RACE AND THE GENETIC REVOLUTION

SCIENCE, MYTH, AND CULTURE

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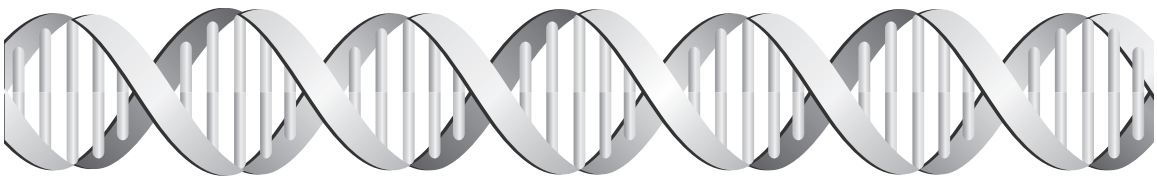

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NATURAL SELECTION, THE HUMAN GENOME, AND THE IDEA OF RACE

Robert Pollack

This chapter discusses the history of humanity as a single species, born of an ancestral species some hundreds of thousands of years ago in Africa. The history of our single species tells us that all people who were ever born anywhere on Earth have been, are, and will be descendents of Africans. Because all human beings are members of one species, all concepts of "race" that place one set of humans aside as in some way more or less fit or worthy than another set, must be in conflict with the facts of nature. The persistence of imaginary, false notions such as "race" is an example of the most remarkable characteristic of all members of our species: our imaginations. The emergence in our species of brains capable of mental worlds and self-awareness has paradoxically produced both the science that reveals these facts of our history and our biology, and the dreams of perfection that keep such imaginary notions as "race" and racism alive despite these facts. The chapter concludes with the optimistic observation that the same DNA-encoded brains that can have any thought are also therefore capable of learning these facts from science and choosing to discard the fantasies of "race."

THE IDEA OF RACE

Can there be a plausible biological basis for the negative category called race? As we use the term in America today, "race" is an idea of a particular sort. The idea of "race" uses biological differences, but it is not about biological differences. It is the classic example of the idea of a negative category, one that defies definition because it lacks content. Race is not what a racist may say it is; it is simply whatever a racist thinks he or she is *not*. What can knowledge of the facts of natural selection and the human genome contribute to our understanding of such an idea?

To begin at the beginning, such knowledge can give us a sense of the radical novelty of humanity as a single species in the context of the long histories of the universe, and of life on our planet. Unlikely and exotic as it may seem, the best explanation for the facts of astronomy today is that the universe, all space and time itself, began at a point, all at once, some 13.7 billion years ago.[1] As space has expanded from that point to beyond the furthest galaxies, it has never once been separated from the passage of time, with one exception. Time flows neither in our imaginations nor our dreams as it does in nature; we may imagine timeless idealizations, perfectible futures, and heroic pasts all at once.

Recently, in terms of the history of the universe—about 4 billion years ago—something as improbable as anything we might imagine occurred here on the Earth. In the salty seas, and apparently initially at random, clusters of atoms found in interstellar space got hooked up into long strings, and a very rare sequence of those strung-out clusters acquired the capacity to make a copy of itself, preserving the sequence of the subunits in the string. A self-replicating string preserves the information in the sequence of that string, so long as the copies themselves can make more copies of themselves in turn. One of these self-copying strings of chemical letters, DNA, has been copying itself ever since.

DNA is a chemical of great informational density, a text of great importance. As far as we know today, it is a new thing in the history of the universe, having appeared on our planet and, so far, nowhere else we know of. Of course, self-copying by itself does not explain why life emerged on our planet; it is necessary, but not sufficient. The second requirement for life is that the different strings of subunits of the self-copying DNA

carry meanings, and that one of these meanings be the capacity to assist the DNA in making more copies of itself. Thereafter, any version of DNA encoding a novel strategy for the survival of DNA after copying would itself be preserved as the novel meaning of that new sequence of DNA. This second step, Darwin called it natural selection, is both necessary and sufficient to explain the history of life on Earth, from the first DNA-encoded organisms, to us and all the species of creatures and plants alive on Earth today.

Our form of life, which emerged out of the same process of natural selection from DNA variations that has operated to produce the living novelties of this world since then, has been around only a very short amount of time indeed.

Think of each million years since the beginning of the universe as a page in a book. Today that bookshelf of the Universe would hold 30 volumes of 450 pages each (see fig. 2.1). The first 21 volumes would have nothing in them about life. Both DNA sequence and fossil evidence agree that the informational molecule DNA would have been born some time in volume 21, because archeobacteria, the first forms of life, would appear in the seas in volume 22.

Bacteria would continue to be the only shape life took for volumes 23 and 24 as well, though the ones emerging in volume 24 would change the planet's atmosphere to one rich in oxygen by bacterial photosynthesis. Big-celled forms of life like paramecia and diatoms would appear for the first time in volume 25. Living things made of many big cells would appear in volume 27. Animals would remain in the seas where life had begun until the first forms of animal life that appeared on land, the first tetrapods, march on shore at the end of volume 29.

Dinosaurs would appear in the middle of volume 30. They would for the most part be wiped out by an asteroid on page 385. Only the last 65 pages of the last volume would have anything to say of significance about mammals like the cat. The last ancestor of both us and our nearest living relative, the chimp, would have lived and died only by page 440 of the most recent volume, 10 million years ago. From that ancestor many other ancestral hominoid species would follow, each coming and going in the last 10 pages.

On the last tenth of the last page of that last volume humans would have a note about our emergence in Africa. And then, somewhere toward

FIGURE 2.1 A. Pollack and R. Pollack, "We Have Been Around Only a Very Short Time," *CrossCurrrents*, Spring 2007, 136.

the last sentence would be the emergence of language, texts, and, in that *mental* world, thoughts of imagined and imaginary creatures like Alice in Wonderland. The period at the end of that sentence would hold the time since science emerged in our mental worlds as a social activity with the capacity to understand all this.

And so at last we come to "race" and racism. In this last eye blink of universal timekeeping, we find ourselves entranced by two notions that share the same persistence in our minds and the same imaginary quality as Alice herself: first that a person is no more than what that person has inherited in her DNA, and second that a person's race is merely the clearest example of that presumption. The first is a dream because the facts

of science assure that our mental worlds are *not* encoded in our DNAs. Any brain can imagine, learn, teach, remember, or forget any idea, regardless of the ancestry of the person whose mind is emergent in that brain, and regardless of whether that idea does or does not reflect the facts of nature. Perhaps the most self-serving and punitive example of such a dreamt idea is the notion that "genes are destiny." They are not, and the dream that they are, must certainly prevent a person from celebrating the freedom to think a new thought, which is in fact the birthright of every human brain and mind.

We hold to these dreams even though for many decades science has been able to establish, through the repeated failure of all experimental attempts to disprove it, that in fact the contrary is the case. Any person's genome—his or her complement of two copies of each of about ten thousand genes, one copy of each from each parent—is no more the complete statement of that person's life and character, than any single version of a canonical text is the complete statement of a living religion. Everything interesting in both cases is the product of interpretation and social interaction. Appearances, as well as more subtle aspects of a person's individuality, begin with the information encoded in DNA, but anyone who knows an identical twin also knows that person to be unique, despite the presence of another person with the same DNA text in each cell.

From any one person to another, unrelated person, the differences in base-pair sequence—letters in the text—for the coding region of any gene studied come to about one in a thousand. The DNA sequences of the cells of two siblings are more closely related, but not that much more so, as each of the two copies of each gene have only a one-in-four chance of being the same in each child. Cumulatively over all ten thousand genes, even brothers and sisters are different in DNA sequence to almost the same degree as strangers. That is very different indeed: with three billion letters in the DNA we inherit from each of our parents, one base-pair in a thousand comes to three million sequence differences between any two people.

Beyond that fact, we should remember that the number of our ancestors doubles with every generation, so that in the past few centuries—the past ten generations—each of us has had more than a thousand ancestors, and all of them would have had this same larger number of DNA sequence differences from each other. Imagine a canonical text with that many variations from century to century and from copy to copy: no

chance of any version possibly being the only true one. Yet that is precisely the meaning of the otherwise empty notion of "race."

A racist holds that one person and all her ancestors can be the product of a set of DNA sequences so restricted in its variation that no one else but other people who look like that person have ever had or will ever have any of those sequences. The data are in, and this is not possible. It is not merely that we do not have such data; we do have enough data to be sure that the notion of oneself as the member of any such genetically restricted group, let alone one that is defined by a singular closeness to any imagined ideal, is merely a fantasy.

All that makes our genomes human, and all that makes us human in a biological sense, is that these six billion different genomes, and only they, are all capable of coming together with each other through sperm and egg to make another generation of people. The sieve of natural selection assures us that no matter what the differences in our DNA sequences, all of us are here because our ancestors' DNAs contained the capacity to encode the structures for fertile reproduction in their bodies. Everything else encoded by their DNA, and therefore by ours, that makes us different from one another, is either in service to that fact of the necessity for fertility so that the species and its DNA will survive, or it is a difference carried along by that fertility because it does not get in the way of it.

No rational explanation of what it is to be human, then, can possibly begin with the claim that one set of these exceedingly large number of genetic variants encoding fertile but different people encodes a fully human person, and another only apparently human but not worth the full recognition and rights of "one of us." The biology is clear: there is no chance of some human genomes being special and others not; the biology of us makes us truly all equal.

The presumption of "race" in the American context runs up against a second fact about our history as a single species. Our species is African in origin; we are all the very recent descendants of Africans. The evidence for this comes from many quarters, but in our terms the DNA evidence is most interesting. Because Africa is the home of us all, people today who are the descendents of the original people—hundreds of millions of Africans—have the greatest genetic diversity of all human subpopulations. This is because those subpopulations who left Africa to cover the other continents left close relatives behind, and their descendents are the people

who live in central Africa today. Of course the DNA sequences of people everywhere are also in flux as new DNA changes (mutations) pass the test of natural selection and persist, whether by being of no consequence or—rarely—by being advantageous for the survival of offspring. Still, the life of any species is measured in millions of years. We are therefore very young, and the descent of all of today's many "ethnicities" and "races" from people who lived in Africa only tens of thousands of years ago is well established.

America is also a genetically diverse place, but for a different reason. We are, in the words of President John F. Kennedy, "a nation of immigrants."[2] Setting aside most "African Americans" for a moment, the rest of the diverse American population is a set of immigrant subpopulations, each the descendents of one of the initial emigrant subpopulations to leave Africa tens of millennia ago. In that sense, though only some of us are African Americans, as a nation of immigrants from all over the globe, we are still all American Africans.

The many different versions of a stretch of chromosomal human DNA still found today in East African populations have been studied in other populations as markers of first African subpopulations to have left the ancestral homeland for the one or another of the lands reached by a series of migrations that began no later than sixty thousand years ago. These DNA fragments confirm archeological evidence that the most recent human migration to arrive at its final destination was the one that settled at the southern tip of the Americas about ten thousand years ago.[3]

The first people we would recognize as our ancestors if we met them today were Africans whose skins were dark. From these first ancestors, emigrants migrated throughout Africa and then to the Middle East, Europe, Asia, Oceania, Russia, and North America, finally ending at the southern tip of South America ten thousand years ago. Once the planet had been colonized by African emigrants, the itch to move on did not go away, nor has it even today. There is a difference between those first migrations and later immigrations and invasions. For the last ten thousand years, no migration would have been likely to settle in territory not already occupied in part by descendents of that initial migration. The resulting wars and conquests form the narrative of what we are pleased to call modern civilization.

Our way of understanding our history as a nation needs revision in light of what we now understand is the pattern of migration of

human populations.[4] Universal African patrimony makes the insult of American racism more stupid, but not less dangerous, than any other dehumanization. The series of European "discoveries" of the Americas in the past millennium were simply secondary migrations to, and conquests of, the lands first occupied by the original African settlers of North and South America by descendents of the original African settlers of Europe. That some of these "conquerors" first entrapped then enslaved Africans of their day, that these Africans arrived on the shores of the Americas in that fashion, and that the founders of the United States then enshrined the legal nonpersonhood of their descendents in the very first article of the country's Constitution makes this compelled migration only more poignant and ironic: "Representatives and direct Taxes shall be apportioned among the several States which may be included within this Union, according to their respective Numbers, which shall be determined by adding to the whole Number of free Persons, including those bound to Service for a Term of Years, and excluding Indians not taxed, *three fifths of all other Persons*. (my emphasis)."[5]

"Indians not taxed" were at that time members of unsubjugated nations. However inconvenient their presence was to notions of the manifest destiny of Europeans on this continent, they were powerful and free enough to be understood to be people in their own right. "Other persons" were not people. People can either be ignored or taxed and given the vote; "other persons" could not vote, could not become voters, had no rights, and could be bought and sold. But they had political reality and political utility. For the purposes of counting the number of seats in the US House of Representatives, "other persons" would be counted, so that a slave owner who owned one hundred "other persons" would be counted for that purpose as if he were sixty-one voters.

The recent election of the United States' first President of acknowledged and recent African ancestry has not closed this sorry history, but it has transformed its irony into simple failure. We have no national monument to "other persons" per se, while in the past few years we have seen a National Institutes of Health (NIH) initiative to examine human DNA for evidence of race. This NIH project intends to find versions of genes that are in everybody of one race, or "ancestry" (a euphemism for race in this context), but which are never found in the genomes of people not

of that race, so that the complexity of a real person, with all her uniqueness of character, history, and potential for change, may be reduced to the presence or absence of such a DNA sequence. Enough is known of human genetic diversity to make this an unlikely outcome in any event. Of all such putative DNA differences, it would be irrelevant at best and racist at worst to seek to use DNA differences associated with skin color differences. DNA differences responsible for skin color differences, the gold standard of American racial classification, turn out to be subject to very strong and rapid natural selection.

Here is how one scholar of the evolution of human skin and skin color put it in a recent review: "Dark skin evolved *pari passu* with the loss of body hair and was the original state for the genus *Homo*. Melanin pigmentation is adaptive and has been maintained by natural selection. Because of its evolutionary lability, skin color phenotype is useless as a unique marker of genetic identity."[6] Our shared African ancestors were dark-skinned because our species had emerged from hairless variants of an ancestral species, and naked apes like us were most likely to survive under the UV-rich rays of a tropical sun with the pigment melanin robustly produced by cells under their skin. As our African ancestors migrated away from the equator to more northern latitudes, the sun's rays were no longer so much of a selective agent, and lighter-skinned variants of human DNA conferred the advantage of permitting enough UV light to reach the blood under the skin, so that a person would be less likely to suffer the consequences of a Vitamin D deficiency. When these light-skinned early Europeans and Asians returned by further migration to the equatorial regions of Asia and the Pacific Islands, their descendents once again emerged as dark-skinned.

In sum, DNA samples from an individual cannot be used for any purpose related to the skin-pigmentation notion of "race," because the DNA differences associated with pigmentation will reflect the range of skin colors of one's most recent ancestors. Worse, when the categories of a "race" are attached to the DNA differences responsible for the intensity of melanin production, the result will be a biologically useless but politically powerful justification for the presumption that the DNA sequence signaling dark skin is also a signal for any data-free racist presumption of what a person will necessarily be when this DNA says he or she is "not like one of us."

THE BIOLOGY OF AN IDEA

To the extent that race is a negative category, racial differences cannot be the result of any number of genetic differences at all. This is the origin of the arbitrary nature of any and all racial categories and the absurdity of the recent evasive slide in America from "racist race" to politically correct "identity politics." In any event, the negative category of "whom I am not" can never be reducible to a countable number of genetic differences. But beyond that, there is the question of purpose. Even looking for genomic data on this question will not be of interest to the racist, who says or thinks, "if you are not like me, you can be anything else at all, I don't care." Why, then, should it be of interest to anyone else? As a negative category, "race" is an idea that resists scientific elaboration, but it is a powerful idea nevertheless, and as such it needs to be studied and understood. Where, then, do ideas come from?

There are about three billion letters in the human genome. But there are about a millionfold more synaptic connections in a human brain at birth than there are letters in any human cell's canonical text. These synaptic connections, the basis of all mental activity later in life, cannot have all been specifically encoded by our genomes. At birth some are not functional, nor are many stable or specific; synaptic connections harden into circuits only later. We begin with a tissue that becomes a mind by social interaction. Our DNA encodes, in other words, a "learning machine." The learning machine is very complicated: it requires that most human genes be present in functional versions; that is, half or more of the genes in the genome are active in the nervous system, and for the most part only in the brain.

What these genes encode is the capacity of synaptic connections to be stabilized by use through the activation and repression of genes in nerve cells. The learning machine starts up at birth at the latest, activated by the initial input signals from the organs of perception. This is the mechanism by which the mind slowly emerges from the brain, through imitation of the minds of those people with whom the infant interacts. The experiences of the first two years, before language, lay down much of the stable circuitry of the thinking brain. But even after our formative years, the mature brain forever retains plasticity in its circuits, and it never loses the

capacity to link past with present experience by familiarity of synaptic pattern. Synaptic connections are made and broken throughout life; these are experienced variously as sensation, perception, memory, repression, and, most important, one's ongoing teaching and learning.

Make no mistake, this may be a difficult idea to take in, but, in terms of biology, it is the best we can say about how we understand ourselves. Whenever in your entire life you learn, or forget, or remember, or deeply feel any emotion, these mental events are not merely accompanied by the reorganization of cell-cell circuits within your brain: they *are* those reorganizations. Reading these words with comprehension is such a reorganization, remembering them is another, telling someone you learned something odd is still another rewiring of your brain. Because we never stop thinking and feeling, we now know that in ways we do not yet fully grasp nor measure our brains never stop this ceaseless reweaving of their circuitry.

The "learning machine" that is the human brain cannot weave and reweave itself in isolation. Mental development and mental health both require adequate social interaction from birth on; absent that, sociopathic disasters ensue. Racism is one of these disasters. Whoever is cast as the "Other" by adults when they interact with their children will become the "Other" to those children. When "race" is learned in this way, it is a biological event, in that the synaptic wiring of associations in the brain of the child will have mimicked those in the brain of the adult. This form of inheritance is not through DNA, but it can be as stable, and as long-lasting, as genetic inheritance. But we must be clear: it is social, not genetic.

As a social construct, "race" may appear as a useful idea when it is couched in contexts of service, in particular when it is used as a way to identify an American population that might specifically benefit from a medical or other social intervention. But that apparent utility will always be reduced to close to nil by the complexity of our history and the diversity of the human genome. We have seen a drug marketed to "African American" Americans on the argument that the drug requires the presence of a single DNA sequence found in many Africans and not many Europeans (see chapters 7 and 8). We know already that this allocation scheme has assured that the drug has been wasted on some number of Americans with both European and African ancestors who are identified

as "African American" but who did not inherit that version of that DNA, while a number of "white" Americans of similar parentage who did inherit it and therefore could benefit from the drug do not get to use it.[7]

Surely if the DNA sequence that is required for drug action is known, then a simple assay for that sequence, not a measure of "race," is the appropriate prognostic test. The same argument holds for the high frequency of disease-associated DNA sequences in populations descended from a small number of ancestral families, like the Ashkenazi Jews of Eastern Europe. These are sometimes called "Jewish Diseases." In fact, the ancestry of Eastern European Jews includes their almost complete obliteration about 350 years ago; all Ashkenazi Jews today are the descendents of a small number of surviving families, so these should probably be called "survivor diseases" instead. Whenever DNA assays for these DNA differences are done as broadly as they should be, many people who have that DNA sequence and therefore may benefit from the knowledge are not Jewish, but turn out by that assay to learn of the likelihood of having a forgotten or denied Jewish ancestor.

Here, finally, is an example of how rapidly and completely the idea of "race" may be understood in two different ways, depending on which set of presumptions informs our mind when we learn that information. The "Human Diversity Project" has examined thousands of peoples' DNA, sampled from all over the planet, and sorted short DNA sequences that are most common in people from one or another continent today. People present a DNA sample to this organization and are told they are "25 percent African and 75 percent European," or the like.

How do we understand this? On the one hand, we may say that since we are all Africans initially, this must mean that among the ancestors of that person are some people who left for Europe about forty thousand years ago and others who never left. Or, we could say that this person has a one-quarter dose of "Other" and is therefore, in the old pre-DNA language, a "quadroon." I would argue that until the notion of the "quadroon" has entirely left our culture—and it has certainly not—we should choose to be very careful not to use any language that speaks of a person in percentages of anything, let alone ancestry or "race." The racist thinks of everyone in the "Other" category as if they were genetically identical clones: "all you people look alike to me." The irony of thinking of the "Other" this way is more perfect in the American case than any other. Here the "Other" is

likely to be a descendant of Africans, who are today the most genetically diverse of all people. It is the racists who, thinking alike despite all facts, form a clone, not a genetic clone, but a social one. That is why there is no contradiction between thinking of "race" as a social construct, the product of racism, and thinking about it in the language of genetics.

The best example of the ease with which a decent and insightful person may fall into the trap of imagining some members of our robust, outbred species to be not merely the "Other" but to actually be another species entirely is found not in the atrocities of the last century, but in the ruminations of the brightest mind of the century before. Charles Darwin, whose bicentennial we celebrated in 2009, followed his momentous work, *On the Origin of Species*, with another book, *The Descent of Man*, intended to deal with the many questions about humanity's origins and nature raised by the insights of his first book.

Of these questions, the most fraught with risk was the matter of whether or not all humanity was one species. He weighed the evidence, explained the difficulties, and concluded that the main observational impediment to the notion that "humanity" is an agglomeration of different species was the disconcerting fertility of any and all matings among people of any supposed racial "species." The cornerstone of his first book was the notion that life persists through time only in species, whose boundaries he operationally defined by the failure of individuals from different species to produce fertile offspring.

Unexpectedly, and to my eye disconcertingly, he concluded by overturning his own insight to protect the notion that the "Other" and he were not of the same species:

> Man in many respects may be compared with those animals which have long been domesticated, and a large body of evidence can be advanced in favour of the Pallasian doctrine, that domestication tends to eliminate the sterility which is so general a result of the crossing of species in a state of nature. From these several considerations, it may be justly urged that the perfect fertility of the intercrossed races of man, if established, would not absolutely preclude us from ranking them as distinct species.

To speculate on the motives of a great thinker when he or she trips up in this way seems to me unseemly, but Darwin's contradiction of his own

findings may reflect the fact that, despite his insight, he was a product of his time and culture, and that his brain had been woven and rewoven in its circuitry so that he found himself, in the absence of evidence, comfortable to think in a racist manner. In any event we no longer have Darwin's freedom to ruminate along these lines. We know that we are a single species at every level except in our imaginations, and we need not look back even a century to see the horrendous damage done by the counternotion, when it emerges as the policy of a state.

CONCLUSION

Human developmental biology and genetics must be present in any serious future discussion of "race" as an idea. But because "race" is an idea of great toxicity, the proper genetics here is not the genetics of skin, or of lips or hair or the shape of one's rump (an embarrassment even to write here), but the genetics of human neonatal neural development. That is where we will find the biology of the ineluctable and irreducible, but *reversible*, role of parental modeling in the emergence of a mind and of ideas in that mind. It is through the constant reweaving of those circuits in social interaction and in isolation that we experience the twin gifts of natural selection: free will and the chance to change our minds.

NOTES

1. Dennis Overbye, "With Updated Hubble Telescope, Reaching Farther Backing Time," *New York Times*, January 12, 2010.
2. John F. Kennedy, *Nation of Immigrants* (New York: Harper and Row, 1964).
3. See G. Stix, "Traces of a Distant Past," *Scientific American*, July 2008, 56.
4. US Constitution, article 1, clause 3. See also Stix, "Traces of a Distant Past," 56.
5. N. Jablonski, "The Evolution of Skin and Skin Color," *Annual Review of Anthropolology* 33 (2004): 585.
6. www.fda.gov/bbs/topics/news/2005/new01190.html.
7. Charles Darwin, "On the Races of Man," in *The Descent of Man* (New York: Appleton, 1880), 172.