms (11 percent of total storms) there is no way to associate the increasing intensity of hurricanes with anything but a natural cycle. On the other hand, Kerry Emanuel also says that globally it appears that "the intensity of hurricanes is going up owing to global warming, and their duration is increasing, as well."[22] He does not think that we will see any direct evidence in the immediate future; it will take time for the connections to become evident. In half a century the connections will be more evident—insurance companies: take note. In the meantime, particularly during the 1970s and 1980s (when there was a lull in the

intensity of tropical storms), there have been significant construction and population growth along vulnerable coastlines.[23]

For New Orleans, climate change is experienced most directly by rising sea levels, which will put the city lower and lower below sea level over time. As shown by Amsterdam, Galveston, and other places around the world, this is not necessarily an insurmountable engineering or social problem, but it is one that requires local knowledge and investment. For the greater New Orleans region, rising sea levels are but one factor contributing to the collapse of the coastal area, together with the loss of alluvium which is washed out to sea by the channeled Mississippi but would otherwise be deposited along the riverbank, shoring up the coast and nurturing the wetland's protective zones. Deposits of nitrogen and other chemicals from fertilizer runoff (and perhaps other sources) in the alluvium cause hypoxia, creating dead zones in the Gulf, and land slumping due to depressurization from offshore oil drilling further contributes to loss of wetlands.[24]

We thus come full circle in these first narratives of nature. "Catastrophe" and "deep play" provide windows into our responses, passions, and meaning structures. They help us see ourselves as not particularly puny microorganisms in the larger scales of the universe and our multiple worlds or frames of reference. Even very small organisms, we learn from ecological studies, have cascading effects that can change larger-scale systems.[25]

Second Natures: German Modes of Production, French Parliaments of Things, and American Regulatory Sciences

The contamination events at Minimata, Japan (mercury poisoning from Chisso Corporation's chemical factory's wastewater over the 1932–1968 period affecting some 2,265 people in official counts by 2001), Love Canal (21,000 tons of toxic waste found buried in Niagara Falls township in New York State, causing declaration of a public health emergency), Bhopal, India (42 tons of toxic methyl isocyanate released from a Union Carbide plant in 1984, killing thousands within two weeks and many more since), Chernobyl (1986 nuclear reactor release of radioactivity which badly contaminated the immediate area in the Ukraine and also drifted over large parts of Eastern and Northern Europe and beyond), and Woburn, Massachusetts (dumping of carcinogenic toxic waste from tanneries and three industrial plants and ill-advised drilling of two water wells by the city,

causing a cluster of leukemia cases and an important book and film that helped transform public awareness) form a series of engagements with the complexity of our environment and nature different from earthquakes, hurricanes, and tsunamis. They have to do with our chemical industries, our bodies, and our engagements with high-hazard, high-consequence missions, including medicine and public health, aeronautics and space flight, and nuclear industries. It was Friedrich Hegel and the generations that would conceptualize the transitions between the first and second industrial revolutions who elaborated the notion that men and women create around themselves a reworked nature, a second nature, a technological and cultural nature that is increasingly difficult to separate from nostalgias for a lost, primal, and mythic first nature. In literature and rhetoric, this lost pastoral was used to criticize and critique industrial, urban society.[26]

But it is within the politically "green" lineage of concern (from Rachel Carson and Barry Commoner onward in the 1960s United States, and from the election in 1983 of the Greens in Germany) that a different register of work has emerged, probing for voluntaristic, politically organized ways in which society could be reorganized to protect itself from the dark sides of its own production.[27] While there are striking parallels across countries in the processual or dramaturgical responses to industrial disasters that affect the environment and public health across national boundaries,[28] there are also dramatic differences in cultural politics, in the presuppositions of how political decisions should be legitimately resolved (Sheila Jasanoff's "civic epistemologies"), and in the unstable coalitions of actors "called forth" by particular conjunctures of crises, social pressures, and double-bind commitments (Kim Fortun's "enunciatory communities").[29]

The concept of "enunciatory communities" constituted in the vortex of contradictory demands helps make clear the importance of dialogical accounts (multiple play of arguments across interests, values, perspectives) that are often pushed into the background of monological expert summaries. In the Bhopal case, to take the double binds of three of the key enunciatory communities: the State of India, the women's association of affected families, and the lawyers for the victims. The Indian state attempted to represent the victims and at the same time publicly assert the hospitality of India to foreign capital. The women's association of methyl isocyanate gas–injured families asserted women's agency and yet had to recruit a male leader, who unfortunately fell into a typical male patriarchal mode of leadership antithetical to the women's organization. The lawyers for the gas-injured needed to appeal the dismissal of their suit in New

York against Union Carbide on jurisdictional grounds (because their clients would get less compensation in Indian courts than would American victims of similar accidents on U.S. soil, an invidious double standard of justice) without thereby asserting the incompetence of Indian courts to provide fair trials. The Indian government was a party to charges of not enforcing safety regulations as well as having conflicting interests in the legal outcome. The lawyers wanted to force Indian courts to hold the Indian state accountable.[30]

Enunciatory communities and dialogical narrative formats are among the conceptual tools that can register and incorporate the multiple points of view that are required in *real time*, lest complex social systems under crisis conditions break down. The best-known of these formulations is, perhaps, Ulrich Beck's notion that we are entering a second-order modernization, coordinated and governed through new reflexive social institutions.[31] We increasingly live, he argues, in risk societies, producing risks and dangers that are not calculable in the way the insurance industry constructed actuarial tables for factory accidents in the nineteenth century. Beck's narrative begins as a delightful, almost parodic, reprise of the language of Karl Marx on the transformation of feudal modes of production into industrial capitalist ones. It has the same doubleness of rhetoric, being simultaneously hortatory for a politics without which the transformation cannot occur and descriptive of the internal institutional pressures to save old capitalist and bureaucratic forms from their brittleness and simplistic rationalities. Marx's notion of new modes of production arising from the accumulated pressures and contradictions of older modes of production is adapted by Beck to frame a structural account of shifts and changes.[32]

Beck's elegant argument is that our chemical and nuclear industrial processes, among others, are producing risks that we cannot see without scientific instruments, that respect no political or class boundaries, and whose causality and thus liability are hard to trace. In preindustrial society, risks were largely not man-made. In industrial society, insurance systems were based on understandings of systematic causation and statistical probabilities, so that rules of liability and compensation could be devised. But in risk society, risks accumulate slowly, are not limited in time and space, affect future generations, and are often testable only after the fact. The globe thus becomes used as a laboratory for toxic waste, the spread of illness vectors, and cascades of nonlinear causalities that make accountability diffuse and rules that the polluter pays hard to enforce.

In such circumstances corporate behavior becomes a shell game of defensive and competitive actions, as when one industry publicizes risks of

another industry (for instance, the nuclear industry publicizing the ozone hole[33]). The ad campaigns so generated contribute to wild swings in public mood between hysteria and cynicism. Politicians are urged to make dramatic policies based on such mood swings. "Parapublic" expert bodies are created by political leaders to contain public anxiety and often to narrow and contain public debate. The logic of social divisions is reorganized sometimes along sectoral lines rather than class lines, with, for instance, tourist industries opposed to chemical industries. (The Po Valley is one of Beck's exemplars since it is both a crucial tourist landscape and the heart of industrial production in Italy. The tourist industry wants green environments free of the pollution by-products of the chemical industries. The political stakes and social divisions, Beck argues, thus fall out differently in risk society than in industrial society).

Some of these differences between industrial and risk society contribute to the decay and brittleness of legacy industrial-society institutions.[34] For instance, demands for ever-higher standards of scientific accuracy and causal linkage can be used to minimize risk and the need to take counteraction.[35] But other features militate toward reparative and potentially transformative institutional forces such as pressures toward green production and the use of consumerism to drive ecological consciousness (rights of consumers to clean air and water; increasing market segments for organic food; citizen pressure toward mobilization of socially administered security). One of the key features of these new institutional forms is "reflexive" social organizations that are able to integrate and use input from many different positions in society rather than relying on isolated top-down expertise of policy planners, factory designers, or laboratory scientists.

Minimata, Love Canal, Woburn, and Bhopal all provide case examples of the agonistic battles to evolve "reflexive" social organizations. The "dramatological" pattern of citizens having to struggle against older corporate and bureaucratic structures is one of citizens noticing cancer clusters or seemingly patterned illnesses, demanding from the state epidemiological surveys, being denied by the state and corporate authorities on the ground that the alleged causality is impossible, that the industrial processes in question were carefully constructed in the lab.[36] That shop-floor practices are frequently different from lab practices is often overlooked and denied, and in the case of the Union Carbide plant in Bhopal, safety features were being dismantled because the entire plant was scheduled to be closed and moved. Citizens thus are forced to find scientists and epidemiologists who can collect sufficiently rigorous data to stand

up in court, and once this barrier is passed, a long and arduous community organizing process must be launched to get remediation, restitution, compensation, and medical and other help. In the Minimata case, the effort was still ongoing after thirty years, in the Bhopal case new charges were filed on the twentieth anniversary, and in Woburn, community activists are still fighting after twenty years.

Love Canal spawned a toxic-chemical clearinghouse alliance for communities across the country. Superfund legislation in the United States mandated citizen action panels, providing the citizens some funding to hire technical experts in their battles with corporations, military installations, and government facilities. Tactics of both citizen organizing and corporate defense have evolved over time. In the Louisiana chemical corridor, older civil rights organizing traditions helped with environmental organizing, only to be countered by petroleum companies organizing their own "grassroots" organizations, a tactic which is the subject of at least one corporate "how to" guide.[37] The Bhopal case involved litigation in the United States as well as India, and the parallels with struggles over Union Carbide's plant in Institute, West Virginia, illustrate that the Bhopal struggles were not merely due to "Third World backwardness." In West Virginia, capital was less mobile but labor was made mobile, with Mexican labor brought in to stop local union organizing. The post-9/11 concerns about terrorism reversed the drive toward right-to-know postings on the Internet of emission releases and worst-case scenarios for local residents.[38]

Still the argument for second-order modernization or "reflexive" social institutions remains vital and more general than these particular cases of breakdown. Silvio Funtowicz and Jerome Ravetz note that "policy-relevant science," or what Jasanoff more felicitously calls "regulatory science," operates differently from normal science (in Thomas Kuhn's sense) or even consultancy science (where there is thought to be an application of available knowledge to well-characterized problems); instead, highly uncertain, contested knowledge is generated in support of health, safety, and environmental decisions, and this requires a quite different sort of peer review, one that is extended to multiple stakeholders.[39]

One of the most intractable (and hence interesting) renegotiations of governance of environmentally damaged and hazardous areas is described in Joe Masco's 2006 study of the lands surrounding the Los Alamos National Laboratory, with quite different legal resources, perspectives, traditions, and data collection among the Los Alamos scientists (whose past hiding of facts has lost them credibility as objective stewards), Pueblos and Nuevomexicanos (both of whom are dependent upon Los Alamos for

jobs), Anglos (often with romantic New Age environmentalism discon-nected from local political economies), and Washington bureaucrats.[40] No longer is Los Alamos or Washington (or the University of California, as operator of Los Alamos) in control of all information or legal standing. This example should provide a comparative probe for other such sites around the world and connects the institutional reflections of this section with the shifts in environmental management and the climate warming debates in which the Inuit are engaged (see note 23).

The degree to which local knowledge, tacit skills, and intuition build up over long periods of practice and experience is critical to the flexibility and robustness of complex systems, whether they are "traditional" knowl-edge (as with the Pueblo and Inuit) or "situated" on the "shop floor" of nuclear power and chemical plants or large engineering projects such as the space shuttle, or in medical operating theaters and emergency disaster relief organizations.[41] These are arenas that will repay detailed ethno-graphic attention in the coming years as the sites for some of the most consequential of ethical decision-making. Philosophically (epistemologi-cally, methodologically), if not practically, the French tradition of political ecology and what Bruno Latour calls the "parliament of things" can per-haps help keep thinking in this arena from falling into overly simple for-mulations.[42] Luc Ferry begins his 1992 book in this French political-ecology tradition by reminding readers about older "natural contracts" that drew together social and human-insect-animal relations in ways dif-ferent from our own natural contracts. In sixteenth-century France, wee-vils and beetles were put on trial, accused by villagers of destroying their crops. Trials were held for insects, reptiles, rats, mice, leeches. Even dol-phins were excommunicated for blocking navigation in a port.[43]

The idea of natural contracts in the French tradition has been picked up by Michel Serres not so much as a matter of rights and standing in court, as in the famous 1972 law review article by Christopher Stone, "Should Trees Have Standing?"[44] Rather, Serres points out that social-contract theory in political philosophy was implicitly local, taking nature as given and as available for appropriation. As technological extensions make human reach global, this implicit relation to the environment en-counters new forms of feedback and resistance. Human societies need to move from positions of parasitism to ones of symbiosis with natural cycles. Serres's notion of a natural contract, Kerry Whiteside explains, is not an ethical act in which people come to an agreement, nor is it grounded in a view of a preexisting nature that is given judicial recognition (as in the sixteenth-century examples), but it is rather a literal *con-trahere* (gathering

together), as in the image of tightening the ropes of the rigging of a sail-boat, "a complex set of constraints and freedoms in which each element receives information through every adjustment."[45]

Bruno Latour's "political ecology" focuses this French tradition of thought as one of shifting competences among "mélanges of things that transcend human control and of actions imputable to mankind."[46] Whereas premoderns sacralized nature and feared nature's wrath, moderns attempted to create purified worlds they could control in science and politics. Today, however, Latour suggests, hybrids have broken through these efforts at purification; global warming, nuclear waste, and genetically engineered plants are among some of these unruly mélanges. In his provocative formulation, he suggests that what is needed is to give such hybrids or mélanges seats in our parliaments and representative assemblies, a parliament of things. The point seems to be that already all such "things" are matters of controversy and disputation among scientists but also among human rights activists, ecologists, government agencies, and others. These negotiations and backstage wars of position (to adopt a Gramscian formula) need to be made visible, explicit, and part of our open representative assemblies. Latour insists that there is no nature independent of human interests and practices that might be used as a standard for preservation or restoration, that life is always in an experimental mode, and that what we need to pay attention to are the mediating instruments, inscriptions, and practices that form what we call "objects."

There is an institutional move here, which perhaps can be seen if read together with Foucault's trajectories and assemblages of biopower. The modern creation of disciplines (labor/economics, language/linguistics, life/biology) for Foucault begins with the collection of social statistics, which can then be used by the state to discipline both bodies and populations.[47] Other material devices, such as the arrangements of prisons, schools, and clinics, contribute to the construction of such disciplining. Latour pays attention to the material assemblages of things and people, the "mélanges of things that transcend human control and of actions imputable to mankind" in his studies of the rise of bacteriology (Pasteur's carefully staged public demonstrations; the creation of the laboratory as an obligatory point of passage; the reversal of ratios of power between farmers and scientists),[48] of intelligent transportation systems (the shifting coalitions enrolled to make a futuristic technological system come into being or fail to come into being),[49] and of the constitutional court that adjudicates new laws in quite a different fashion from the way science would.[50]

Latour suggests that the parliament of things would allow the contours of hybridization or mélange composition to be observed and that the "moral effect" comes not from applying a priori ethical schemas but from a slowing down and modernization of the production of hybrids. This is not unlike the idea of "slow motion" ethnography that Wen-Hua Kuo uses in his recent dissertation on the International Conference on Harmonisation (ICH) of clinical trials among the United States, European Union, and Japan.[51] At issue for Japan is the claim that because Japanese bodies are different in nature from European ones (drug dosages, for instance, are often adjusted), clinical trials must use Japanese bodies. In part this is an obvious political-economy ploy to create a space for a Japanese clinical-trial industry and to block American and European–based pharmaceutical companies from dominating the market. But by patiently and carefully examining the exchanges at ICH meetings, the arguments about the state of the pharmaceutical market in Japan, and how clinical trials are done there, Kuo tries to show that more is at stake, that a hybridization of medical culture is at issue. Japan is also positioning itself to become an obligatory point of passage for larger regional and global markets, with the idea of building a genomics database (which other Asian countries can ill afford).

In all these cases (chemical industry accidents, nuclear accidents, and biological safety and efficacy), unitary expertise narratives seem increasingly less robust than dialogic (not two person, but *dia*-logic, cross argument) ones, involving persons differentially located, with different "stakeholder" interests, or, in Kim Fortun's terminology, enmeshed in different "enunciatory communities."[52]

Nature inside Out: The Double Career of Bioethics in Cultures of Trust, Procedure, and Skepticism

Beyond second natures, we are now, via genomics and proteomics, polymer engineering, material sciences, and other new molecular and nanotechnologies, entering into the promises of regenerative medicine, of rebuilding our natures inside out. The story of the remaking of our natures—from cellular, genetic, or tissue level up, using technological manipulations too small to be seen by the naked eye, revealed thus only through the mediation of scientific instruments and graphical interfaces, and also heavily mediated and interpreted by advertising technologies on the part of companies, on the one hand, and religious groups, on the

other—contains at least four moments. First there is the evolution of institutions of regulation in their different public-sphere settings. England, Jasanoff argues, relies heavily on trust in experts, while Germany relies more on procedural correctness, and the United States on litigation to test and establish regulatory rules.[53] These presuppositions about how decisions must be made are embedded in historically contrasting institutional developments.

Second, there are contrasting policy outcomes, as in the application of the precautionary principle for genetically modified organisms in Europe versus "good science" calculations of probabilities and risk in the United States. The former is more cautious and more embedded in German procedural and bureaucratic traditions. American entrepreneurial traditions view the precautionary principle as inhibiting investment and market support for innovation and development of new technologies. In the case of stem cells, in England the House of Lords voted to permit cloning of human stem cells at the same time that President George W. Bush, on the advice of Senator Bill Frist, blocked federal spending on stem cell research except for the use of already existing stem cell lines (which proved to contain fewer and fewer viable stem cells as time went on, most of which were unsuitable for research on human diseases because they had been immortalized in mouse cells). In England a "pre-embryo" category (blastocysts to the development of the primitive streak at fourteen days) was accepted by the House of Lords,[54] whereas in the United States the term "embryo" (or even "unborn child") was dominant. President Bush's Council on Bioethics translated "reproductive cloning" into "cloning to produce children," shifting the connotations away from reproductive rights, and "therapeutic cloning" into "cloning for biomedical research," shifting connotations away from therapy toward experimental uncertainty and lack of control.[55]

Third, the histories and evolution of deliberative democratic forms are not only different in different countries but also now include considerable transnational histories of treaties, conventions, arbitrations, and adaptation of rules from one another. After the Asilomar conference on safety issues surrounding recombinant DNA technologies in 1975, for instance, U.S. National Institutes of Health (NIH) rules on the handling of recombinant DNA were widely adopted outside the United States, and today clinical trial facilities in India and elsewhere tend to follow NIH protocols closely so as to be able to provide services for companies dependent on the American market. On the other hand, good manufacturing practice (GMP) rules for therapeutic cell technologies (stem cells for bone marrow

transplant) differ somewhat between the U.S. Food and Drug Administration (FDA) specifications and those of the European Union.

Fourth, the battles of marketing campaigns to control the semiotics of new drugs and other biotechnologies—as in the above example of "pre-embryos" versus "unborn children"—can sharply affect the understandings and political room for maneuver of physicians, patients, politicians, and others. Indeed, all four moments involve the boundary work of what is natural or unnatural, of the relation between what can and what should be done, and between what is socially possible (not just ideally possible) and what is socially preventable (and does not return by another route).

Molecular biology techniques have undergone rapid development, beginning in the mid-1970s with the breakthrough in recombinant DNA and proceeding to the biotechnology revolution of the 1980s that brought assisted reproduction technologies, genetic engineering, genomics, the promises of individualized therapies, and now the nuclear transfer technologies of therapeutic (and potentially somatic) stem cell cloning. In the popular press and public discourse into the 1990s, concerns surrounding these techniques often focused on potential category confusions and blurrings: What is your kinship if your genetic material is cloned from a parent? Should organ transplant donors and recipients have any moral ties? What would be the status of living with xenotransplant organs, that is, organs from another species (for example, would one have to live with lifelong monitoring in the beginning, and could that be ethically enforced)? Will human-assisted gene transfer among plants and potentially among mammals change the course of evolution?

Anthropologically (and sociologically) more interesting, however, are the coproductions of social venues for decision-making as these technologies are shaped, because it is in these slow-motion, recursive, repetitive, and contested settings that new ethical stakes become visible, moral systems are developed, fears are distinguished from real danger, and utopian hopes are separated from real possibilities. In contrast to accounts of the evolution of regulatory institutions for dealing with social, ethical, and legal concerns that are simply chronological—by implication, self-correcting, gradual social learning toward flexible, adaptable, second-order modernization or reflexive institutions—the work of Jasanoff and Herbert Gottweiss reminds us that civic epistemologies, moral traditions, and cultural politics look different in different countries.[56] Moreover, the work of João Biehl, Paul Farmer, Fortun, Kuo, Adriana Petryna, Kaushik Sunder-Rajan, and others reminds us that global politics (variously called "the new

world order," "neoliberalism," "empire," and "globalization") also have effects that reach far down into the fates of localities and individuals.[57]

"Ethical, social, and legal issues" (ELSI) is the formula from the Human Genome Project of the 1990s that set aside a small percentage of money for discussions about these issues,[58] but these concerns go back to efforts to regulate and provide oversight for the use of human subjects in experimentation (the Nuremberg Code of Medical Ethics of 1945; the Helsinki Declaration of the World Medical Association of 1964; the Beecher Report of the Harvard Medical School of 1966; and the belated exposure by the *New York Times* in 1972 of the Tuskegee syphilis experiments, which withheld treatment long after a penicillin treatments were available[59]), which produced institutional review board (IRB) oversight for federally funded research in the United States. More broadly, these concerns led to the introduction of "bioethics," a term coined in 1970 by Van Rensselaer Potter and promoted by the Hastings Center (founded 1969), the Kennedy Institute of Ethics at Georgetown University (1971), the issuing of the 1978 Belmont Report (which established the three ethical standards of respect for persons, beneficence, and social justice), and the 1980-to-1983 Presidential Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research.

Potter intended "bioethics" to refer to biology and values, encompassing medicine, environment, public health, and spirituality.[60] But the term was instead rapidly professionalized into a focus on informed consent and the rights of individual patients. This was a period when the frontiers of medical knowledge were shifting from how to cure or prevent infectious diseases to chronic diseases as the key problem of First World medicine. In medical ethics, it was the time of a shift to an emphasis on patient autonomy.[61]

Professionalized bioethics has been severely criticized for being captured by medical schools and more recently by pharmaceutical and biotech companies to provide the ethical veneer on practices they wish to pursue, and criticized, too, by social medicine proponents for its individualist ethics rather than concern with access, inequality, and social justice. Yet, as Jasanoff suggests, a funny thing happened on the way to the forum. As biotechnology in the 1980s moved from laboratory research to the marketplace, civil society also appropriated bioethics as a vehicle for gaining a voice in policy and ethical oversight. Hence the "double career" of bioethics: a formal professionalized form and a more open one in the public sphere. Jasanoff suggests, moreover, that these public-sphere forms work through different civic epistemologies in England, Germany, and the

United States, which she tags with the shorthand labels of, respectively, trust, procedure, and skepticism.[62]

In the 1970s, public concerns over potential escape of genetically engineered organisms from the laboratory and ecological and evolutionary implications of transferring DNA from one species to another were handled by calling for a self-imposed moratorium. Then, at the 1975 Asilomar conference on DNA, regulatory controls were proposed that were made into NIH guidelines. By 1979 the debate over the safety of recombinant DNA research had been contained (to resurface later, however, in Germany and Switzerland regarding bovine growth hormone). As experience accumulated, the NIH guidelines were gradually relaxed. Jasanoff suggests that the experts at the time were not able to conceive that in the future this technology might destabilize kinship or farmers' rights to replant seeds.[63] An important feature of such parapolitical modes of control (presidential commissions, National Academy of Sciences studies, etc.) is the way in which they narrow what is to be considered and thereby contain public discord. As technologies move into the marketplace, Jasanoff suggests, these techniques of containment become subject to public scrutiny and contestation, and at the same time broad ideological positions become more nuanced.[64]

In the United States, 1980 saw dramatically changing institutional and patronage environments for the biosciences and for the creation of a new power-knowledge nexus emerging around the new biotechnology institutions. Four arenas were changing: modes of funding, parapolitical modes of expert regulation (and containment of disputes), market forces and the relation of scientists to the market, and legal rulings and guidelines. This was the year of the Bayh-Dole Act, which fostered rapid development of new biotechnologies by encouraging NIH-funded research at universities to be patented and licensed to the private sector. The 1980 Chakrabarty Supreme Court case opened the floodgates to patenting of life forms as manufactured products, processes, and new composition of matter.[65] Another case, *Foundation on Economic Trends v. Heckler*,[66] found that the public interest was not satisfied by expert review, but required more open deliberative processes. The 1980 Superfund legislation (the Comprehensive Environmental Response, Compensation, and Liability Act) provided for citizen action panels or remediation review boards with some funding to empower citizens to hire their own experts independent of government agencies.

This was a period in which advertising became more and more sophisticated as well. Copyright, patent, trademark, and brand names, Donna

Haraway suggests, are the "genders" (generic marks, "directional signals on maps of power and knowledge") of "asymmetrical, congealed processes which must be constantly revivified in law and commerce," especially in our new world of creating transuranic elements and transgenetic organisms.[67] The FDA in 1991 streamlined approvals for biotech food by introducing the criterion of "substantial equivalence." Review would only be triggered if there was an indication that toxic or allegeric reactions were caused by substitutes or changes in nutritional content. What is important, the FDA reasoned, is the product, not how it is made.

This rationale required revision in the later 1990s struggles over "organic food" labeling. As Jasanoff points out, in 1993 recombinant bovine growth hormone (rBGH), also known as recombinant bovine somatotropin (rBST), was approved despite its questionable need in a dairy industry that already produced surpluses, its likelihood to aid only large producers (and drive out small ones), and its possible effects of mastitis in the animals.[68] Monsanto opposed labeling of rBST. Labeling is a powerful tactic in building a market. Lack of labeling means it is harder for consumers to opt out. Labeling, Monsanto argued, could negatively affect markets by suggesting that something was wrong. The civic epistemological form that opposition in the United States was forced to take was of developing counterscientific arguments such as that rBST is not obviously "substantially equivalent" because it has additional amino acid subunits (linker proteins).

Similar struggles over the labeling of organic foods in the 1990s eventually conceded to the organic growers and their lobbies that foods treated with irradiation or produced with the use of sewage sludge as fertilizer, also genetically modified (GM) foods, could not be labeled "organic." Not only the product was important, but also how it was made. By the time this point was conceded by the U.S. Department of Agriculture, organic farming had become a $6 billion industry producing 2 percent of the nation's food and was growing at a rate of 20 percent a year.[69]

Opposition to genetically modified foods, Jasanoff points out, was always part of wider issues (agricultural practices, nature preservation, integrity of food) and national styles of civic epistemology or cultural politics. In England, the crisis over bovine spongiform encephalopathy (BSE; mad cow disease) in 1996 created a breakdown in confidence in the Ministry of Agriculture, Fisheries and Food and contributed to the defeat of the Conservative government. New deliberative democratic forums were created to rebuild confidence under the new Labour Party government. A public debate, "GM Nation?" was organized through a Web site, and

more than six hundred public meetings were publicized via the Genewatch Web site. A citizens' jury was organized by Greenpeace with the University of Newcastle and the Consumer's Association and with sponsorship by Unilever and the Co-op Group. The Prime Minister's Strategy Unit did a cost-benefit analysis, presenting models and precautionary methods in public seminars to prepare people for potential "Shocks and Surprises." The government chief science advisor organized an expert advisory process with open meetings and expanded panel membership. Jasanoff notes that in view of displays of scientific and social unknowns through these attempts at public education, the government announcement of March 2004 to go ahead with commercial growing of GM crops came as a surprise and was felt to be a betrayal.

At issue in England in civic epistemological terms was the culture of trust in experts, whereas in the United States, as illustrated in the cases of the first commercially grown genetically engineered food granted a license (in 1994) for human consumption, the FlavrSavr tomato, as well as the rBST and organic foods examples mentioned above, the market (and litigation) became the arbiter, as it did again later in the 2000 case of genetically modified StarLink corn (produced by Aventis), which was found to have entered the human food chain for which it was not licensed, causing a recall of three hundred food products.

In Germany, public hearings introduced after the Green Party gained seats in Parliament were gradually withdrawn as the political tactics of environmentalists became obstructionary (e.g., demanding that all documents be translated into German, and other delaying tactics). Not only was it argued that public hearings make sense only if they actually function as a Habermasian public sphere, requiring an informed public; but questions of "whose rationality" were increasingly foreclosed (e.g., in the rBST debate, whether this technology would hurt small businesses was not discussed, only whether it was a safe and could help production of large farms).[70]

Issues of process in Germany are tied, Jasanoff argues, to constitutional requirements that the state protect human dignity. In Germany's stem cell debates, the Christian Democratic Union (CDU) and Christian Social Union (CSU) invoked this doctrine to forbid even the import of embryonic stem cells created abroad. The Social Democratic Party (SPD) voted to allow importing stem cells for research on the grounds that these are not embryos proper and so do not require the same level of protection. The reprehensible act, if such it was, of creating stem cells had already taken place outside Germany and the cells in any case were not capable of

becoming fully human. The Free Democratic Party (FDP) voted to allow imports because they could benefit humanity and would not harm human beings or potential human beings. The law that passed in 2002 allowed import under supervision by an expert committee established by the Robert Koch Institute. This moved the discussion back into a contained deliberative environment, away from public debate.

Jasanoff summarizes part of her three-nation comparative study by saying that the rise of bioethics illustrates Foucault's account of how the growth of biopower ropes ethical debates into larger national narratives. In the United States the narrative is one of medical and agricultural innovation, in Germany it is one of building a principled *Rechtsstaat*, and in the United Kingdom it one of maintaining a well-ordered space for research.[71] The European Union becomes not so much a source for higher-level rulings as a political resource in federal and *Länder* (local state) negotiations. Wen-Hua Kuo's 2005 analysis of the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) reveals a similar pattern. Taiwan is not an official member (analogous to the European Union not being a sovereign nation or a superstate with overriding authority), but provides a mediating role facilitated by its cadre of returned diasporic biostaticians.[72]

I conclude this "double helix" account of new challenges to our sense of the [un]natural coming from the new biotechnologies as well as the institutions through which we recursively and repeatedly revisit and renegotiate our cognitive understandings and visceral feelings by thinking about xenotransplantation as deep play. It is a deep play of the fantasies of abolishing disease and immortalizing life, sometimes at the expense of human rights, informed consent, equity, and access.[73] The American physicists went ahead with the bomb for Nagasaki, as Oppenheimer memorably put it, because it was "technically sweet." So, too, today physicians and patients often go ahead with heroic experimental trials because they are caught up in what Mary-Jo Good calls the "biotechnical embrace," doing what technically can be done, under the Hippocratic formulation of preserving and extending life, because it can be done, sometimes at the expense of the good death.[74] The Austrian cartoonist Manfred Deix captures some of the fantasies and nightmares surrounding biotechnologies in the picture of a genetically engineered pig altered to be already a huge sausage, or in his mutant monsters (think post-Chernobyl) who have voting rights.[75]

Xenotransplantation is one site among the biotechnologies where, because the science is so hard, there is some time to experiment with some

creative thinking toward new institutions and new ways of bringing into being an informed citizenry on a global scale that can provide civil society oversight, accountability, and decision-making. Prominent immunologist and xenotransplantation researcher Dr. Fritz Bach's call for a moratorium on clinical trials provides an overview of some of the changing venues for ethical and policy deliberation.[76] Old institutions of medical ethics seem insufficient. The promise of a supply of organs from pigs, primates, or other mammals for increasing numbers of patients on waiting lists for organs is the public justification for xenotransplantation research. (The other promise is that such research expands basic immunological knowledge that will be helpful whether or not xenotransplantation emerges as better therapy than, say, regenerative medicine.) On the other hand, the threat of zoonosis (and specifically of known and possibly unknown retroviruses from pig populations) that could unleash a pandemic like HIV/AIDS, however small the risk, is not something that can be dealt with through medical ethics models of doctor-patient relations, or by hospital ethics committees (which negotiate patient demands for heroic care versus doctors' judgments that such care is fruitless and will cause needless suffering), or even by national-level regulatory institutions.

Older methods of self-regulation by scientists in the Asilomar style of dealing with the fears about recombinant DNA in the 1970s seem no longer possible or adequate, and the recent experience of Monsanto with the "terminator seed"[77] in the controversies over genetically engineered crops shows that the refusal to engage in public consultation can lead at minimum to public relations fiascoes. Dr. Bach has been experimenting not only with education modules at the high school, church, and grassroots levels and with national committee structures at the political level in several countries in both the First and Third Worlds but also with new modes of global Web-based public consultation seeded with a network of opinion leaders in various countries.[78] It will be interesting to watch this and other experiments in new institution and public critical knowledge building, especially in an environment in which calls for even limited moratoriums draw the ire of those who find it harder under such circumstances to raise research money and venture capital to push the science further.

Bach's interventions have come a long way from the model of Asilomar in 1975 and the handling of concerns over recombinant DNA research in the 1970s. That trajectory is one of the changing possibilities for parapolitical modes of expert self-regulation and containment of disruptive disputes and public politics. At issue in many of the debates over biotechnologies are questions of public safety. But equally at issue are the "gut

feelings" and highly emotional stances that people adopt in regard to what they feel is "natural." The anthropologist is interested in how fast or slowly feelings about what can count as "natural" can change and in what facilitates or blocks such change. This is what Durkheim would have called the *conscience collective* or moral sensibility, what Jasanoff more recently calls civic epistemologies, and what is often called by moral conservatives the "slippery slope" leading to ethical confusion, to which many scientists often reply that in scientific work and new knowledge production we are always already on slippery slopes. To deal with the slipperiness, we need to characterize it and understand it better, not try to black-box it.

Companion Species: Animal Models, Sentinels, Alterities, Phenomenologies

J. M. Coetzee's published version of his 1997–1998 Tanner Lectures, *The Lives of Animals*, foregrounds the debates over "animal rights," but evokes in the wings four series of questions about just what the natures of animals are in relation to: (a) human genetics, evolutionary development, and transitional medical artifacts such as the OncoMouse that promise regenerative medicine to replace the slash, burn, and poison of today's brute medicine; (b) "the morality of the table," or human ecologies of food and illnesses such as obesity and diabetes; (c) sentinels of climate warming and habitat change; and (d) coevolving species that repeatedly mirror our sense of being in the world in uncanny and refractory ways.[79] Coetzee's character Elizabeth Costello, mother, English professor, and animal rights moralizer, stands in for Wendell Berry, Troy Duster, Jim Hightower, Winona LaDuke, Michael Pollan, Peter Singer, Vandava Shiva (all of whom contributed to *The Nation*'s special issue on food), and many others who both rightly and irritatingly remind us of the sins of the social systems in which we participate and are complicit.[80] Costello argues that in tasting the flesh of living things, we violate animal rights and may be tasting sin, a trope that interprets the biblical story of the tree of knowledge in a particularly masochistic way.

    Sin and *rights* may not be the most appropriate terms for thinking about our animal relations. Animal models, animal sentinels, companion species, and phenomenologies of emotion may be much more appropriate. Literature and philosophy all too often use animals as symbolic tokens but betray a disabling lack of interest in actual animals, their socialities, their sensoria, or how to interact with them. Thinking of lab animals and work animals,

Donna Haraway asks what would happen to our conceptual and ethical stances if we thought of responsibility in terms of the category of labor rather than rights. She complains about Deleuze and Guattari's appropriations of wolf packs and particularly their dismissal of pet and other animal training relations as merely regressive narcissism rather than as critical epistemological and ethical sites.[81]

Similarly, Jacques Derrida points out that while philosophers attribute muteness and therefore often also melancholy to animals, it is the human philosophers whose language, calculus of responsibility, and *responsiveness* fail.[82] At best, Derrida demonstrates, invoking his cat, it is the return gaze of the animal that provides philosophers with an optical space in which to contemplate key zero points of phenomenology—nausea, shame, suffering—for recovering bodily nonoptical modes of being.

Haraway gently criticizes her younger self, the author of *Primate Visions*, for not having gone into the field with the primatologists as an anthropologist would have and thus for having perhaps slighted the noncognitive but critical ways in which people (primatologists, in this case) have learned to interact with, respond to, and become included in the communication styles of animals. And so we turn to animal models, animal sentinels, companion species, and phenomenologies of affective communication.

ANIMAL MODELS, EXPERIMENTAL SYSTEMS, AND (UN)NATURAL KINDS

In arguing quite rightly against genetic determinism, the molecular biologist Stuart Newman argues quite dubiously in favor of a classical notion of "natural kinds."[83] The notion of "natural kinds" seems hard to reconcile with contemporary ecological understandings or with unfolding of knowledge within molecular biology itself. At issue are at least two troubling dilemmas: the use of animal models in medical research; and the use of life-forms as technological instruments. I deal with the first dilemma together with Haraway's interventions on companion species (both lab animals and work animals). I deal with the second dilemma together with animal sentinels (including viruses as cross-species delivery systems).

Newman makes two crucial claims: that "species are 'natural kinds' . . . because they exhibit causal homeostatic mechanisms that enforce their type-specificity"; and that an epigenic or "plasticity-based 'phenotype first, genetic programs later' scenario, rather than the gradualist, gene-driven processes of neo-Darwinism, makes the whole enterprise of improving phenotypes of plants and animals by genetic tinkering . . . all but

irrational."[84] The claims for evolutionary developmental biology against genetic fundamentalism are an important corrective to much hype in contemporary science and biotechnology. Still, this is only one area of transformative ideas about nature that are being both discovered and "rewritten" (in the sense of creating objects, materials, and biologicals that have not previously existed). Newman's caution about experiments that seem to jump across the slow testing of natural selection seems well taken. On the other hand, his formulation seems insufficiently open to the slow, incremental nature of the experimental discovery procedures that he seems to argue against. The sciences involved are not easy, and the time they take should allow us to understand the self-organizing properties and constraints (including homeostatic ones).

Newman is correct that in arenas such as agriculture and ecology we desperately need to find alternatives to the self-destructive industrial organizations and financial drivers that destroy us. To begin to do this, it may be helpful to turn to animal sentinels and animal companions.

ANIMAL SENTINELS: ECOLOGIES OF FOOD, ILLNESS, BIODIVERSITY, AND CLIMATE CHANGE

The likelihood of an H5N1 avian flu pandemic has emerged in recent years as one of the most feared (or perhaps most hyped) of threats to human populations. It is a more dangerous virus than SARS, experience with which has already put public health authorities on alert about the critical need to report outbreaks and the self-defeating dangers of denial or hiding of cases.[85] The H5N1 avian flu threat is belatedly recalling from repressed "memory" the 1918 influenza that killed millions around the globe. And it is one of a series of recent viruses and retroviruses, including HIV/AIDS, Ebola virus, and dengue virus, that can cross species and reinscribe into our consciousness our symbiotic repertoires.

Viruses operate as double figures in both the popular and scientific imaginaries of nature: (1) as a figure of thought for a variety of biological processes that disturb the understanding of "natural kinds," species, and evolutionary trees; (b) as means of drug delivery and new materials fabrication that reconfigure the sense of the boundaries of natural kinds into more permeable and new ecologies of interaction. As figures that disturb the understanding of natural kinds, viruses are one of a series, including infectious agents (bacteria, viruses), symbiogenetic forms and parasites (e.g., the wasp-polydnavirus-caterpillar association), jumping genes and

lateral transfer.[86] Understanding the molecular mechanisms of host-parasite interactions could lead to a variety of new, hopefully more biologically gentle therapies.

As biological tools, viruses are used as drug delivery vehicles and are part of the experimental and still dangerous technology of genetic engineering, but they are also now being used in nanofabrication technologies. Viruses subvert their hosts to reproduce themselves, but we are now learning to repay the favor and turn them into new optics and electronic material assemblers. For example, Angela Belcher's MIT lab has produced the first virus-assembled nanoelectrode and virus-assembled battery and is working on a virus-based transistor.

Belcher bombards a semiconductor wafer with nontoxic viruses to see which react, looking for ones with the chemical functionality matching the target material. Once found, the virus's genes are manipulated so that they make protein coats that collect molecules of cobalt oxide and gold. Once altered, the viruses are inserted in a bacterial host, which replicates or clones millions of copies. They align on a polymer surface to form ultrathin wires (circa 6 nanometers or six billionths of a meter). Because viruses are negatively charged, they can be layered between oppositely charged polymers to form thin, flexible sheets that serve as an anode. (Batteries are anodes and cathodes separated by electrolytes.) Nanowire structures are used to assemble thin lithium ion batteries (from the size of a grain of rice to that of a hearing aid battery). The necessary reactions can all be done at room temperature and pressure. The energy density of these batteries is two to three times that of other batteries. By harnessing the electrostatic nature of the self-assembly process with the functional properties of the virus, highly ordered composite thin films combine the function of the virus and polymer systems.

Viruses, bacteria, parasites, and the like provide experimental systems for exploring the permeability and symbiotic repertoires of natural kinds. Comparative genomics tracks some of the commonalities across living forms. But it is really ecological studies that provide some of the most worrisome questions about our futures by both tracking cross-species transfers that simultaneously map ecologies of human practices and transfer of organisms, and cataloguing, regulating, and redirecting the destruction of biodiversity and climate change.

Mobilization around the term "biodiversity" dates from the 1986 National Forum on Biodiversity, sponsored by the National Academy of Sciences and the Smithsonian Institution, led by Walter Rosen, and including such key figures as Paul Ehrlich, Ernst Meyer, Peter Raven, and E. O.

Wilson.[87] The organizers announced: "The species extinction crisis is a threat to civilization second only to the threat of nuclear war."[88] These already senior figures could afford to join the newly growing field of conservation biology, which understood itself to be scholarly advocacy and was viewed for that reason with some apprehension by the National Academy.

At issue are a series of wonderful (for the anthropologist and science studies scholar) ambiguities about not only how to guesstimate the decline of biodiversity but what such concepts as "ecological system," "keystone species," or even "species" and "habitat" should mean. On the one hand, it is crucial to the enterprise to emphasize how little we know about and how much research needs to be done on the functional role of species in ecosystems. David Takacs quotes Peter Raven: "We know so little about biodiversity, the interchangeability of biodiversity in communities and all the rest that we don't know what the limits are."[89] At the extreme is E. O. Wilson's observation that "the little things that run the world" (bacteria and insects) are hardly evident on the endangered species lists, which primarily include either large animals that humans relate to or small creatures that are useful to block development that should be opposed on other grounds but the Endangered Species Act of 1973 is the available tool to hand.

Still, on the other hand, the notion of biodiversity gets around both the charges that proponents wildly inflate the estimated rates of extinction and the endless task of making a species-by-species case for ecological integrity when we do not really know what makes for such integrity (whether one should be protecting maximum genetic diversity, genetically distinct populations, communities of tightly integrated organisms, or larger ecosystems). Protection for larger animals requiring larger home ranges can serve as umbrellas for other organisms.

Even so, there are ambiguities in managing populations using tools such as those that measure minimal viable populations (MVP), the smallest populations that could survive genetic drift or catastrophic events. Debates about culling and about defining ecosystems, are inevitably political and draw in economic interests. Among the most interesting efforts to leverage political and economic interests and make the market incentives work in a green direction is the Costa Rican experiment of commodifying biodiversity around pharmaceutical, ecotourist, and scholarly renewable industries.[90] Especially interesting is the idea of retraining rural local people to treat their environments as intellectual resources, thereby enchanting the

environment in new ways and capturing traditional knowledges, as well as building computerized databases with their help.

Conceptually, this expansive view of biodiversity and ecology leads to what Takacs calls metaphysical holism. Again he quotes Peter Raven: "Peace, social justice, human order, the protection of biodiversity, the production of or promotion of a stable biosphere are all inextricably interwoven."[91] Warwick Fox says that the knowledge-producing process of trying to protect biodiversity is a "this-worldly realization of as expansive a sense of self as possible."[92] This view is on the surface unexceptionable but, as the case of E. O. Wilson increasingly makes clear, can be a kind of priestly calling on the part of sociobiologists convinced that encoded in our genes is a biophilia evolved in hunter-gatherer pasts that has undergone remarkably little evolution, culturally, institutionally, or otherwise. As Takacs nicely argues in his final chapter, the self-contradictory mix of apocalyptic crisis, urgency, and need for expertise that only people like Wilson can supply is indeed a kind of charismatic and priestly call to faith, with many metaphysical, unsubstantiable, claims, such as biophilia, made vociferously.[93]

While the trope of the "disappearance of nature," often attributed to Bill McKibben,[94] turns out to be a nostalgic one (nature doesn't disappear, it changes, impoverishes, etc.), somewhat like the pastoral image used in the nineteenth century to critique industrialization and its destruction of the wild, perhaps the most trenchant structural argument for the loss of biodiversity and thus the loss of sustainable, complex, "wild" ecosystems is that of Steven Meyer.[95] Meyer argues that while the Earth will continue to teem with life, it will be an increasingly homogenized assemblage selected for compatibility with human beings. He claims that the extinction rate is now over three thousand species a year, while less than one new species appears over the same period; hence within the next one hundred years half the Earth's species and a quarter of the genetic stock will disappear.

The argument is a structural one: there is a hierarchy of three kinds of species. *Weedy species* are adaptive, flourish in variety of ecological settings, switch easily between food types, breed prolifically, and often have their needs met more efficiently by humans. For example, raccoon populations are five times denser in suburbs than in the wild; aquatic plants such as hydrilla thrive in waterways enriched with runoff from farms, suburbs, and sewage treatment facilities; rats and white-tailed deer reach pest proportions around human habitation. *Relic species* do not thrive in human-dominated environments and survive either in isolated areas or as managed

"boutique populations," as do African elephants, giant pandas, Sumatran rhinoceroses, and most of Hawaii's indigenous plants. *Ghost species* continue to exist but are past the tipping point of population collapse. These include African lions, gray wolves, and prairie dogs. Meyer claims that 90 percent of the stocks of tuna and swordfish are gone (sturgeon, which used to populate the East coast of the United States, have been gone for many years), and that more lions live as pets and in zoos in the United States (10,000) than worldwide in the wild (7,000).[96]

Meyer argues that while various factors in this "dumbing down" seem manageable, once one understands their cumulative interactions, they become unmanageable. While some ameliorative efforts seem to work (whooping crane numbers are increasing; tiger numbers in India's Sunderban forest region seem stable), most prohibitory (protection) regimes are focused on relics and ghosts; most refuges and reserves are too small and thus illusory; and the slogan of "sustainable communities" is usually an anthropomorphic use policy based on calculations of how much can be harvested, not on ecological models, with the result that much is driven by global markets. "The race," Meyer says, "to save the composition, structure and origin of biodiversity is over: we've lost." What we can and should do, he argues, is "to purge ourselves of the humanistic love affair with the wild, landscape, and aesthetics," and do research on the functions of what is here and how it lives.

However apocalyptic one might judge the ecological and species extinction crisis to be, the sentinel feedback that is given to us by our animal and plant environment is not to be disregarded. Obesity and diabetes (via the foods we eat) are signals. So too are endocrine hormone disruptions (of the chemicals we ingest and inhale) and multiple chemical sensitivity syndromes (caused by incremental, interactive, cumulative encounters with toxic elements). Cross-species infectious diseases, the succession of invasive species, the devastation of tropical forests and possible disruption of the Earth's carbon cycle, the softening of the tundra and the disturbance of whale and caribou migration in the Arctic are all sentinel feedback signals. The use of freshwater dolphin censuses are signals that help measure the water quality of the Orinoco River.[97]

ALTERITIES AND COMPANION SPECIES: RESEARCH,
DOMESTICATED, AND WILD ANIMALS

I return to Haraway's and Derrida's complaints that most of the literary and philosophical literatures that use animals to think with do not actually

deal much with the actual lives of these animals.[98] These literary and philosophical meditations do not consider the anthropological literature on how cultures categorize, name, and use different classes of animals, how animals carry mythic armatures of ecological knowledge, or how affect gets attached to animal figures through structural positioning in classifications from the domestic to the wild.[99] Deleuze and Guattari create new philosophemes with animal categories—wolf pack as a figure for multiplicity; orchid-wasp as a figure for symbiosis—but at the expense of the "points of view" of animals, and most grievously, as Haraway complains, they dismiss pet and other training relations as merely regressive narcissism rather than as overlapping arenas of differential phenomenologies.[100]

In this context, Haraway is perhaps one of the most useful of thinkers at the moment, coming from the broad world of the history of biology and science studies, both in the trajectory of her career from *Primate Visions* to *When Species Meet*, and in thinking about the unresolved struggles that particularly research animals pose, struggles that will grow in public awareness as biotechnologies continue to expand. With Haraway, perhaps we can prepare the ground for how to think intelligently about the dilemmas of the real world of illness and death, killing and making live, and *responsiveness* to companion species of all sorts, a responsiveness that parallels but is not exactly the same as earlier ecological notions of feedback in systems that will collapse or deteriorate if the component flora and fauna are misused or destroyed.[101]

In her 1989 *Primate Visions*, Haraway took on the newly developing profession of primatology as it began to use anthropological-style fieldwork to study baboons, chimpanzees, lemurs, and then other animals in their natural habitats and societies rather than in laboratories or artificial colonies. *Primate Visions* turned the tables on the researchers, exploring their intellectual genealogies, hierarchies, and, above all, the ways in which they projected human cultural concerns onto their nonhuman subjects of study. This was elegantly done by charting decade by decade how changing theories of primate sociality correlated with changing popular human cultural anxieties. Second, it focuses attention on female primatologists, helping raise their profile in a male-dominated field but criticizing them, in a friendly, puzzled way, for buying into the then-faddish sociobiology. Third, it contributes to the wider anthropological critique of sociobiology's importation of American folk theories of reproduction, competition, aggression, sexuality, and status and of sociobiology's crude genetic reductionism (long before one could even map the genome or begin to unravel the mediations of protein, cellular, and other functionalities). Fourth, it

was a tour de force and exemplary exercise in using (and keeping carefully distinguished) popular culture materials about animals (hunting and photo shooting in the wild), interview and archival materials on a science in formation, and the gradually growing positive knowledge gained about animals and their socialities.

As noted above, it is quite in character that Haraway should in her most recent work reflect back on *Primate Visions* and gently criticize her younger self for not having gone into the field with the primatologists as an anthropologist would have and thus for perhaps having slighted the noncognitive but critical ways in which people (primatologists, in this case) have learned to interact with, respond to, and become included in the communication styles of animals. The trajectory of Haraway's work builds a new perspective. In her 1985 "Cyborg Manifesto," an essay in *Simians, Cyborgs, and Women*, Haraway began to speculate on mixed technical and biological systems that would lead to the creation of animals with human genes and illnesses for medical research such as the OncoMouse.[102]

In her 1997 *Modest_Witness@Second_Millennium.FemaleMan@_Meets_OncoMouse™: Feminism and Technoscience*, her concerns with the relations between technologies, animals, and humans have evolved into a set of reflections on the grammar of these relations in material reality as well as conceptually.[103] These grammatical relations are signaled in the focus on cyborg creatures such as the OncoMouse, a humanly modified genetic organism (unlike the original NASA mouse fitted with an osmotic pump) designed to aid in research on human diseases. The grammatical relations are signaled in the title of the book and in section titles, adapting the usages of the computerized information environment in which biology has become infiltrated, embedded, and facilitated.[104] And they are conceptually signaled by Haraway's neologism "material semiotic objects"—that is, real-world objects whose coming into being configures the way our semiotic and symbolic worlds work. OncoMouse is not only a biological organism but a legal one that generated court cases and new understandings of the intellectual property rights regime that in the 1980s transformed the doing of biology and biotechnologies.

At issue throughout *Modest_Witness@Second_Millennium* is the challenge that biology is civics, that biology is inseparable from political relationships and that rearranging biological relations simultaneously has civic implications. The several strands of grammatical relations alluded to above are also markers of our civic politics. Copyright, trademark, and brand have become, she wrote in a brilliant *bon mot*, our genders, generic marks on maps of power and influence. One of the essays in the volume is on the

material and biological crossings (and material-semiotic changes they help produce) of the DuPont Corporation in polymer chemistry (nylon, rayon, synthetics), transuranics (nuclear power), and the new world of transgenics—a cross section of our changing first and second natures.

But it is with *The Companion Species Manifesto* and *When Species Meet* that Haraway begins to signal three important themes: that to mistake pets as children is to endanger both the human and the animal (alterity is real and needs to be worked with in any useful animal-human ethics); that species contain rich histories of coevolution with humans in their biology, labor regimes, and pedigree (consumption-branded) regimes; and that living with and loving animals can be a way of learning to live and work with diversity.[105] I am particularly struck in a chapter on laboratory animals in *When Species Meet* by the honesty of struggle with commitments that resist simultaneous and seamless closure. These commitments are to medicine, to science, and to protecting animals from suffering as much as possible. Haraway commits herself to thinking about how the humans in the lab might work, think, and interact with their animals otherwise.

Animal models for medical research attract the ire of animal rights activists but are still thought by most biomedical researchers to be necessary and not yet replaceable by computer models, regenerative tissue engineering, or other techniques. Of particular interest for the discussions of the nature of animals is that many, if not most, laboratory animals are genetically modified artifacts. This is particularly true of research mice and rats, which make up 95 percent of research animals, although the range of animals as experimental systems extends from nematodes (roundworms) and drosophila (fruit flies) to mice, dogs, cats, and nonhuman primates (mainly monkeys imported from abroad).

Of particular interest in the current context of arguments about the (un)natural is Haraway's observation that "rights" language seems philosophically inappropriate, even if legal initiatives on such grounds may occasionally have tactical value.[106] Some utilitarian "rights" arguments invoke pain and suffering as phenomenological grounds on which rights might be attributed.[107] But while Haraway also invokes animal suffering and affect, she recognizes the alterity of animals and does not assimilate them to the same, a point that she makes through a series of anecdotes about dog training and collaboration in agility competitions as well as through contrasts between dog breeds.[108]

"Intersubjectivity," Haraway points out, "does not mean 'equality.' . . . It does mean paying attention to the conjoined dance of face-to-face significant otherness." Again: "To regard a dog as a furry child" demeans

both, setting up children to be bitten and dogs to be killed.[109] Moreover, dogs have been bred for different subjectivities: meta-retrievers, bred for herding, are not interested in chasing balls on the beach but can be totally obsessed with chasing retrievers as they chase balls, attempting to block and herd them away from the balls. Border collies, bred through generations of competitive sheep herding trials, became popular pets when shown on British television, but then were frequently abandoned when owners could not satisfy the dogs' needs. Living ethically in such heterogeneous relationships, Haraway suggests, is a training ground in alterity.

Acknowledging the emotional dynamics or responsiveness of animals, she asks how the humans in the lab might work, think, and interact with their animals otherwise. One thinks here of Karin Knorr-Cetina's *Epistemic Cultures*, showing how laboratories modify the organisms they form into experimental systems, but also how the human investigators are re-made into socialities whose dynamics are quite different in a high-energy physics lab and in a molecular biology lab. At issue is that for the time being, until methods can be developed that will not require the making ill and sacrificing of animals in the service of medical research, in the laboratory as in nature, killing and illness are required.[110] As a first step toward a less brutal relationship with our companion species in the lab, Haraway wonders about involving more hemophiliacs in laboratory work with hemophiliac dogs used to study hemophilia.

ANIMALS AND PHENOMENOLOGIES OF AFFECTIVE COMMUNICATION

The philosophemes of Wittgenstein's lion; Levinas's dog, Bobby; and Derrida's cat all indicate something similar about our relations to our companion species, but they do not go as far as Haraway. The philosopher Stanley Cavell interprets the encounter with Wittgenstein's "mute lion" ("If a lion could talk, we would not understand him") as generating self-reflexivity: "sooner or later it makes us wonder what we conceive knowledge to be." But dog and horse trainer Vicki Hearne objects: the lion is reticent, not mute, and it has presence; indeed, "if the chimpanzee Washoe learns human language and still remains dangerous," Cavell's epistemological mirror becomes confusing. For Hearne and Haraway, "the shared language of animal training makes possible a common world between beings with vastly different phenomenologies."[111]

Levinas's dog, Bobby, the "last Kantian in Germany," recognized and restored the humanity of the prisoners in Nazi camp 1492 (uncannily the

date of Columbus's discovery of North America and of the expulsion of Muslims and Jews from Granada) through a responsiveness that the Nazis denied in their stripping of the prisoners down to their presumptive species biology, their animality (a zero point undone by Goebbels' "I decide who is Jewish"). As Haraway also echoes in relatively more civilized circumstances, Levinas does not fail to acknowledge that humans also eat meat. But against Heidegger's 1949 callous leveling of the difference between genocide and industrial agriculture, Levinas uses the juxtaposition of genocide and industrial agriculture to raise questions about the various and different claims upon consciousness. As Derrida would more explicitly thematize, Heidegger's obtuseness is an object lesson in the ideology of difference. Levinas uses the fact of our consuming flesh as a zero point that exposes how the "I" is dependent on others, prior to distinctions between ego and nonego. Derrida radicalizes this: "There is no such thing as animality, but only a regime of differences without opposition."[112]

Nausea and shame rivet us to our bodies and have served from Kierkegaard to Derrida as phenomenological touchstones for thinking about how the physiological body provides a substrate for consciousness. What philosophers fail to do is to expand this insight toward comparative ethology or even historical change. Derrida at least elaborates on Levinas, using the story of his cat, whose gaze, when Derrida is naked, brings on a kind of shame of revealed intimacy. As with Wittgenstein's lion, this could be taken merely to mean that there is a bestiary at the origins of philosophy, that the cat's gaze instills self-consciousness. But Derrida speaks of the animal's point of view, something occluded by Cavell's reading and by philosophical discourse generally. As Steve Baker explains: "Believing that human conceptions of the animal are stuck in a language which generally does animals few favors, Derrida puns *animaux* into '*animots*,' presenting these language-laden composite creatures as something close to . . . botched taxidermy."[113] "*Animots*" puns on *mot*, French for "word." Haraway's more material-semiotic version is to speak of dogs as *metaplasms* (from the Greek *metaplasmos*, remodeling or remolding), having separated from wolves, according to mitochondrial studies, some 50,000 to 150,000 years ago ("at the dawn of *Homo sapiens*"), feeding off human-discarded food and thus coevolving with us.

Derrida's cat and his "shame" also index something like Wittgenstein's forms of life, language games, and metalinguistic meanings carried by the kinesthetics and pragmatics of communication. As Gregory Bateson says, "If you want to know what the bark of a dog 'means' you look at his lips, the hair on the back of his neck, his tail and so on;" and "if you say to a

girl, 'I love you,' she is likely to pay more attention to the accompanying kinesics and paralinguistics than to the words themselves."[114] For the anthropologist, this indexing between the physiological and phenomenological also carries historically differentiated and socially formed anxieties.

Using a century and a half of clinical reports on agoraphobia as both an index of changing pressures on the collective technobody (empty squares at the hearts of rebuilt European cities; urban freeways; and shopping malls) and the closely associated descriptions of nausea and shame in the phenomenological existentialisms of the late nineteenth and early twentieth centuries (Kierkegaard's objectless anxiety, Edvard Munch's agoraphobic painting *The Scream*, Dostoyevsky's agoraphobic *Underground Man*, Heidegger's abyss of death as the ground of authenticity, Levinas's analysis of nausea and shame, Sartre's nausea and nothingness), Kathryn Milun points out that these function as zero signs. Zero signs refer only to themselves. They occlude an organizing dimension, like the vanishing point in one-point linear perspective drawings, an invisible point that establishes the grid around which all other signs in its field are organized. Such zero points and their occluded organizing functions, as Levinas and Derrida delight in exposing, open up a space for dissension and recover social contexts occluded by the zero sign.[115]

Such is the function of companionate species, who, through comparative ethology, comparative genomics, animal experimental models, and sentinels of ecological deterioration and health, open up for us frozen categories, relationships, knowledges, and bases for ethical reconsideration.

Conclusions: The Four Trials of Anthropologies to Come

At the end of *The Elementary Forms of Religious Life*, Durkheim argues that religion and science do not stand in a relationship of replacement; rather, at the boundaries of what each society takes to be empirically knowable (science) are questions that demand answers supplied by "religion," itself seen as a product of deeply socially structured relationships.[116] E. E. Evans-Pritchard called this the two-spear theory of causality.[117] Both science and religion are thus always changing with respect to one another. Return to religion, Jacques Derrida points out in his commentary on Kant's similar notion of religion at the limits of reason, is never a return to the same but more like respiration, a return after taking a break, a renewal of inquiry.[118] As with Derrida's *animots*, Levinas worries that anthropomorphism, allegory, and other figural aspects of language can collapse crucial differences.[119] And yet, of course, some of the art of

differences and *différances* in Levinas and Derrida comes from the multiplying of meaningful figurations. I am intrigued by the seeping-through of religious traces in the ambiguous denials/acknowledgments of E. O. Wilson's Baptist fundamentalisms (genetic, biophilial), Haraway's Catholicism (material-semiotic incarnational symbols, the "Christian realism" which she claims to decipher in much American science), Levinas's and Derrida's Judaism (expulsion, errancy of signification), and, indeed, the title of this anthology, which I take to be worrying the notions of natural law.

My inquiry into the empirical places where ethical, political, and policy-making decisions are (re)formulated, adjudicated, and negotiated are an anthropologist's experimental effort to locate where contemporary theology could come into play with our emerging technosciences. This essay groups these into four "trials" or places of moral testing: from nature as a place of *context or environment*; to nature as *contingency, accident, and risk*; nature as *nano- and molecular culturing, cultivation, Bildung, from the inside out and bottom up*; and nature as *dealing with and accepting alterity*.

Old metaphysical words such as "soul" or "presence" have meaning in today's world only by taking on a (weak) metaphorical or translational cast. They gesture toward helping people work through (and clarify) the conflicts in their lives and among the social forces in which they participate. Parables and stories have always been part of this tradition. They help point us to interconnections in society, to the ecological complexity of changing things rather than allowing the market, competition, or accumulation to define the "nature" of things. In this sense the old stories of Moses and Khizr, the Muslim version of Elijah, who travels back and forth between this world and the next and who in the Qur'an has encounters with Moses, still apply: we humans are always in possession of only partial knowledge (that is what we have to work with), with which we fashion our moral robustness (a social thing) as well as our ethics (a personal thing). We are tested with these tools in repetitive, recursive, ever slightly changing tournaments and ways.

So, too, the internal debates of religious traditions more generally provide narrative forms for ethnographic analysis of the social interests at stake. Like "justice" as an aspiration in contrast to actual decisions of the "law," the terms *values*, *ethics*, and *morals* operate as aspirations, as regulatory ideas, as odd-job terms, generally left unspecified or specified only in the context of particular cases. When dogmatized and claimed to be instantiated or perfectly embodied, they often undermine their own credibility. Just as minority opinions in legal decisions sometimes become majority ones in the future, so too with the formulations of religious thought.

In the scholastic traditions of the three monotheistic traditions, in the logical debate traditions of Buddhism, Hinduism, and Jainism, and in the parable-telling of Native American traditions, there is always dialectical room for alternative interpretation, particularly at the limits of reason and tradition. The old Aristotelian modes—visceral emotion, cognitive reason, and character—are institutionalized today as advertising, science and technology, and civic epistemologies.

To explore and define these positions, this essay deploys the notions of (1) narratives (Benjamin's catastrophes, Geertz's "deep play"); (2) second natures (modes of production, parliaments of things, litigations, and contestatory, emergent "enunciatory communities"); (3) nature inside out (new biologies and biotechnologies, new forums for social definition of what is un/natural); and (4) expansion of symbiotic repertoires with our animal familiars, analogues, and coevolutionary species. I use the dialogues (cross-arguments) between comparative ethology, animal training, comparative genomics, and other emerging scientific fields, on the one hand, and phenomenological, philosophical, and psychiatric notions of agoraphobia, nausea-shame, and pleasure, on the other, to come back to the question of the collective technobody with which I begin the first section.

My interest is in the changing "coevolution" of sites of dilemmas and ethical-political decision-making, from reflexive social institutions of second-order modernities to regulatory forums differently handled by different civic epistemologies; to tournaments of ethics rounds in medical settings including changing definitions of mental and social health as agoraphobia (once defined in relation to space, now defined by pharmaceutical medicine as panic attacks without reference to space); to sites of interspecies and intercultural negotiation of radically different phenomenologies and social consciousnesses.

What might all this mean for an *anthropos* and an anthropology to come? Let me sum up with five hypotheses or queries:

1. Historically speaking, "nature" is an odd-job word, unlike "culture," which has an analytic history in anthropology as a quasi-technical frame of analysis. "Nature" no doubt has a history from classical times through the natural-law tradition but in more recent times has increasingly lost its foundational referents and instead is a covering label for the paradoxical ambiguity with which I began (nature is that which is both our other and our "essential" self); and as our knowledge expands and reconfigures itself, this ambiguity also expands.[120]

2. Cross-culturally speaking, only in a heavily Christianized or "globalatinized" world can one speak of the "death of God" or the dissolution

of a foundational "natural law."[121] One need not be a holy fool, Sufi saint, Hindu guru, Jain monk, Zen or dialectical Buddhist, Talmudist, or Spinozan to recognize that "God" diffuses into nature, leaving traces of divinity everywhere, and that the decisions of the world are in the hands of the creatures and forces of the world. Thus to speak of its death or absence seems not to make any sense, nor does the nineteenth-century fear (intensified by World War I) that without rules (metaphorized in traditional moral language as God), nihilism and chaos would ensue. "The death of God" and "without nature" are pre-mid-twentieth-century European philosophemes.

3. In the *anthropos* and anthropology to come, nature can be no more than the output of humble, partial, experimental systems, meaning this less as a Darwinian idea than a contemporary interoperable, kludgy, work-around, molecular, nano, and genetic, algorithmic, but also tissue and polymer conglomerate view, in which our epistemology is always already entwined, mediated, mutated, or transduced into (dis)harmonic registers of Lévi-Strauss–like symphonies of meaning.

4. At issue here is a structure of feeling that as the world changes, as scientific and pragmatic knowledges expand, our very vocabulary also shifts, increasingly inflected by the sciences and technologies of our time and the epistemologies and instrumentations through which they are elaborated. We need to embrace these languages and interrogate them for their "zero points" and other naturalizing and occluding features in order to keep them, as well as our ethical stances in the world, lively and informative.[122]

5. An anthropology to come will need to be collaborative and intercultural, not only across traditional cultures but across cultures of specialization, and will need not only to incorporate the lively languages of the new technosciences but also to reread, redecipher, and redeploy the palimpsests of traditional knowledges. Such collaboration is not easy: as with animal training, it involves coordination, translation, exchange, and responsiveness to different phenomenologies, epistemologies, ways of doing, and ways of knowing.