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The changing face of human nature

In 1992, at the start of the surprisingly short decade's march toward the sequencing of the human genome, one of its key initiators, geneticist Walter Gilbert, claimed that "one will be able to pull a CD out of one's pocket and say, 'Here is a human being; it's me.'"[1] Gilbert's brilliant piece of theater was echoed by other leading molecular biologists in their campaign to win public support and enthusiasm for the Human Genome Project (HGP). It seemed not to matter how often the biologists employed the same theatrical device, whether in California or at London's Institute for Contemporary Arts: holding up a CD to a spellbound audience and saying, "this is human life itself" was a brilliantly chosen trope. The CD, so familiar to the audience of a high-tech society, was recruited to symbolize the merger of molecularization and digitalization heralded by the developing HGP. At once a science and a technology, this technoscience of human genomics simultaneously offered a new definition of human nature and new, promethean powers to repair and even redesign that nature.

DNA and genomics dominated the media throughout the 1990s, with its deterministic gene talk and genes for everything from the most severe diseases to compulsive shopping and homelessness. While the CD played its part in the popularization of the HGP, it was the representation of DNA's double helix that came to be the dominant signifier of life itself. More subversively, numbers of graphic artists saw the potential surveillance powers of genomics, striking a more critical note than the CDs or the double helix by, instead, showing people with bar-coded foreheads. Here human nature was reduced to a mere commodity with no agency, to be read at the checkout counter.

The explosive growth of genomics, with its relatively subdued cultural debate, was not alone. Another powerful and expanding field, namely, neurobiology, led to the 1990s being nominated by the National Institutes of Health as the Decade of the Brain. (Europe was slower; its Brain Decade started about five years later.) By 2009, on both sides of the pond, neuroscientists claimed that advances in brain science had been so substantial that it had become the Decade of the Mind. Just as the double helix became the symbol of the HGP, so have the vivid, false-color skull-shaped images locating the "sites" of brain activity come to symbolize the new neuro-

science. These sites include not only well-understood regions within the brain, such as those associated with vision and speech, but also new ones, like regions thought to be associated with London taxi-drivers' knowledge of the London streets,[2] for example, or with "romantic love."[3] Londoners were delighted to learn the location of their cabbies' "knowledge," persuaded by the high-tech images one could see in any newspaper. For those humanists who understand the concept of romantic love as originating with the medieval troubadours, the claim by leading imager Semir Zeki that this is a universal brain-located human phenomenon, unaffected by culture or history, is distinctly challenging.

Contemporary genomics and neuroscience not only claim to explain how the brain and, hence, the mind work, but also to put psychiatry on a sound scientific basis. While the drivers for the scientists may primarily be curiosity, as the conditions for exploring these latest scientific frontiers ripen, the practical implications, both for medicine and, more disturbingly, as tools for controlling and manipulating the mind, are profound. Patients' accounts of their experience of mental illness will become less or even unnecessary as brain scans and gene scans are taken as speaking more accurately about the underlying causes. Once again the human agent disappears and human nature becomes digitalized. In a biotechnological age, where major funding for genomics and neuroscience comes from the biotech and pharmaceutical industries as well as from venture capitalism, and universities move to protect their intellectual property with patents, disinterested curiosity increasingly belongs to a distant age of science.[4] However, our concern here is not so much with these commercial implications, but with the claims that these technosciences now make: that they can provide a materialist account of human nature itself, whether body and brain or mind and consciousness.

In this, genomics and neuroscience are building on a materialist tradition that runs back to antiquity, but that gained increasing authority from the birth of modern science in the seventeenth century. Previous materialist claims by philosophers, such as Hume and la Mettrie, could not make the power move of offering an alternative theory; only the cultural authority of the growing natural sciences provided this. It isn't possible to understand and interpret the construction of human nature by present-day genomics and neuroscience without locating them, however sketchily, historically within this materialist tradition.

By the late eighteenth century, "animal electricity," mesmerism, and phrenology were attempting to locate mental attributes, and indeed life itself, within the explanatory realm of the natural sciences. The early-nineteenth-century materialist accounts of nature and human nature produced by natural philosophers (that is, scientists) found a receptive audience among intellectuals. High up in the Yorkshire Dales, the Brontë sisters (Bramwell was probably in the pub) would walk the several miles from the Haworth parsonage down to Keighley, their nearest town, to listen to a lecture on phrenology, the hottest materialist account of brain and mind. In the vivid descriptions of the head shapes of Mr. Rochester and Jane Eyre we find the influence of the new phrenology in the pen of Charlotte Brontë.[5] In distant Cornwall, the young chemist Humphry Davy and the poet Samuel Coleridge formed a lifelong friendship, and Davy's speculations about electricity as a life

force lay behind Mary Shelley's unforgettable creation of Frankenstein's monster. Today, novelist Ian McEwan's *Enduring Love* embraces evolutionary psychology; A. S. Byatt's *Babel Tower*, genetics and neuroscience. Thus the humanities of past and present gesture toward the new materialist accounts of human nature.[6]

By the mid-nineteenth century, a fully reductive materialism, or to use philosopher Daniel Dennett's term, a "greedy reductionism,"[7] had taken a firm hold within the sciences. In 1845, four rising German and French physiologists – von Helmholtz, Ludwig, du Bois-Reymond, and Brucke – swore a mutual oath to prove that all bodily processes could be accounted for in physical and chemical terms. The Dutch physiologist Jacob Moleschott put the position most strongly, claiming that "the brain secretes thought like the kidney secretes urine," while "genius is a matter of phosphorus."[8] For the zoologist Thomas Huxley, mind was an epiphenomenon, like "the whistle to the steam train." But it was above all Charles Darwin who provided the intellectual and empirical bedrock for a materialist account of human origins and human nature. *On the Origin of Species*, published just 150 years ago, both precipitated and symbolized a transformation in Western society's understanding of human origins. As the geneticist Theodosius Dobzhansky confidently asserted, "[N]othing in biology makes sense except in the light of evolution."[9] Certainly, biologists had been challenging the notion of the fixity of species for a good three quarters of a century before *Origin*, but it was the Darwinian mechanism that proved decisive. And indeed, in the intervening century-and-a-half, biologists have continued building on Darwin in insisting on a fully materialist account of nature and human nature – on what it is to be human, from our basic physiology to our powers of cognition, our emotions, and our beliefs.[10] The supernatural and, hence, religious belief became unnecessary to the explanation of human nature and mind.

Origin set out a theory of evolutionary change through natural and sexual selection, displacing the centrality of Judeo-Christian theology and the two-page creation story from the book of Genesis. No longer were "kinds" to be understood as having been created independently in the brief interlude between God's separating heaven and earth and then resting on the seventh day. Rather than having been intelligently designed, as the Rev. William Paley had famously insisted half a century previously, species had evolved from a single common origin and been transformed by selection operating on random variation over long periods of geological time. (Evolution, according to one outraged opponent, was "the law of higgledy-piggledy.") Origin stories about who we are and where we come from are central to the belief systems of human cultures, and Darwin's contemporaries were quick to recognize that the European commitment to the Judeo-Christian origin story, which insisted on the immutability of God-created species, was under challenge from a materialist and evidence-based narrative of speciation through variation over time and place. The persistence of belief in creationism/intelligent design in the United States, still the research superpower, remains an extraordinary anomaly. While adhering to the late Stephen J. Gould's assertion that faith and science are non-overlapping magisteria, the intensity of such beliefs among U.S. evangelical Protestants challenges the comfortable assumption that secular-

ism would accompany the deepening of modernity.

Although Darwinian evolution rejected the Linnaean view of the Great Chain of Being, in which all living organisms were ranged in a God-ordained hierarchy, for Darwin evolution was still progressive, with lower organisms giving way to higher ones. Darwin represented this as a many-branched tree of life, with *Homo sapiens* at the highest point. (Today's Darwinists prefer the metaphor of the bush, with all currently extant species equally "evolved.") In *Origin*, Darwin only hints enigmatically at the relevance of his theory to humans. Not until *The Descent of Man, and Selection in Relation to Sex*, published eleven years later, does he finally affirm humanity's ape-like origins, and locate human differences – between races and sexes – within an evolutionary framework. Unlike some of his contemporaries, such as Huxley, Darwin embraced a monogenic view of the origin of the human species. Certainly *Descent* divides humanity into many distinct races, describing their differences in skin, eye, and hair color in some detail. But Darwin nonetheless insisted that there was but a single human origin, the various human races having separated from this common stock over evolutionary time. This difference from the prevailing polygenic view, in which the races constituted separate species with distinct origins, was a major issue for biological theory albeit minor in social practice.

Darwin, like the rest of his circle, shared the confidence of Victorian gentlemen at the height of Britain's imperial power, of a racial hierarchy ranging from the less evolved, degraded savages of Tierra del Fuego to the higher European civilization, not least that of Down House in the garden of England. Huxley went further, arguing that the evolutionarily inferior black races would in due course be out-evolved and defeated by the whites. Evolution is an ongoing process so far as Darwin is concerned, without endpoint. Indeed, as a nineteenth-century progressivist he speculates on the wonderful civilization of the future as the species evolves: "And as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection."[11] More negatively, his concept of variation within the species is trapped within a very nineteenth-century understanding of fixed social hierarchies. Thus, despite his hatred of slavery, Darwin's concept of race essentializes difference, so that variation within the species slides into hierarchy between the races.

Sexual selection is almost as central to Darwinian evolution as is natural selection, because it explains both the differences between the sexes within a single species and some of life's extreme and otherwise apparently non-adaptive features, such as the glories of the peacock's tail. Sexual selection accounts for the fact that males and females of the same species often differ in shape and size. Males compete for females; they may fight like stags, or display like peacocks. Females then choose the strongest or most beautiful male.[12] This serves to enhance the male characteristics that females find most attractive. Like his view of race, Darwin's view of the differences between the sexes was entirely conventional. Thus, he states, in humans the result of sexual selection is for men to be "more courageous, pugnacious and energetic than woman . . . [with] . . . a more inventive genius. His brain is absolutely larger . . . the formation of her skull is said to be intermediate between the child and the

man."[13] Nineteenth-century biologists' differentiation between the sexes was crucial in providing a biological basis for the superiority of the male and the explanation for the near invisibility of women (along with the common people of both genders). While female choice explains sexual selection, it is the males who evolve in order to meet the chosen criteria of strength and power.

By the mid-nineteenth century the universalism of the Enlightenment began to show its cracks – at least to feminists and abolitionists. The stirring calls for universal equality made throughout the revolutionary ferment of the preceding century, from Thomas Paine's *Rights of Man* to the Declaration of Independence, were seen by pioneering feminists as excluding the claims of women. At an 1851 women's rights convention in Akron, Ohio, the freed slave Sojourner Truth brought together the struggle against slavery and gender with her "Ain't I a woman?" challenge. Darwin's androcentricity was not missed by his contemporary feminist intellectuals; within five years of the appearance of *Descent* in the United States, Antoinette Blackwell Brown[14] had published her critique. But it was not until a century later that sufficient numbers of women had entered the natural sciences, and so were inside rather than outside the production system of science, that feminist biologists returned to the critique much better armed. Ruth Hubbard bluntly asked of Darwinian theory, "Have only Men evolved?"[15]; ethologist Sarah Blaffer Hrdy pushed this argument further in her 1981 book *The Woman That Never Evolved*.[16]

Darwin did more than locate humans within an anatomical and physiological evolutionary continuity.[17] He anchored the human mind firmly into human biology and laid the foundation for an evolutionary psychology; human emotions and their expressions were for him evolutionary descendents of those of their ape-like ancestors. However, from Darwin's day until recently, neuroscience was unable to cash out these promissory claims. It could, as in the view of the early-twentieth-century physiologist Charles Sherrington, trace the great neural pathways up from the periphery to the brain, and out again, enabling the organism to act on the world; but although what went on inside the three-pound mass of tissue inside the skull could be studied chemically and physiologically, science could not explain mental processes.

Over the past three decades, genomics and neuroscience have been transformed in scale, from small sciences to full-scale technosciences. While genomics' goal is to read the book of life in the genes, neuroscience offers to solve the mind-brain problem. Both also share medico-technological ambitions: to eliminate disease, treat mental and neurological distress and disorder, and enhance technologies of social control. The scale of these new enterprises is prodigious. The scope and scale of genomics is familiar, but neuroscience begins to rival it. More than thirty thousand neuroscientists attend the annual meeting of the American Society for Neuroscience, including a large international contingent. Conferences, though few on this scale, proliferate in the rich researching nations. Add to the cost of the many conferences, those of salaries, laboratories, and the hugely expensive technologies and it becomes self-evident that the neurosciences, with their powerful, empirically rich knowledges, are funded on a totally different scale from the academic humanities and so-

cial sciences, with costs running into hundreds of millions of dollars annually.

This huge growth of investment in neuroscience from governments, including their military establishments, private foundations, and the pharmaceutical industry has not yet resulted in anything like a generally accepted theory of how brains/minds may work; rather, it has endorsed a multitude of new reductive insights and approaches, of which we single out four: two theoretical and two experimental. Theoretically, sociobiology and, later, evolutionary psychology claimed a closure of the Darwinian evolutionary program by integrating human social behavior within it. The theoreticians of informatics have sought in cognitive neuroscience to locate in the computer a mechanical metaphor for brain/mind processes that transcends the mere hand-waving of the past. The experimental advances in genetics and imaging have enabled the biomedical gaze to penetrate ever deeper into the brain to levels hitherto inconceivable. Thus if phrenology was a premature materialism, and Moleschott's claim was more of a provocation than a research program, the last years of the twentieth century, those of the Decade of the Brain and the current Decade of the Mind, have witnessed a resurgent confidence among neuroscientists. Finally they have in their hands the keys with which to open the mind to natural science's objectivity.

That the human mind and human nature have been shaped by evolutionary pressures is of course not in question. Humans are long-lived social animals whose offspring are born neotenous, requiring several years of caregiving before they can live independently. These parameters must play a central part in the formation of the human mind. Living in groups requires learning social skills – that is, adjusting an individual's ways of being and thinking to the needs of others – a theme currently being actively explored by a variety of researchers. A new field, "social neuroscience," is emerging, stimulated by neurophysiologists' discovery of so-called mirror neurons, which are active either when an individual performs a particular act or watches another doing the same – allegedly the neural base for empathy. Empathy (or at least mirror neurons) is present in humans' nearest evolutionary neighbors. The social nature of human existence also must have driven the evolution of mind and consciousness. As a result, evolution has ceased to be seen as an entirely biological process, and many now speak of the emergence of modern humans as a co-evolutionary process, involving both biology and culture.[18] Such an argument insists on the inseparability of human biology from human culture, not as a matter of arbitrary partitioning – such-and-such a percent genes and such-and-such a percent environment – but of the continual interplay between both during development. Humans are biosocial beings.

However, as with eighteenth-century phrenology, the possibilities of an empirically based evolutionary psychology have been sullied by a group of self-proclaimed evolutionary psychologists, the more recent avatars of 1970s sociobiology, who have hijacked these possibilities. Evolutionary psychology bases itself not just on the assumption that human nature is an evolved property, but on the profoundly un-Darwinian assertion that human nature (by contrast with the rest of nature) was fixed in the Pleistocene, and there has not been enough evolutionary time for human nature to change subsequently. Thus, it is not just that the demands

of social living may have impacted the evolution of morality, but that humanity is, according to the evolutionary psychologist Marc Hauser, endowed with a universal set of moral principles, independent of culture or social context.[19] Also prominent among these apparently fixed human characteristics is the expression of so-called basic emotions,[20] racial preferences, and gender relations. Male preferences for mating with younger women of defined body shape, and female for richer, older, more powerful males, do little other than repeat in contemporary language Darwin's own assertions in *Descent*. Evolutionary psychology has been subject to severe criticism. Scholars across disciplines, from the humanities and the social and life sciences, have challenged its theoretical base and empirical adequacy.[21]

To evolutionary psychologists, the human mind is "massively modular," consisting of a large number of semi-autonomous, innate components. (Leda Cosmides and John Tooby liken it to a swiss army knife.[22]) However, not only is this claim disputed by those who argue that the mind's specificities are formed during development through an infant's interaction with a social environment,[23] but brain imaging studies also find no evidence for such modularity. The complexity of the brain, with its hundred billion nerve cells, and hundred trillion internal connections, still defies comprehension. Twenty-two thousand genes cannot begin to specify in any more than generalities the pattern of these connections, which are shaped by the activities of the developing child.

"Mapping the brain" is conceptually and technically orders of magnitude harder a task than sequencing the genome, which is a linear and stable sequence; the brain is a dynamic structure organized in three dimensions of space and one of time. However, the power of informatics is making possible a human brain project modeled on the Human Genome Project, though more informally organized. The idea is to produce a brain-gene map, in which all of the genes expressed in the brain are localized, and from which the mind can be divined. How such a map may change our concept of how the brain works is, however, another matter. Identifying sites or genes "for" particular brain processes or mental attributes ignores both the complexity and dynamism of the brain.

The advent of brain imaging, coupled with informatics, has technically driven such proposals. Placing subjects into a functional magnetic resonance imager (fMRI) and asking them to think of God or contemplate moral dilemmas identifies regions of the brain that show increased blood flow compared with controls. In such studies, blood flow is taken as a surrogate measure for neural activity. Another technique, magnetoencephalography, which measures the fluctuating transient magnetic fields around the head, offers millisecond-by-millisecond records of the brain's activity during such thought processes. Reciprocally, focusing an intense magnetic beam through the skull onto specific brain regions can influence thoughts and emotions. The mathematical manipulations that lead to the identification of these brain regions are disguised by the dramatic false-color representations that grace the plethora of popular books and articles describing the latest aspect of human nature to be thus given a specific site within the brain.[24]

Taken together, these theoretical and investigative tools have opened the way to an increasingly assertive reductionism, in which the collapse of mind into

brain is unquestioned. This programmatic agenda has been articulated by the new neurophilosophers, notably Patricia and Paul Churchland, with their robust dismissal of mind language as mere folk psychology, to be replaced by the rigors of computational neuroscience,[25] a project committed to digitalization and shared by many leading neuroscientists. Consciousness theorist Gerald Edelman quotes Emily Dickinson's poem "The brain is wider than the sky" before asserting, "[Y]ou are your brain"[26]; neurobiologist Eric Kandel comfortably agrees.[27] For Semir Zeki, the brain, rather than the mind, has "knowledge" and "acquires concepts."[28] Larry Young, extending Zeki's brain localization of romantic love and reprising Moleschott, argued in a recent *Nature* essay that human love (by analogy with the mating practices of voles) depends on a polymorphism in the *AVPR1A* gene.[29] Francis Crick is in robust Alice in Wonderland mode: "You're nothing but a bunch of neurons," he writes, before going on to speculate that "free will" is located in the anterior cingulate gyrus.[30] Crick's mischievous localization exemplifies the internal phrenology that brain imaging fosters: Franz Gall and Cesare Lombroso redux.

The neuroscientific reach into the mind has by now gone beyond even love and religious experience to approach what many consider humans' most enigmatic attribute, that of consciousness itself. Consciousness studies no longer inhabit a borderland between the speculations of theoretical physicists and new-age mysterians, but instead occupy ambitious young neuroscientists, who employ all the armory that brain imaging and computer simulation can provide (although the still proliferating books on mind and consciousness are written mainly by their seniors). In the past, philosophers of mind pondered the problems of qualia and first- versus third-person experience, without feeling the need to relate them to findings from the neurosciences; this is no longer adequate. Philosophers (at least in the United States) are beginning to enter labs to observe scientists at work.[31] But the confidence, even hubris of neuroscientists that their accounts of brain functioning will explain mind can indicate a failure by the neuroscientist to understand what the philosopher is saying, as in the case of the public debate between the neurochemist Jean-Pierre Changeux and the hermeneutic philosopher Paul Ricoeur.[32]

Perhaps this helps explain why, despite the explosion of literature coming from the neurosciences, the most satisfying accounts of "mindedness" have come not from "basic" laboratory-based accounts, but from researchers who are also clinicians. At the birth of both modern physiology and sociology, there was an interesting debate between Claude Bernard and Auguste Comte. Bernard's project was to put medicine onto a proper scientific basis, arguing that the route to scientific understanding was through the study of normal physiological mechanisms. Comte, by contrast, insisted that one best approached the normal via the pathological – that is, through the clinic and patients' lived experiences of pain and suffering. The same seems true today. No neuroscientist studying memory has explored its vagaries more richly than the Soviet neuropsychologist Aleksandr Luria.[33] Oliver Sacks's *Awakenings* combined a study of the clinical effects of l-Dopa in patients with a sensitive understanding of their existential crisis in being wakened from the deep sleep of encephalitis. More recently, Pat Wall's

approach to understanding the neurophysiology of pain has been enriched by his listening to patients suffering intractable pain.[34] And it is perhaps not surprising that some of the most detailed attempts by a neuroscientist to come to terms with the complexities of human consciousness have come from Antonio Damasio, whose collaboration with the neurologist Hanna Damasio has required not just brain imaging, but listening to their patients suffering from disturbances of will and emotion.[35] He describes one patient with severe frontal brain injury who showed none of the anticipated cognitive effects; surprised, Damasio tells of how he came to realize that the negative effects were in Elliot's lack of emotional response despite having been through terrible trauma. In this meticulous storytelling – which also makes a philosophical point – Damasio says that he realized he was more distressed by Elliot's telling him of the traumatic events than was Elliot himself. It is the minded clinician who makes the diagnosis when purely cognitive tests cannot.

As this neurological example illustrates, imaging techniques are used increasingly for neurological diagnoses. But, more disturbingly, there has been an increasing enthusiasm for employing them to predict potential "antisocial" behaviors, from attention deficit hyperactivity disorders in children to criminality, psychopathy, and terrorism.[36] Coupled with the power of the new genomics, for biological determinists this opens the possibility of a eugenic social policy. Such thinking stretches back to Francis Galton's 1869 foundational text, *Hereditary Genius*, which saw genius as passing down through the male line. Galton's central concept of eugenics crystallized a growing concern among the social and cultural elite with the quality of the national stock in late Victorian England. Darwinian theories provided a substantial ideological support to the nascent eugenics movement, itself given strength in the early twentieth century with the rediscovery of Mendel's genetics. The widespread enthusiasm for the new science of eugenics was shared by Euro-American intellectuals of almost all persuasions (barring Catholics) and professions, and ranged from conservatives through pro-birth-control feminists to Scandinavian social democrats, above all the Myrdals. For the Myrdals, eugenics was an essential plank in the formation of the welfare state, understood as a science-based social policy, necessary to maintain the collective well-being of the nation. The welfare state could not – would not – carry the burden of the unfit. Hereditarian biologists (with Cold Spring Harbor in the United States and University College London's Galton Laboratory as key locations) envisaged moral or mental deficiency as inherited and as weakening the national stock. The body of the nation thus took priority over the body of the individual. The chosen method of inhibiting the breeding of the "unfit" (above all, the learning disabled) varied from country to country, ranging from compulsory sterilization in the United States and Scandinavia to sexually segregated incarceration in the United Kingdom and Holland. Both social technologies served eugenics equally well.

Such comfortable and explicit acceptance of eugenics, at least by the cultural and political elite (though more dubiously by their subjects), was shattered by the advent of Nazism and its ideological underpinnings of race science, publicized by the influential race scientists

Baur, Fischer, and Lenz.[37] Some races, Jews and Gypsies in particular, were *untermenschen* and therefore outside the definition of what it is to be human. After 1945 and the Nuremberg trials, whether these were victors' justice or marked the advent of bioethics, the word eugenics became taboo. Geneticists (above all, clinical geneticists) dissociated their discipline from eugenics and its hideous past. This distinction was uneven though, as numbers of Nazi race scientists were reappointed to leading positions in genetics labs in postwar West Germany. The practices of eugenics continued until the mid-1970s, still guided by biomedicine and still ranging from compulsory sterilization to incarceration and sexual segregation. It was the explosion of the new social movements of the late 1960s and 1970s, not least the women's liberation movement, with their new demands for personal and cultural freedom, which helped terminate these practices.

Despite the UN 1948 Declaration of Human Rights, with its intended deathblow to the very idea of race, outside the mainstream of science biological racism flowed steadily as a highly conservative response to the social challenges, within the United States, of the civil rights movement and Johnson's War on Poverty. This conservatism extended from Jensen's attack on Project Head Start,[38] a waste of resources in his view because of the inherited lower IQ of black Americans, to Herrnstein and Murray's *Bell Curve*,[39] which argues that those at the bottom of the curve formed a genetic underclass and were outside the reach of progressive social policies. By the end of the century, the hierarchical difference of biological racism had been largely replaced by cultural difference, fought out politically as a clash between multiculturalism and cultural racism. Social groups now identify themselves (and are identified by others) according to culture rather than biology or even nationality, and are still frequently seen through the hostile prism of racism. In the United Kingdom, Pakistanis became Muslims, subject to increasing and violent Islamophobia. This dangerous brew has been intensified by the rise of Muslim fundamentalism and its terrorist attacks on civilians and by the wars in Iraq and Afghanistan. Ironically, it is only now, at the beginning of the twenty-first century, that the life sciences show tendencies to re-racialize difference through the discourse of genomics.[40]

Even as compulsory eugenics retreated, prenatal diagnostic techniques grew. By the 1960s, Down's syndrome could be identified during pregnancy, and women and their partners offered the possibility of termination. With the Human Genome Project, DNA diagnostics proliferated; but despite the vocal promises of molecularized genomics, few safe, effective gene therapies have been delivered: the main option offered by DNA diagnostics has been abortion. Few (other than right-to-lifers) would argue against the desirability of tests for such devastating conditions such as Tay Sachs or Lesch-Nyhan, conditions associated with extreme suffering and death in infancy. Genetic or brain imaging diagnostics for late-onset conditions, such as the probability of Alzheimer's or the certainty of Huntington's disease, raise more complex issues. Optimists like Philip Kitcher[41] regard this situation as offering a "utopian" eugenics, in which the desire of women and their partners to have healthy babies coincides with the utility to the state of fewer children being born with severe and expensive dis-

abilities. Many feminists, influenced by the growing international disability movement, have been more skeptical, questioning the cultural assumption that what women want is a perfect baby.

Such skepticism, reinforced by the challenges from the disability movement, has had a measurable effect in the United Kingdom; today, despite the increasing availability of NHS diagnostic testing for Down's, there are more babies born with the condition, not fewer. People with Down's syndrome are increasingly valued in themselves, and are not, as ethicist John Harris[42] would have it, doomed to live worthless lives. The complexity of what it means to have a worthwhile life is demonstrated by the recent claim of autism researcher Simon Baron-Cohen that testosterone levels *in utero* can predict autism and could therefore offer the possibility of termination. Baron-Cohen himself recognizes the dilemma that this diagnostic technique raises.[43] The same newspaper that reported Baron-Cohen's concerns on the front page also carried the story of the young autistic man who hacked into the Pentagon. While his action is reprehensible, it was done, it seems, for fun, and it unquestionably indicates formidable talent. Such extreme talent is rare, though those with autism share a typical lack of social and moral sensibility. But do we want, and can we afford, a conception of human nature that is so narrow – and potentially so boring? Many of the most talented in our society seem to have more than a touch of Asperger's.

Nor does the debate get easier. Issues around designer babies, savior siblings, and human cloning have led the philosopher Jürgen Habermas to raise the profound question of the desirability of a society in which human beings are made, not born.[44] Conversely, are we to be reassured by anthropologists Sarah Franklin and Celia Roberts[45] that this is a false dichotomy and that human beings can be both? The lines between nature and culture shift: as technosciences, genomics, and neuroscience define human nature as fixed, they also offer technologies of manipulation and modification. Yet even if it is this generation that comfortably decides what is at fault in the fetus within a woman's womb and how to fix it, and then fixes it, it is not the generation that has to live with the results. At their bleakest, twenty-first-century technosciences threaten to add formidable powers to the burden the poet Philip Larkin already sees: "They fuck you up your Mum and Dad, they may not mean it but they do."

Over the two hundred thousand years since the appearance of recognizably modern humans on earth, human nature has been subtly transformed in response to the evolutionary pressures resulting from rapid ecological, social, technological, and cultural change. Whether this "nature" has the resilience to respond adequately to these latest challenges remains to be seen. Big and powerful brains may not be the best of all survival strategies. After all, as Darwin pointed out, the fossil record is full of once successful and now extinct species. And at the core of evolutionary thinking is the recognition that the future is not predictable.

ENDNOTES

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10 Elisabeth Roudinesco, *Philosophy in Turbulent Times: Canguilhem, Sartre, Foucault, Althusser, Deleuze, Derrida*, trans. William McCuaig (New York: Columbia University Press, 2008).

11 Charles Darwin, *The Origin of Species*, ed. J. W. Burrow (1859; Harmondsworth: Penguin, 1985), 459.

12 It should be noted that although biologists today regard sexual selection as one of the core features of evolutionary theory, and popular writing, especially from evolutionary psychologists, accepts it unquestioningly, attempts to demonstrate it empirically among, for example, peacocks have not proved very successful. Furthermore, there is evidence that both sexes have other potential sexual strategies. Thus, while massively antlered stags are rutting, females may choose to mate quietly with less well-antler-endowed males – a strategy memorably described by the evolutionary biologist John Maynard Smith as that of the "sneaky fuckers."

13 Charles Darwin, *The Descent of Man*, 2nd ed. (1879; London: Penguin, 2004), 622.

14 Antoinette Blackwell Brown, *The Sexes throughout Nature* (New York: G. P. Putnam, 1875); cited in Ruth Hubbard, Mary Sue Henifin, and Barbara Fried, eds., *Women Look at Biology Looking at Women: A Collection of Feminist Critiques* (Cambridge, Mass.: Schenkman, 1979).

15 Hubbard, Henifin, and Fried, eds., *Women Look at Biology Looking at Women*.

16 Sarah Blaffer Hrdy, *The Woman That Never Evolved* (Cambridge, Mass.: Harvard University Press, 1981).

17 In this respect, Darwin contrasts with Wallace, his co-proposer of natural selection, who in later years demurred from extending the principle to the emergence of humans.

18 See, for instance, Merlin Donald, *A Mind So Rare: The Evolution of Human Consciousness* (New York: Norton, 2001).

19 Marc D. Hauser, *Moral Minds: How Nature Designed Our Universal Sense of Right and Wrong* (New York: Ecco, 2006).

[20] Paul Ekman, *Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life* (New York: Henry Holt, 2004).

[21] Hilary Rose and Steven Rose, eds., *Alas, Poor Darwin: Arguments Against Evolutionary Psychology* (London: Jonathan Cape, 2000).

[22] Jerome Barkow, Leda Cosmides, and John Tooby, eds., *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (New York: Oxford University Press, 1992).

[23] Annette Karmiloff-Smith, "Why Babies' Brains are not Swiss Army Knives," in *Alas, Poor Darwin*, ed. Rose and Rose, 144–156.

[24] We do not wish to diminish the insights into brain processes that neuroimaging can provide. But the dramatic images may hide as much as they reveal. At best they provide a correlative indication of those regions of the brain that are active when the brain's owner is engaged in some mental activity; they do not mean that these regions are therefore the "sites" of such mental activity.

[25] Patricia Smith Churchland, *Brain-Wise: Studies in Neurophilosophy* (Cambridge, Mass.: MIT Press, 2002).

[26] Gerald M. Edelman, *Wider than the Sky: The Phenomenal Gift of Consciousness* (New Haven: Yale University Press, 2004).

[27] Eric Kandel, *In Search of Memory: The Emergence of a New Science of Mind* (New York: W.W. Norton & Co., 2006).

[28] Zeki, *Splendors and Miseries of the Brain*.

[29] Larry Young, "Being Human: Love: Neuroscience Reveals All," *Nature* 457 (2009): 148.

[30] Francis Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (New York: Scribner, 1994).

[31] A classic example is Daniel Dennett's book *Consciousness Explained* (Boston: Little, Brown, 1991).

[32] Jean-Pierre Changeux and Paul Ricoeur, *What Makes Us Think?: A Neuroscientist and a Philosopher Argue about Ethics, Human Nature, and the Brain*, trans. M. B. DeBevoise (Princeton: Princeton University Press, 2000).

[33] Aleksandr Luria, *The Mind of the Mnemonist: A Little Book about a Vast Memory* (London: Jonathan Cape, 1969).

[34] Patrick Wall, *Pain: The Science of Suffering* (New York: Columbia University Press, 2000).

[35] Antonio Damasio, *Descartes Error: Emotion, Reason, and the Human Brain* (New York: G. P. Putnam, 1994).

[36] Adrian Raine and José Sanmartín, eds., *Violence and Psychopathy* (New York: Kluwer Academic/Plenum, 2001).

[37] Erwin Baur, Eugen Fischer, and Fritz Lenz, *Human Heredity*, trans. Eden and Cedar Paul (London: G. Allen & Unwin, 1931).

[38] Arthur R. Jensen, "How Much Can We Boost IQ and Scholastic Achievement?" *Harvard Educational Review* 39 (1969): 1–123.

[39] Richard J. Herrnstein and Charles Murray, *The Bell Curve: Intelligence and Class Structure in American Life* (New York: Free Press, 1994).

[40] "Genetics for the Human Race," special issue, *Nature Genetics* (2004).

[41] Philip Kitcher, *The Lives to Come: The Genetic Revolution and Human Possibilities* (New York: Simon & Schuster, 1996).

[42] John Harris, *Enhancing Evolution: The Ethical Case for Making Better People* (Princeton: Princeton University Press, 2007).

[43] *The Guardian*, January 12, 2009.

[44] Jürgen Habermas, *The Future of Human Nature* (Cambridge: Polity, 2003).

[45] Sarah Franklin and Celia Roberts, *Born and Made: An Ethnography of Preimplantation Genetic Diagnosis* (Princeton: Princeton University Press, 2006).