

## **"Sophistry or Sensitive Science?" An Interview with Martha Herbert**

*Martha Herbert biography:* Martha Herbert is a pediatric neurologist at the Massachusetts General Hospital in Boston and at McLean Hospital in Belmont MA, where she specializes in patients with learning and developmental disorders. She is also Vice-Chair of the Board of Directors of the Council for Responsible Genetics. She received her medical degree from Columbia University College of Physicians and Surgeons, her pediatrics training at New York Hospital-Cornell University Medical Center, and her neurology training at the Massachusetts General Hospital, where she remains and is on the faculty of the Harvard Medical School. At MGH she pursues research on brain structure abnormalities in developmental disorders, particularly autism. She also works on health and ecological risks of genetically modified food, and on neurotoxins and brain development. Prior to her medical training she obtained an interdisciplinary doctorate from the History of Consciousness program at UC Santa Cruz, studying evolution and development of learning processes in biology and culture.

*Casey Walker:* In your recent essay "Incomplete Science, The Body and Indwelling Spirit," you sketched the difference between a science shaped by a "control-oriented, disconnected" belief system and a science shaped by a "systems-modulating, context-sensitive" belief system. What are these differences and why do they matter?

Martha Herbert: I don't believe we can adequately critique the uses of engineering technologies if we don't understand the assumptions driving them, just as we can't critique the life and physical sciences if we don't understand the assumptions driving them. We seem to have no problem understanding all other areas of inquiry, such as literature, history, politics, philosophy, or economics, in the cultural settings that generate them, yet fail consistently to question the same for science.

Briefly and obviously, there is a world of difference—all too literally!—between basing a scientific enterprise on the belief that a sufficient scientific control over the body or nature will achieve an end to human suffering, and basing a scientific enterprise on the belief that the body or nature and all it expresses is our primary source for learning how to live well.

The first, which I would call a "control-oriented, disconnected" belief system, informs most of our recent powerful technologies, from nuclear power, dams, pesticide development, and psychopharmacology to genetic engineering. This belief system tends to make negative assumptions about nature and the human body, suggesting that both are essentially limited, imperfect, undifferentiated, uninteresting, inherently inferior, and morally dismissable entities awaiting the improvements of engineering technologies. Pests have no purpose and should be obliterated; rivers that flood should be paved and straightened; emotional pain is purely chemical and should be drugged. Human suffering can and should be eliminated. Human "nature" is viewed as essentially weak, nasty, selfish, greedy, and lustful, with destructive anti-social impulses that should be controlled externally. The wild spirits of children must be tamed by harsh discipline. The body is a source of pain, appetite, sex, sickness, suffering, and death, which should be fixed, escaped, or transcended. Similarly, the body's pleasures are sinful, dangerous, and degrading and must be vigilantly restricted. Spiritual beliefs consistent with this view of disconnection and control invoke an authoritative deity remote from the body, mind, or earth. Such beliefs aim for a salvation based on transcendence or escape.

With the recent advent of biotech, nanotech, and infotech, we see a techno-utopian expression of this belief system promoting "exciting" projections for the future-physical "conquests" and "upgrades" via Francis Bacon's notions of human designs escaping natural limitations. Plants, animals, and babies can be engineered to specifications we choose. The human brain can be enhanced by genetic or synthetic engineering, and, indeed, the brain can

be left completely behind once we download it into a supercomputer. A limitless supply of replaceable body parts will ensure immortality. On the face of it, this vision appears less punitive and harsh than the control-oriented view of nature and human nature, but in reality it would subvert both. Cognition would be subverted into a mechanistic process, while bodily sensuality and earthiness would be demeaned as immaturely coy, comic book versions of super-sexual, super-muscular, super-sensory prowess.

In contrast, a “systems-modulating, context-sensitive” belief system tends to make positive assumptions about nature and the body—physical constraints are inherent to a flourishing corporeality and, one could say, the artfulness of existence. This belief system comprehends life as connected and emergent at a profound level that is larger and more complex than we currently understand. While this intricacy and complexity militates against promiscuous or wholesale engineering, we may yet come to understand, engage with, and work with life both elegantly and appropriately at its structural levels. Organisms and ecosystems have capabilities that, when understood, can be gently modulated toward greater articulation. And, while human suffering can and should be minimized, it is nonetheless an ineluctable condition of existence essential to developmental competencies and maturation. Through experience and cultivated awareness, the inherent drives of human nature for love, cooperation, curiosity, creativity, and conviviality can mitigate fear-based defenses. Rage, impatience, self-centeredness, greed, and other defenses caused by harmful experiences (isolation, danger, deprivation, humiliation), can be overcome under properly nourishing conditions. Indeed, the full repertoire of the human body and mind is the very substance of a robustly mature physical, mental, and spiritual life

Admittedly, these characterizations are highly polarized. Yet they do intimate the wholly different worlds that can be created by two such widely divergent belief systems. We live in a time when most of science has been shaped by beliefs about nature and the body that are primarily disconnected and control-oriented and that are supported by motives based on fear and defensiveness. I think it is essential, therefore, that large numbers of people quickly come to see the problem: In whose hands do we entrust the power of manipulating the smallest genetic, molecular, and atomic levels of living and inanimate matter?

*It is also obvious to me that we are hugely mistaken if we believe the first worldview is not dominant in the engineering sciences or is capable of self-correction without confrontation. There isn't just a misunderstanding between these worldviews, there is a basic conflict about the nature of life and existence that is dangerously out of balance. Even worse, the conflict is not in conflict. Where is contention? Will you speak to the deafening silence in media and within the scientific community?*

To my mind, there's a dominant sophistry going on. Where is the press for existing, complex system alternatives such as agroecology, alternative medicine, or somatics—all of which work strategically within whole systems, are locally variable, and are not patentable? I had the opportunity to speak to the National Academy of Sciences last spring on health monitoring of biotech food—which currently is not being done at all and would be extremely difficult to do. After sketching how hard it would be to trace or control the many infectious, allergic, toxic, and other risks this technology poses, I asked my listeners: “How can we know if genetic engineering offers the techniques we really need to use, in spite of all the risks, when we haven't seriously discussed alternatives? Why haven't we consulted people who already argue convincingly, and with a lot of evidence, that there are many other ways to grow and produce all the foods we need?” I suggested that if the National Academy of Sciences wanted to exercise genuine scientific leadership, it would set up a serious dialogue between biotech scientists and agroecology scientists. How does each group define the problems, and how do they approach solutions? How would each fare if they were compared rigorously and in good faith? I don't think it would look so good for biotech—in fact, the kind of genetic engineering currently employed would look pretty foolish.

One reason that molecular biologists are incomprehensibly blind to complex system

oriented alternatives is that they have not been required to study ecology or other higher level biological systems for the last several generations. Of course, another problem with these contextualized alternatives is that they can't be patented or privatized. Insofar as industry gets interested in indigenous knowledge, it takes the form of "biopiracy." For example, industry scouts will learn about herbs from a traditional shaman, identify some active ingredient in the laboratory, patent it, market it, and give none of the proceeds back to the shaman or the community where the knowledge originated. Such industries also don't have much interest in the complex cultural contexts in which the use of these herbs is embedded—systems of understanding that are hard to patent and commodify, and is less real to them, in any case, than genes or chemicals.

Imagine what it would mean for science if we didn't have our kind of free-wheeling, intensely escalating, "win-lose" economic pressure. If we could pour all the incredible resources that we're currently wasting on toxic tech "fixes" into sustainable, context-sensitive practices, we could live a lot more simply, effectively, and ultimately more peacefully with one another and the planet. It's a tragic waste that so-called economic imperatives have forced the commercialization of molecular biology and genetics. We could study molecular biology because it's remarkable and beautiful to learn about these mechanisms, and not lose sight of the correctives that come from remembering that these mechanisms operate in larger frameworks.

The sin comes, as I see it, when we use incomplete knowledge to make technological products for mass marketing—and with a hyped urgency, at that. Once we turn these neat little laboratory tricks into products (and one could say this is the essence of commercial biotechnology), we are actively intervening in a system that we don't understand. Technology gives us the power to devastate and to rape without first requiring us to understand.

*In "Dialogue on the Art of the Novel," Milan Kundera raises Kafka's question, "What possibilities remain for man in a world where the external determinants have become so overpowering that internal impulses no longer carry weight?" It's troublesome, isn't it, to extend that question to: What possibilities remain if the external and internal determinants for all living things become radically overpowered by engineering projects and their unintended side effects? Will you speak to what you are seeing as a pediatric neurologist, clinically and professionally, in terms of internal change—the numbers and kinds of cognitive, neurological, and behavioral disorders in children?*

I think that we are witnessing change in the neurological wiring of this generation of children and that this can be attributed to an unfortunate mix of early chemical insults and social/emotional derailments.

Neurologists and neuropsychologists who have been practicing for a few decades or more often comment on the changing character of their caseloads. More than a few of my colleagues (myself included) have dealt with four-year-olds who pull knives on their mothers, something that would have been astonishingly rare twenty years ago. Overall, more children are presenting with diffuse difficulties—not discrete learning disabilities where everything else is more or less intact, but difficulties spread across multiple cognitive, sensorimotor, social, and emotional domains. And the scale of this is enormous: 17% of children in the United States have some kind of attentional or learning problem, and a significant number of them are on medications of one kind or another. I think we are dealing with the impact of the disintegration of family and community bonds and a profound environmental insult on our very neurological wiring.

We know that rapid brain growth and development begins before we are born and continues at least through the first three years of life. After the initial structures are laid out, the brain "edits" itself—keeping some connections and eliminating others—in what has been called an "experience-expectant" process. Many palpable, but hard to measure, qualities of ambient experience impact this process in ways we are only beginning to look for and discern. For example, an infant raised by a depressed mother can develop more right-hemisphere electrical predominance, which predisposes him or her to depression. Or,

children raised in busy, jangled households will accustom their autonomic nervous systems to this level of stimulus and find it very hard to relax. And children who have been emotionally or physically abused can show repetitive, stereotyped motor activities as well as inappropriate aggression and abnormal sexual activity. The patterns of such symptoms strongly suggest that brain circuitry and chemistry are altered by experience in ways that are enduring.

Chemically, the effects of malnutrition and intrauterine drug and alcohol exposure have been fairly well-researched and documented. We already know that children whose mothers used cocaine or drank or smoked often during pregnancy have behavioral, attentional, and language problems that are hard to control. Yet far less research money has been spent on studying the impact of industrial chemicals on brain development. In fact, out of the 85,000 chemicals in our environment, only twelve—that's one dozen—have undergone the developmental neurotoxicology testing protocol ([www.preventingharm.org](http://www.preventingharm.org)). Thus far, testing is voluntary for industry, which is fiercely resisting any more rigorous requirement even though fetuses are almost always more sensitive to toxins than are mature organisms.

Now, in clinical medicine it's hard to make cause and effect connections between cellular-level changes and behavioral problems because of course we don't routinely take brain biopsies on our patients. So although brain-behavior connections have been found in animal models of intrauterine chemical exposure, making such connections gets complicated when you bring these models back to human beings. For one thing, unlike laboratory animals, human beings don't get exposed to toxins in controlled, systematic ways. Instead, exposure happens to different people at different times and in all kinds of combinations with other toxins. Even babies exposed to the same chemical may show different effects depending on when the exposure happened and what else was in the mix. Two pregnant sisters could visit their aunt near Lake Superior and eat fish with PCBs in it, but if one were two months pregnant and the other seven months, the consequences to themselves and their babies would be different. So unless there is a massive, well-documented toxic exposure, like a factory explosion or a major chemical leak, it's hard to pick up patterns of toxic effects in groups of people—and industry exploits this problem in its denials of toxicity. Even so, effects are being demonstrated from chronic or intermittent lower-level exposures.

*Will you speak to the difference between the unintended effects of pollutants or deprivations and the intended effects of engineering technologies on human beings? Could we say that before accepting engineering technologies as instrumental to increased “health or reproductive” options, it's absolutely critical to see how the more radical technologies, such as cloning, germline enhancement, anti-aging, or anti-death engineering, determine people's lives at a structural and experiential level? Are we permanently foreclosing on a biologically natural, situated consciousness and its human potential?*

Yes. I think our ability to say no to these more radical technologies can and should come quite easily from this insight: We may permanently foreclose our human potential for a biologically situated consciousness and, one could even say, conscience. This same tension already exists in the recent and pervasive bioengineering of the human mind and body through psychopharmacology in the United States. We don't have to deny that schizophrenics can be helped by their medications to wonder why everyone knows someone on Prozac or Ritalin. When patients come in with medical or psychiatric problems, medicine tries to manipulate or fix them so they can return to their lives without making waves in their particular situations. We then expect everything to return to normal. For medical psychiatry, “normal” is a static concept that is, arguably, increasingly reified by the need for high-functioning, competitive performance in the workplace—doesn't our culture prize an evenly energized extroversion? Such a notion is at odds with natural bodily rhythms, having time and attention for loving relationships, and the ability to perceive depth and nuance, or the feelings that many of us have that allow us to know ourselves as well know and feel empathy for others.

Now, so much of the time the cause of a person's distress or disease makes it impossible

to go back to “normal,” because that crisis has revealed what previously seemed “normal” to be bankrupt. A major attraction of alternative medical practices is that they involve patient participation and validate personal awareness and change at a level more meaningful than the symptom. Neither western allopathic medicine nor mainstream psychology (especially psychopharmacology) gives us any kind of vocabulary for that kind of change within life. Yet many people are desperate for a deepening of experience, for a way to respond transformatively to the messages of their discontents.

Still in the realm of fantasy—but a very active quest for some researchers and advocates—is the genetic modification of human behavior and intelligence. This fantasy reflects a belief that we are basically bags of genetically determined fixed traits into which we can plug new traits as if they were spare parts. The “cracking” of “the human genetic code” is viewed by these people as further proof that we are just as digital as computers and that upgrading humans should be little more complicated than plugging in a new memory card. There are a number of problems with this concept, not the least of which is that the “code” metaphor does not hold up to research. The initial hype that we would find “genes” for neurobehavioral disorders like schizophrenia or autism has deflated after more than ten years of work. These disorders are far more complicated than people originally thought. Similarly no one has found the gene for intelligence or high scores on college admission tests. Even so-called “single-gene” biomedical disorders such as cystic fibrosis or sickle cell anemia turn out to be modulated by other factors in highly variable ways that we hardly understand at all.

So, can we dismiss bad science as bad science and depend upon its own self-correction? No. Techno-utopian visionaries, many of whom hold prestigious medical positions, still deny that our knowledge is exceedingly incomplete and enthusiastically forecast catalogs of traits that yuppies of the future will choose from to customize designer babies. The frightening truth is that the limited scope of our knowledge will not in itself stop experiments with human genetic “enhancement.” The danger that such experiments will fail or produce human beings with unforeseen illnesses or complications (who can neither be forbidden to have children nor eliminated like sick lab rats) does not stop such fantasies either. Indeed, the danger that such experiments may threaten the “human genome” does not occur to these people.

Industry knows there are vast markets of people—supported by much of urban, media-driven western culture—who are so alienated from the promptings of their inner experience that they see no other way to enhance human potentiality for themselves, their children, or others than through externally imposed engineering. These sorts of people may already push themselves professionally and physically, but to external rather than internal measures. They run more miles, lift more weights, climb more peaks, get more promotions, buy more things, network more cyberconnections—and refuse to admit there may be more than quantity to life, that they don't or can't literally “have and be it all.” For these people, acquiring even more of all these externally measurable things seems a self-evidently worthy goal for genetic or synthetic engineering. Once such attitudes are set, we can see how difficult it is to register, let alone value, aspects of existence that involve sensitivity to private feelings, other people, communities, or nature. It logically follows that these people see no problem with a social Darwinism built on a selection of the “fittest” and are genuinely mystified by objections to eugenics or human genetic “improvement.” Indeed, these people appear to be parochial and presumptuous enough to believe that the qualities making for “success” in a domineering, planet-destroying, corporate culture represent the pinnacle of evolution and should be immortalized in the genome/germline. For them, the suffering of “losers” is theoretically regrettable, but a “price to be paid” for the advancement of the human species.

So, the horror of these various levels of bioengineering is three-fold. First, these technologies are not as precise as their advocates suggest because they are based on a simple-minded model that is at odds with the great complexity of biological systems. Second, the intended use of these technologies is based on a conception of human beings and nature that is ecoculturally destructive and impervious to reasoned discourse. Finally,

full employment of bioengineering technologies is capable of bulldozing both biological and cultural systems in spite of the incredible flaws in the basic assumptions of such technologies. In fact, this bulldozing may be approaching, or even already have passed, a critical point of no return.

*From a neurological point of view, what did you think of the Waldorf education article describing German studies that show a degeneration of consciousness due to overwhelming sensory stimulation in modern environments—that 4,000 people were showing a decreasing ability over twenty years to perceive and synthesize information such as nuanced subtleties in color, sound, and taste, while showing an increasing tolerance for dissonance. Are you seeing neurological evidence for what amounts to a change or restriction in consciousness?*

This study at least has a conception of transformative experience, even if by investigating its absence! To have an increased tolerance for dissonance along with problems perceiving and synthesizing information means that you are less likely to engage in the process of integrating complexity. You simply let it sit there as a mess, and you don't rise to the challenge of coming up with a more comprehensive framework that could account for why it is dissonant, why it doesn't seem to hang together.

I wish more had been said in that article about how these researchers went from their electrophysiological measurements to characterizing specific brain pathways that, at one time, had helped people integrate information and that now apparently are no longer used as much. This process is not obvious and I would like to see it elucidated. However, I am sympathetic to the notion, both for neuroscientific reasons and because it is easy to infer that attention spans have in fact shortened for people living in highly mediated, urban environments without a sustained focus on just about anything. It is also easy to infer that the ability of such people to perceive the world has become constricted. Many of us don't have the time or space to settle into perceiving the world's more subtle and nuanced features. Things don't get time to weave themselves together in intricate patterns. Information is thrown at us in increasingly bright colors and at higher decibels just to get our attention. And the information is so ungrounded it doesn't repeat itself in any kind of a natural pattern—it doesn't have to do with regular routines or rhythms, it just has to do with whatever somebody threw into some video somewhere on your tube. This creates an arbitrary reality of brutal thrills. And because we perceptually fatigue in these environments, the producers of film, music, radio, TV, and fast foods are always upping the ante on effects. So, the idea that we are losing the ability to perceive subtleties on all sensory levels makes good sense. Alarming.

The neurobehavioral disorders I see clinically in kids, such as autism, attention deficit disorder learning disabilities, and the various results of intrauterine drug exposures, seem to me like exaggerations of the sensory and mental processing issues the rest of us face daily in our overloaded lives. These kids are usually swimming in chaos—which looks like a mix of disorganized daily routines, hyper-vigilant jumpiness, and genuine problems with processing experience. A lot of these kids are clumsy and get overwhelmed by tasks that require coordination they can't muster. I often see major problems with processing sensory input, particularly with autism. Some of these kids have complete meltdowns because they can't tolerate things the rest of us don't notice, like the scratchiness of labels in clothes or the high-pitched noise emitted by fluorescent light bulbs. They also melt down if they have to process too many sensory modalities at once or process them too fast. Some of the so-called explosive behavioral problems also seem to be set off by some combination of sensory, cognitive, and emotional overload. And some of these kids engage in what people call “self-stimulatory behaviors” that can range from head-banging to cutting themselves with razor blades—compulsive self-infliction of extreme sensations. Some of my more articulate patients have told me that they do this because it makes them feel “real.”

But to lay the blame for this degeneration of consciousness only on psychological, sensory overstimulation doesn't go far enough in comprehending the amount of injury our bodies and minds sustain from chemical and emotional insult. It's clearly ominous for any individual and for society as a whole to have our brain's capacity to process experience first

impaired by toxins and then overwhelmed by sensory and informational input. How, then, can we rely upon our thinking, our feeling, our judgment?

*Taking the effects of toxins and the effects of sensory overload a step further, we are forced to acknowledge that the possibilities of the human body and mind are inseparable from the possibilities within our environments. It's here that things get interesting to me: Can we become conscious of how we are shutting down the living substance of possibility—both wild nature and human nature—before we extinguish it entirely? This is where Paul Shepard's work becomes provocative. Is there a genetically conserved human "nature" that retains genuine impulses—or are we witnessing a threshold disintegration of that human "nature"?*

There are several ways to look at this question. One is that yes, we do need to deepen our critique of our actions, to see quite clearly the assumptions and outcomes of designing and determining the exterior and interior worlds of wild nature and human beings. I do think we must question the results of our creativity and judge them—where and how do they violate life at a systemic level and at a level of being or ontology? But if we have to make these judgments from our own sense of life that has not been corrupted, violated, or simplified to begin with, then, obviously, we're skating on thin ice, some of us more than others. After all, global chemical, cultural, and increasingly genetic meddling has affected all of us and all life on the planet—and we cannot call it an "experiment" because we have no "normal controls" anymore. We know that physically and cognitively we become the world we create, which brings back the original problem of what kind of worldview is driving our creativity and what constraints does it work within—what does it rub up against? If we acknowledge that we do not "create" life at the structural level, but engage in a discovery of what exists wildly, naturally, we comprehend life much differently.

Reading Paul Shepard's *Nature and Madness* was a transformative experience for me. His idea that the "progress of civilization" has meant the loss, rather than the gain, of conditions necessary for the epigenetic unfolding of our potential profoundly reverses deeply conditioned assumptions. Shepard was really courageous to make his argument, as others are who don't buy the central hegemonic myth of "progress" that claims the past was brutish, miserable, and dumb.

Shepard ends *Nature and Madness* with an evocation of our inner—indeed, I would say, bodily or "somatic"—potential for ecological integration and maturity. He says:

"Beneath the veneer of civilization, to paraphrase the trite phrase of humanism, lies not the barbarian and animal, but the human in us who knows the rightness of birth in gentle surroundings, the necessity of a rich nonhuman environment, play at being animals, the discipline of natural history, juvenile tasks with simple tools, the expressive arts of receiving food as a spiritual gift rather than as a product, the cultivation of metaphorical significance of natural phenomena of all kinds, clan membership and small-group life, and the profound claims and liberation of ritual initiation and subsequent stages of adult mentorship. There is a secret person undamaged in every individual, aware of the validity of these, sensitive to their right moments in our lives. All of them are assimilated in perverted forms in modern society: our profound love of animals twisted into pets, zoos, decorations, and entertainment; our search for poetic wholeness subverted by the model of the machine instead of the body; the moment of pubertal idealism shunted into nationalism or ethereal otherworldly religion instead of an ecosophical cosmology.

"But this means that we have not lost, and cannot lose, the genuine impulse. It awaits only an authentic expression. The task is not to start by recapturing the theme of a reconciliation with the earth in all of its metaphysical subtlety, but with something much more direct and simple that will yield its own healing metaphysics."

From where I sit, the approaches to science that are context-sensitive do conserve a human responsiveness to the natural world. They express an old and enduring vision and practice that are to me the only real way out of our destructive tailspin. The question of our millennium is really, How can we regenerate our bodies and minds so that living is bearable and safe? So that cultural and biological diversity thrive? So that material needs are simple

and spiritual life is rich? So that everybody has enough and nobody has too much? A regenerative vision requires these sciences—not only to untangle our big mess but to demonstrate the whole-system approach. We desperately need a sensitive, complex sophistication in our scientific culture and in our culture at large. And we need to generate this ourselves—we're not going to get it from the dominant sciences, industries, or cultural mythologies, which flourish when all of us humans are dumbed-down, obedient consumers, disembodied from the real feelings of life.

Yet Shepard's poignant hopefulness rests on a delicate interplay between our intrinsic potential and a facilitative ecocultural environment. What remains for us if we poison and engineer not only our environments but also our very selves beyond the bounds of our integrity? From where do we then draw our regenerative powers? Do we give up and revel in the ostensibly infinite combinatorial possibilities of nano-digito-geno-transpeciation? This is a “post-modern” choice, but its dismissal of any integrity that can be violated contradicts its championing of diversity, which was hardly generated digitally. It is a sellout to an opportunistic and misguided reductionism that reduces the world's phantasmagoric complexity to a set of codes (genetic, digital, etc) which are presumed a priori—and wrongly—to interface without residual. Then it engineers on the basis of these ideological reductions, and ignores the screams of those whose non-digitizable qualitative realities are thus violated.

If we don't take a fundamental stance against this triumphalist reductionism, we won't be able to fight it. We won't have any real arguments against industry's picking away at nature gene by gene, chemical by chemical, extinction by extinction, to the point of cultural decimation and ultimately genocide and ecocide. If everything is reducible and interchangeable, like money on the international market, then we're just dickering over spoils, not fighting for sustainability.

Pitted against these true believers in false progress are the rest of us, a ragtag and harried bunch who are dependent upon, implicated in, and damaged by the forces we need to overcome. Shepard's work gave me a new kind of compassion for the unevenness in—or virtual lack of—maturity in every adult I've ever met. Growing up as we have, disconnected from nature and all its wild non-human beings who could have provided models of wisdom different from our own, growing up in denial of the price we pay for our dominion over nature, we haven't stood much of a chance to do better. Add to this the enormous karmic burden from millennia of organized barbarism, and what we've created for ourselves is even sadder and more barren of possibility for psychic health.

“Development” and “progress” have deprived us of any culturally developed basis for imagining how things could be truly different. Paul Shepard's evocation of an intrinsic capacity for ecocultural maturity represents a source of resistance and regenerative creativity that may not hang on as its wellsprings dwindle or are deformed. Yet there is still intrinsic outrage, and we can only work hard to channel it into regenerative, complex, and sensitive directions away from the fundamentalist, nationalist, sit-com, simple-minded hell that otherwise awaits us.

*Will you describe the kinds of scientific approaches you see today that are conserving and could advance the Shepardian ideal through “systems-modulating, context-sensitive” practices?*

If we were interested in the epiphanies people experience—those moments of great transformative insight—and if we had instruments sensitive enough, we could detect many ways in which the mind affects matter. We could learn about how changes in neural circuitry, neurotransmitter concentrations, and gene expression accompany one another during such experiences, as well as about larger-scale bodily functions such as breathing, heart rate, and skin conductance that are also affected. It will be a very long time, if ever, before we model in detail the totality of such experiences. Indeed, understanding the processes of such experiences would not enable us to engineer them. In fact, the folly of the quest to engineer ecstasy comes home to us in the drug crisis—playing with neurotransmitters out of context of cultural meaning and self-discipline hardly leads to

wisdom. Biofeedback, on the other hand, is a technology that enhances awareness of otherwise imperceptible somatic processes and enriches our capacity for sensitive self-regulation. The biofeedback device translates the participant's normally imperceptible physiological responses to relaxation into perceptible sound or light messages, that help the participant learn to work with his or her own inner capacity to relax. The participant can learn to enhance the perceptible signals—by making the sound deeper or the light cooler, for example—and thus alter his or her own physiology. Biofeedback is a participatory dialogic technology, rather than one to which we subject ourselves passively.

Were we oriented to developing more such participatory dialogic technologies, we might exquisitely inform the discipline, should we realize it, of lived experience. The more we learn about the interplay of experience and our system of physiology and regulatory mechanisms, the more we might deepen our understanding of when things are working or not working systemically. With these intentions, monitoring molecular, genetic, and other technology-mediated markers may help us to fine-tune how we modulate our body-mind systems, but I don't think these technologies will ever substitute for long-term programs of sophisticated training and discipline, like t'ai chi or yoga or meditation. Those complex practices were developed over generations of cumulative observation in cultures much slower and more mindful than our own. Our technologies may uncover some mechanisms underlying the effectiveness of such practices, and possibly somewhat fine-tune them or help people get started, but could probably not replace them or invent them de novo. This is what I mean by searching for an elegance and appropriateness of technologies—in this case a participatory somatic technology. How do we ask questions that grow intrinsically out of the wisdom of the process, not out of the naivete of the investigators or the limitations of the measuring instruments? When I study complex self-regulatory practices, I don't want to reduce those practices to my instruments; I want to raise my instruments to the practices. We have all but buried our indwelling dimensions of sensuality, perception, and profound, enormous creativity. In what ways can the new technologies for body-mind exploration help us re-embody rather than caricature our intrinsic sensibilities?

It's these kinds of sensibilities that make genetically engineered food so viscerally repulsive in cultures less ravaged by commercialism and corporate agriculture than ours, cultures in which people perceive food as something entirely different from “consumable products.” Food is an inextricable part of the lives of the individuals, families, and communities who grow it, trade it, cook it, and eat it together. This belief is the foundation of the “slow food” movement we see in Europe, which wants to put the “food” back into agriculture. Sticking genes into patented food commodities, which are grown as manufactured products and sold in identical packaging all around the world, obliterates the reality of food as plant or animal and the reality of people sharing the bounty of field or hunt around a communal hearth. Once the context for food is obliterated, we slip into thinking it's normal and even virtuous to pass off all sorts of abominations because no one has proven them “unsafe.”

In contrast to genetically engineering our food, agroecology (<http://www.cnr.berkeley.edu/~agroeco3/>) is a scientific approach to agriculture that is grounded in and respects ecological, cultural, and socioeconomic context. It sees crops and weeds and insects and fungi and bacteria in their ecological interrelatedness. It takes seriously a traditional agricultural practice like multi-cropping, as such a practice has developed through ages of experience and reflects the wisdom of sustained observation. Finding out why planting marigolds next to tomatoes keeps the bugs away can lead to low-tech, low-chemical, high-intelligence, innovative practices. I should say that these questions are quite parallel to those raised by the context-sensitive study of self-regulatory processes I just discussed: How do we raise our agricultural practices and science to the complex potentialities of nature rather than dumbing nature and science down to our market and patent systems?

Like traditional agriculture, the transformative experiences facilitated by traditional “inner arts” are generated slowly and as a result of sustained observation, discipline, and enculturation. These kinds of changes lead to a wisdom about life from experience and are

fundamentally incommensurable with the gimmicky techno-quick fixes consumer society has trained people to expect. As agroecology refutes genetically engineered food, so the inner artful sciences are a deep refutation of “human enhancement” as promoted by advocates of permanent, germline engineering, such as those in the Extropy Society, who are absolutely sure that we can and must do better than “Mother Nature.” Here we see our most serious confusion between constraint and liberation. Those who earnestly believe that the potentiality of the human body must be liberated from its current design constraints, and re-created beyond nature's conception, seriously and tragically confuse constraint with deficiency or deprivation. They do not comprehend that instead of escaping the “limits” of our bodies and the “limits” of nature, we need to reinhabit our bodies and our rightful place in nature, lest we lose them forever to a techno-hive in a techno-sphere. We must pursue the constrained but infinite potentialities of both. Once we experience constraint not as deficiency but as the actual basis of art, we will understand the structural integrity that creates open-ended potentiality, and might just begin to exercise what is already possible within us and in the world around us.