Guest Commentary

This old house

The human genome and human body as objects of historic preservation

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In a recent issue of *Medicine and Philosophy*, two different authors propose that genetic or other enduring modifications of the human body might be constrained in the interest of cultural or historic preservation:

> Considering the value we attribute to the human heritage in the arts or historic buildings and the natural heritage of landscapes and species, should we not attribute at least a similar value to the "traditional" shape of the human body as well? If people have a right to enjoy historic buildings and familiar landscapes, is the familiarity with the shape of the human body not of equal value?[1]
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> By making radical changes in the long term evolutionary processes of human beings, we damage the human genetic heritage. The concept of a genetic heritage is derived from its cultural counterpart, namely a cumulative achievement or record that we are obliged to pass on from our ancestors to our descendants. It reflects a commitment to natural evolution (or divinely created nature) which should be protected from willful transgression.[2]

These suggestions appeal to a non-consequentialist strain in preservation and presuppose a non-instrumental value in the objects to be preserved. Those objects are regarded either as valuable in themselves, or as integral to social and cultural practices that are valuable in themselves. Thus, we seek to preserve human bodies and human genomes not because their radical modification would cause tangible harms, but because, in the case of bodies, their familiar contours and other dimensions have become deeply ingrained in all human cultures and have played a pervasive role in the course of human events; in the case of human genomes, because they are the product and living record of a long history of physical evolution.

At the same time, the suggestion that we treat the human body or genome as a cultural or historic artifact invites caricature: Gregor Samsa, awakening one morning to find himself transformed into a giant insect and cited for unapproved modifications by the Human Morphologic Preservation Agency; UNESCO inspectors closing down tattoo parlors and sanctioning bodybuilders for steroid use; paradigm "specimens" of humanity branded with markers designating them as Historic Landmarks.

What are we supposed to be preserving?

The obvious response is that such caricatures display a crass confusion of token and type — it is the "traditional shape of the human body," not particular bodies, however shapely, that is the object of preservation; the "human genetic heritage," not the genome of a specific individual. But if so (to modify a lament from past preservation failures), there goes the analogy. Cultural and historic preservation is generally about tokens, not types. It is specific buildings, cities, and other artifacts deemed worthy of preservation, not their readily reproducible shapes or blueprints. Although the distinction between token and type is difficult to apply

to the preservation of such intangibles as cultures, languages, and social practices, their preservation seems to require a "critical mass" of speakers or practitioners; this has no obvious counterpart in the case of the human body or genome. Do most, many, or only a few people need to preserve their traditional forms or unaltered genomes to avoid a significant loss of cultural or aesthetic value?

There are problems, moreover, even if we preserve the analogy. Part of the historic and cultural legacy of the human body is its protean character and its willful, sometimes perverse, modification by those who "inhabit" it. Tattoos and steroids are but contemporary variations on the ancient and enduring arts of bodily embellishment, and individual variations in human morphology and function are themselves familiar features of our cultures and history.

Preserving social and cultural practices associated with human morphology

But the concern about widespread or collective changes in the human body, and about radical modifications of the genome, remains. Individual variations have occurred against the backdrop of modal or typical morphology and function — an individual who adopts an atypical form or function, no less than one born with such a variation, hardly threatens our cultural practices and historic traditions. But a sweeping collective change might well do so. If a large proportion of the human population were radically to alter its bodily form and function, cultural practices might be subverted and a sharp discontinuity introduced into our history. Imagine the impact on cherished social, cultural, religious, and athletic practices if billions of people were to awake one morning having transformed themselves into, say, arachnids. They would have trouble recognizing their "ancestors" on Grecian urns and in Egyptian hieroglyphs, and they would have to remake completely their bathrooms, their sports, and their sexual practices.

As a practical matter, such a widespread metamorphosis would only be possible through germline, as opposed to somatic, genetic engineering. And it could only result from germline engineering mandated by a state agency, not chosen by individuals, even individuals subject to fashion, social pressure, and public subsidy. Those social forces are more likely to produce small incremental changes, *e.g.*, in average height, that may have significant aggregate effects, but are unlikely radically to alter human form or function. In fact, those pressures may tend to encourage parents to engineer their children so as better to conform to existing social practices and activities, *e.g.*, endowing them with stronger pitching arms, rather than deliberately to reshape social practices.

And yet such piecemeal modifications may well have cumulatively profound if unintended effects. The development of stronger pitching arms by conventional means has had a striking — some would say unfortunate — impact on the game of baseball, and the genetic acceleration of that development might alter the sport beyond recognition. We should not underestimate such unintended effects. Individual germline engineering that was subsidized by the state might alter practices and traditions of which typical human form and function were integral parts at least as profoundly as the advent of the mass-produced automobile and the asphalt highway altered practices and traditions resting on limited mobility. But we have surely learned something from the automobile age about the need to anticipate and control such unintended consequences. We have recognized, and tried to regulate, the destructive consequences of consumer-driven transportation technology, and there is no reason to think that we would be less adept at regulating the consequences of consumer-driven biotechnology. Of course, there would be mavericks who would defy any effort at regulation, but they would be unlikely to undermine a modest regulatory regime that enjoyed broad popular support. And just as regulating automobile use and highway construction has not required us to abandon the family car(s), regulating biotechnology should not require us to abandon parental germline engineering, merely to restrict it in ways we cannot yet foresee in any detail.

Moreover, we should hardly assume that all transformations in our social and cultural practices, however profound, would be undesirable. If germline engineering, with or without state sponsorship, had the effect of making future generations less equipped for fight than flight, more lithe than muscular, and did so broadly enough to avoid the obvious practical problem of "unilateral genetic disarmament" by one family or nation, there would be little cause for lamentation. Those pacific future generations might look back with a perverse fondness and admiration for their warlike forbears, much as some contemporary Swedes look

back on the Vikings, or on Gustavus Adolphus and Charles XII. Despite the profound changes in personal or national character wrought by genetic engineering, there might be strong continuity, and strong mutual identification, between the present and future generations. That continuity and identification would, if anything, be strengthened by the deliberate character of the transformation; by the recognition of the present generation that its descendants would embody its desire to beat swords into plowshares, and by the recognition of those future generations that they sprang from that desire.

Preserving the genome as an evolutionary heirloom

There is another reason to oppose the germline modification of the genome — not for a phenotypic impact far more radical than any likely to be achieved through somatic modifications, but because the genome itself, or the genome of each of us, is an object of great historic value. Our genomes are, it could be argued, a peculiar kind of heirloom, that can be modified continually and replicated geometrically without loss of value, as long as they are modified and replicated by the same processes that have until now always characterized their propagation. Our genomes are small but pervasive bits of nature entrusted to each of us as stewards; relics as well as blueprints. To alter those relics permanently by germline engineering rather than the vagaries of sexual recombination would be to "denature" the genome and to cut us off individually or collectively from our evolutionary heritage.

The qualities of that connection, and of the genome as relic, are somewhat obscure. Thus, the Human Genetic Diversity Project sought samples from small, vanishing sub-populations of "First Peoples" to preserve the diversity of our heritage, but it is unclear what it would take *truly* to preserve that heritage. Maybe the preservation of the sampled genomes *in vitro* would not suffice; perhaps genetic diversity would be lost whenever the actual members of one of these groups died out before producing their own offspring. On the other extreme, it might not even be necessary to preserve actual genetic material from dying: it might suffice to sequence the samples, so that their distinctive characteristics could be recorded and, if desired, reconstructed.

This uncertainty about what it would take to preserve genetic diversity raises a broader issue about whether it is the process or product we would be seeking to preserve. Until now, this has been a more familiar issue in the preservation of art and nature. For example, Maryland's state tree, the venerable Wye Oak, was cloned by plant biologists shortly before it succumbed to a windstorm. It is now possible to purchase the biological material to grow a genetically identical tree. But the prospect of little Wye Oaks popping up in suburban back yards across the state is hardly consoling to those who mourn the loss of the original tree. Nor, presumably, would it console those who fear the loss of the natural human genome through genetic engineering that some of the last natural genomes would be preserved, and available for reproductive cloning at a modest price. We appear to value the process of chromosomal division and recombination, not (merely) its product, let alone the information it contains. It may be, then, what we really fear is the disruption or loss of the natural processes of human mating and reproduction.

The threat posed to these natural processes by genetic engineering is not, or not only, the threat of excessive genetic control by parents or the state (threats that several commentators find to be greatly exaggerated). The threatened de-naturing of the human genome, and of our natural history, may not be a problem of control at all. Imagine, for example, that in order to eliminate the danger of excessive control, parents were required to assemble their childrens' genomes by randomly selecting from a pool of manufactured genes. This gene pool could be constituted so as to permit wide, arguably desirable variation in such valued traits as height, strength, and intelligence, while raising the "quality" of the pool and eliminating alleles associated with disease and impairment — though this last would also be problematic. The randomness of selection from the pool would bar excessive control by parents or the state and yield an element of contingency and chance arguably as great as that found at present, where unregulated variation in the gene pool is limited by the implicit selectivity of "assortative mating." Such artificially achieved contingency might preserve the robustness and moral vigor of the parent-child relationship, as well as restricting state control over the characteristics of future children, but it would, no less than the deliberate genetic engineering of desired characteristics, attenuate the connection between the new being and his or her forbears; indeed, it

would complicate or confuse the very notion of "forebears."

Why preserve our genetic connection with nature?

This objection faces two obvious challenges: first, it is unclear why it is important to maintain any *biological* connection to our nature and our forbears; second, it is unclear why the genome itself is critical to maintaining that connection. As to the first, we have long been profoundly ambivalent about our connection to the natural world. Many of the most influential thinkers of the past two millenia have *opposed* human nature to nature — or at least regarded as natural humanity's transcendence of its natural origins. The connections that such thinkers have regarded as most worthy of preservation have been with our historic past, not our biological past. Moreover, we've all heard the observation that humanity has radically interfered with natural selection through practices of modern medicine, public health, and public welfare. The course of human history has been one of an increasing divorce from nature, sometimes gradual, sometimes fitful and abrupt.

But the very ideas of transcendence and divorce suggest or presuppose something to transcend or be divorced from. Even from this Enlightenment view, an essential aspect of our humanity is our relationship to, or struggle with, that part of us which is biologically given — a part that we now see as constituted primarily by our genome. Once our genome itself becomes a product of our own making, no part of us is biologically given, and we may utterly lose our connection to the natural world. That connection, the argument goes, is essential to our humanity, though it may also be essential to our humanity that we chafe and struggle against it.

Even if we accept the need for such a connection, however, the question remains why it must be maintained with genetic material. If the genome is a relic, its veneration is a recent phenomenon. We did not even know we had genomes until modern times, nor that we were the products of random evolutionary processes. More important, as my colleague Mark Sagoff notes, it is unclear why the insertion of manufactured genes into a human organism would transform it into an artifact, when the insertion of an artificial limb, hip, or heart does not.[3] No one thinks that by stitching a Dacron patch into a heart a surgeon transforms the heart's owner from a product of nature into a fabrication of humanity.

Yet one does not need to give an exaggerated importance to genes to worry that genetic engineering would attenuate our connection to nature. The implicit charge of genetic essentialism — of giving the genome a defining or essential role in that connection — could be met by arguing that it is the timing and comprehensiveness of the intervention that matters, not the genetic or non-genetic character of the material used. We might well have similar concerns about the loss of natural connection if we placed "natural" zygotes into artificial wombs, where the resulting child, even the genetic material in his or her differentiated cells, would be made almost entirely of artificial, or at least processed, materials.

Moreover, the charge of genetic essentialism may be belied by the grave concern that is often expressed over *somatic* modifications which do not merely mimic but also alter and enhance natural functioning and that alter the operation of organs or systems seen as partially constitutive, rather then merely supportive, of humanity: the brain or nervous system as opposed to the heart or cardiovascular system. Such innovations are a far cry from Dacron patches and breast implants, and their critics bewail the impending loss of humanity much like critics of genetic engineering. Thus, in a special issue of *Science* on "Bodybuilding: The Bionic Human" one critic denounced the effort of a British neuroscientist to connect his and his wife's nerve endings through a computer as "profoundly immoral," because "enhancing one's information by connecting chips to the nervous system marks a very fundamental change in what human beings are."[4] Admittedly, this specific piece of engineering is especially troublesome, in allowing people to "feel each other's pain" a bit too literally. But other equally radical innovations would pose no comparable threat to individuality or privacy.

Even if the preservationist case against genetic engineering does not rest on genetic essentialism, however, it may be profoundly misguided. The fact that some somatic modifications are denounced as shrilly as modifications to the human genome hardly shows that the latter denunciations are warranted. The extension of such objections beyond the genome

might just as well be taken to show that it is possible to fetishize more than one aspect of the human body.

Will we lose our sense of wonder?

Critics of genetic engineering would, of course, deny the charge of fetishism. They might argue that what made any comprehensive body- or mind-altering technology objectionable was the danger that it would strip the creation and shaping of human life of its mystery and awe and lead us to see its products as commodities. But the increasing intrusion of technology into the process of creating and shaping people need not end in the complete routinization or demystification of that process. Once the genetic engineers are through with their work, there is still room for awe. A genetically-engineered baby will still inspire amazement (and relief) as it draws its first breath and emits its first cry. The gradual transformation of a clump of cells, genetically engineered or not, into a moving and thinking being will remain an event or process "commensurate with our capacity for wonder" — however refined the technological interventions that modify the process or its end result. Moreover, that technology itself could become endowed with a sense of gravity and awe. The process of gene selection or artificial incubation could even be sacralized, coming to display the gravity and power possessed by a solemn secular marriage ceremony.

Finally, it may be harder than preservationists think to sever our connection with the natural world or to lose our attendant sense of dependency, uncertainty, or surprise. Perhaps our nature-modifying technology can at most weaken that connection and those emotions, not eliminate them. We will still, at least in the foreseeable future, perform our technological interventions with material ultimately from the natural world, and through processes in part beyond our control. We can still see ourselves as coming from dust as well as returning to it, even if the dust we come from has undergone a good deal of technological refinement. Further, biotechnology, to a greater extent than other modern technologies like artificial intelligence and robotics, mimics nature even as it improves on it. Imitation may not only be the sincerest form of flattery; it may be a morally significant form of continuity.

The role of nature would remain far greater in the "assembly" of a human genome than the assembly of an automobile. Not only would the genomic pieces — the base pairs and scaffolding — be merely one remove from nature, but the assembled product would, even with human monitoring and artificial incubation, undergo a series of autonomous and self-perpetuating transformations that could inspire humility and awe even in its human creators. That humility and awe would quite comfortably continue to exceed whatever gratification an automobile worker might experience at watching the latest model roll off an assembly line. Even if we assume far greater and more deliberate influence over the creation of human beings than is now possible, we may well preserve not just a *process* of creation but also the full measures of amazement, bemusement, and frustration that humans have always derived from the creatures they cherish as their children.

And even if human control over human creation makes gestation and birth more routine and less awesome than they now are, such control may only defer, not destroy, our sense of wonder. A car (except perhaps for the proverbial "lemon") does not develop in dramatic and unpredictable ways through close interaction with its drivers. Nor do the products of agricultural biotechnology change in profound ways in interacting with their consumers. Fruits and vegetables may age or ripen, they may be cooked or frozen, but their transformations can hardly be compared to the growth of a child. It is unlikely that we will lose our sense of wonder at our children and their development, as long as we continue to rear them from their earliest years.

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References

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