

# The Human Genome Project and Minority Communities

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*Ethical, Social, and Political  
Dilemmas*

Edited by  
**Raymond A. Zilinskas**  
and **Peter J. Balint**

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**PRAEGER**

**2001**

**Westport, Connecticut  
London**

## Chapter 5

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# Scientific and Folk Ideas about Heredity

*Jonathan M. Marks*

Anthropology tries to bring together the exotic and the mundane. In classical anthropological research, investigators go into the field and study the lives and thoughts of remote peoples. The knowledge thus obtained has important implications. First, it shows that the life, the concerns, and the feelings of a Pueblo Indian or Sudanese Nuer are in fundamental ways not all that different from yours or mine; in other words, what at first seems exotic is really quite mundane. Second, cross-cultural understanding reveals that our own ideas, which we take to be entirely natural, are in many cases somewhat arbitrary social conventions and not natural at all. If looked at from a distance, the way we see the world, which seems mundane, is actually exotic.

To some extent this is recognizable from the study of history. We can look back at the dress styles of the 1960s, which seemed entirely appropriate, normal, and natural at the time, and see them now as weird. Anthropology does this more broadly. It shows that the ideas we take for granted are not necessarily the way things have to be, maybe not even the way they actually are. It is an intellectual field that can be threatening—primarily because its very reason for being is to subvert existing social power structures and to question things we take for granted as natural about the way we are (Boas 1928).

Now, one of the ideas we take for granted most strongly in our society is that races represent natural categories of people. That is to say, the human species comes packaged in a small number of ways, even color-coded for your convenience: black, white, yellow, red. You belong to one of these categories. Your race is a property of your constitution, innate and assigned at birth. And by virtue of being in that category, you have more in common, particularly more of the fundamentally important things in common, with other people in the same category than with people in other categories.

I want to begin by questioning that assumption. The earliest anthropologists in the mid-1800s recognized that there is an intimate connection between the way people think about the world and how they classify it. After all, this is how we make sense of the infinite jumble of things we are exposed to—we decide “this” is a kind of “that,” and slightly different from something else, which also a kind of “that,” but a different kind of “that.”

This is particularly evident in social relationships centering on the family. You, for example, give the same name to four different people: your mother’s sister, your father’s sister, your mother’s brother’s wife, and your father’s brother’s wife. Of course, I am describing your aunts.

Why should you put all those people in the same category? Your mother’s brother’s wife and your father’s brother’s wife aren’t even genetically related. Your mother’s sister and father’s sister are genetically related to you, but they’re on opposite sides of the family. Traditionally, they don’t even have your family name; only your father’s brother’s wife has your family name.

Well, the fact is that other peoples do it differently. They may have one term for an aunt on the father’s side of the family and a different word for an aunt on the mother’s side of the family. They may have one term for blood relatives and another for spouses of blood relatives. You might notice also that you differentiate by sex the names of your father’s brother and father’s brother’s wife—they are your uncle and aunt—but their children, both male and female, are all termed cousins. Why not differentiate male from female cousins as we do uncles and aunts? And we don’t even have a word for the person married to your cousin (Schneider 1968).

So people impose order on their social universe by classifying it, by deciding that these people cluster together under this name, and that they’re different from those other people assigned a different name. These classifications sometimes match genetic relationships and sometimes diverge from them significantly. How we classify is not

based on nature, not determined by nature, but is a construction of our social minds that we impose on nature to help us organize things, in this case our relatives.

How did we come up with these social conventions for classifying our relatives as we do? We don't really know.

We do know a bit more about how we came to classify species as we do, and the same general things hold true. Jorge Luis Borges (1965) writes of a Chinese encyclopedia that "divides animals into: (a) belonging to the Emperor; (b) embalmed; (c) tame; (d) suckling pigs; (e) sirens; (f) fabulous; (g) stray dogs; (h) included in the present classification; (i) frenzied; (j) innumerable; (k) drawn with a very fine camel-hair brush; (l) et cetera; (m) having just broken the water pitcher; (n) that from a long way off look like flies." This is apocryphal, of course, but it makes the point well: You have to classify animals somehow; why not this way?

If you go to the Bible you find that the ancient Hebrews classified animals too: see for example Leviticus, chapter 11, and Deuteronomy, chapter 14. They did it to decide what was ritually clean or unclean, and on that basis, what was edible or inedible (Douglas 1966). And their criteria, which are entirely natural, were where the animal lives and how it moves. And so they divided animals into flying animals, swimming animals, and walking or crawling animals. These divisions certainly work, although there are some areas where they do not map well onto our modern categories. The bat is classified with the birds, for example, and lizards and mice end up together.

Our own modern scientific classification of animals is based on evolutionary relationships, common ancestry—although in fact scientists started categorizing animals this way about a century before they realized that was what they were doing.

We, for example, are mammals. That was established in the year 1758, a hundred years before Darwin, by a Swedish biologist named Linnaeus. Mammals constitute a natural category. If you ask biology students, they will tell you we are mammals. Why? Because we nurse our young.

Here is something the student probably cannot tell you. Do we nurse our young because we are mammals, or are we mammals because we nurse our young? Let me rephrase the question: Why is milk so important in the great scheme of things that we should take our very name on that basis? Couldn't we come up with the same group using a different criterion, and if so why don't we?

For example, Aristotle more than two thousand years ago called land animals "Quadrupedia" (four-legged), and divided them

into those that lay eggs and those that give birth to live offspring. Creating a category of four-legged creatures that give birth to live offspring gives you basically the same constellation of animals as the category of mammals (with a few exceptions, like the duck-billed platypus).

Mammals actually have many features that distinguish them from reptiles, amphibians, fish, and birds—hair, for one thing. Some scientists in the eighteenth century actually did call this group “Pilosa,” or hairy things. But Linnaeus called us mammals, based on an anatomical feature that’s only functional in half the members of our species, and then only rarely.

So why did he do that?

It turns out to have been a political gesture. In the 1750s, there was major controversy surrounding the practice of wet-nursing. Many middle- and upper-class women in Europe were sending their babies off to stay with poor women in the country to be fed, rather than nursing the infants themselves. Linnaeus was active in the movement opposing this practice. In fact he wrote a book on the virtues of breastfeeding your own children, how it was natural for mothers to do this, and how therefore wet-nursing was something unnatural and bad. Up to that time he had been calling mammals simply *Quadrupedia*, like Aristotle. Now he calls mammals *Mammalia* and uses his “objective” scientific classification to make his point. He is saying the natural role of women is to nurse their own children—that is what is right, and that is what your family should do (Schiebinger 1993).

The point of all this is to show that what a biology student takes for granted as a fact of nature, that we are in our very essence a lactating species, is actually a fact of history—a political stand from the eighteenth century embedded into biology. It is true, of course, that mammals are a natural unit, and that the group can be defined by nursing, but having a shared natural property doesn’t make a group an objective category, simply “out there” to be discovered. It is not obviously the case that breastfeeding is the key feature that makes us mammals, any more than having a single bone in the lower jaw (which all *Mammalia*, and only *Mammalia*, have) is the key feature that would make us “One-bone-in-jaw-malia.” There’s more here than nature.

So: we make sense of our place in the universe by classifying; our classifications are not necessarily derived from nature; and even when they are derived from nature, they encode cultural information.

Now, if there isn’t a natural classification for the things we’re interested in, we often come up with one anyway. For example, time is continuous, but we divide it into sixty-minute hours, twelve-hour days

and nights, and seven-day weeks, with the days named after skygods. These are entirely arbitrary conventions; we inherited these time divisions from the ancient Babylonians (Zerubavel 1985).

Here's the paradox. The classifications that are the most arbitrary, and the least natural, seem to be the ones that matter the most to us. People could be categorized in many ways. There are short people and tall people; people with straight teeth and crooked teeth; with wiry, muscular, or chunky body builds; with freckles; with more or less body hair. These are natural differences, but they're not very important to us.

What is important? Whether you're an American or an Iraqi. Whether you're a Nazi, a Communist, a Democrat, or a Republican. An Oriole fan or a Yankee fan. Rich or poor. Us or them. The categories of history and of society, the categories of human invention, are far more important to our daily lives than the categories of natural variation in our species.

Sure, people look different, but the people who hate each other the most are generally the people who are biologically the most similar—Irish and English; Hutu and Tutsi; Arab and Israeli; Huron and Iroquois; Bosnian, Croatian, and Serb. Group identifications and animosities, lives and life-and-death struggles, are rooted in cultural, social, political, and economic differences, not in biological differences. Biological differences can be recruited to reinforce them, because that makes human evil appear to be the result of nature, but nature is not at the root here.

So, returning to the issue of race, how old is the idea that there are, say, four kinds of people, each localized to a continent? The answer is that the first person to suggest it was a Frenchman named François Bernier in 1684.

The ancient Egyptians and Greeks had recognized that people from different places looked different, that the Egyptians were more darkly complected than the Greeks, and less darkly complected than the Nubians, and all of them were lighter than the Scythians. Of course in those days, long travel was done over land, where the physical differences between neighboring peoples were more subtle and gradual.

But by the end of the seventeenth century, most of the world had been visited by Europeans. Their typical mode of travel was by boat—you boarded in one place where the people looked a certain way, and several weeks later you got off at a port where the people looked quite different, for example in West Africa or East Asia (Brace 1995).

It was our friend Linnaeus, once again, who in 1758 scientifically formalized the distinction among the continental

populations of the world. The order Primates (a term Linnaeus coined) subsumed several genera, of which our genus *Homo* was one. *Homo* (Linnaeus thought) subsumed two species, *Homo sapiens* (us) and *Homo nocturnus* (incorporating the more anthropomorphic descriptions of the chimpanzee). So how many subspecies did the species *Homo sapiens* subsume?

Linnaeus decided there were five subspecies of our species. One was *Homo sapiens monstrosus*, which included people with birth defects, and the other four were geographic. Those were white Europeans, yellow Asians, red Americans, and black Africans.

Linnaeus maintained that he was simply doing to humans what he did to any other species, being scientific and objective in his categorizations. But if you read the characteristics he used to differentiate the geographic subspecies, you see that they're ridiculous over-generalizations, frequently outright slanders, and usually not even biological attributes at all.

Thus, for example, *Homo sapiens americanus* is red, ill-tempered, and impassive. After a terse description of the looks and personality of each group, Linnaeus proceeds to describe their dress and government. Americans paint themselves, Europeans wear tight-fitting clothes, Asians wear loose-fitting clothes, and Africans anoint themselves with grease.

Now, it's easy to bash scientists from 250 years ago. The point I'm trying to make, however, is that this is very specifically the origin of the idea that there is a scientific and authoritative way to categorize people into four distinct groups (Hudson 1996).

The generation of scholars immediately after Linnaeus jettisoned the use of clothing as a taxonomic criterion. But it was not until the middle of the present century that anthropologists began to question the empirical basis for generalizing continentally about the human species (Montagu 1941). We now recognize that these are neither the discrete fundamental units of our species, nor are they even comparable biological subdivisions.

The human species simply doesn't come packaged into something like zoological subspecies. Rather, what we find are local populations that are similar to other populations nearby and different from populations far away. This variation no more tells us there are four kinds of people than it tells us there are five or six or twelve or thirty-seven kinds of people (Montagu 1997; Livingstone 1962; Marks 1995).

If we focus on people from the most geographically divergent places on earth—say, Norway, Nigeria, and Vietnam—of course they

look different. But what does that difference represent? There is no reason to think it represents primordial purity, as if once upon a time there were people living only in Oslo, Lagos, and Saigon. There have always been, as far as we know, people living in the rest of the Old World.

Consider, for example, the people of South Asia—India and Pakistan. Many of them are darkly pigmented like Africans and have facial features similar to Europeans, yet they live on the continent of Asia. What do you do with these people? And if you put them in a separate group, then what about all the other people who look distinctive—Polynesians, New Guineans, Australians, North Africans?

Our ideas about the small number of basic human groups have been shaped largely by accidents of European history—the ports of call for the merchant fleet—and by patterns of immigration into the United States. Immigrants to the United States have come disproportionately from the regions surrounding those ports of call.

Africans are incredibly heterogeneous. When we think of Africans we often think of West Africans. But remember you have the tallest people in the world in parts of Kenya and the Sudan, and the shortest people in the world in parts of Congo and the Central African Republic. The people of East Africa look different from the people of West Africa; the people of southern Africa look different too. There are populations of very variable facial features and skin tones.

Why group them all together and distinguish them from Europeans and Asians? Answer: because it's a difference we want to emphasize for political reasons. Of course, when you do that, you create a classic empirical problem at the boundaries. Let's say you juxtapose a Negroid African race against a Euro-Mediterranean Caucasoid race, as anthropologists used to do. Here's the simple fallacy: it works for Swedes and Senegalese, but what about Ethiopians and Iranians?

Any way you compare them—physically, genetically—African Ethiopians are more similar to "Caucasoid" Iranians than they are to the African people of Senegal. Why? Simple: they are closer geographically. Likewise, Iranians are more similar to Ethiopians than they are to Swedes. So, how can you objectively put a boundary line between them and decide they're in different groups? Such a division is just not biologically true.

Humans vary gradually in nature, yet for cultural reasons we partition them into races (just as we divide time, which is continuous, into discrete units of minutes, hours, and weeks).

Race is intended to denote discrete basic subdivisions of the human species, equivalent to subspecies of mice, within which there is little variability and among which there are discrete differences. These subdivisions do not exist objectively in the human species. Why? Two reasons. First, populations are adapted to the places they live. Since geographic and climatic conditions vary gradually and continuously, so do the human populations occupying these spaces. And second, what Cole Porter called “the urge to merge” has its effect. That is, human populations interbreed with their neighbors: population A with population B, B with C, C with D. And of course, sometimes A with C or D, that is, with people from further away. All human populations have histories—they trade. None of them has been sitting isolated and untouched since the Pleistocene (and the failure to appreciate that, by the way, is one of the last great ethnocentrismisms in modern science).

This is why anthropologists no longer talk about races; we talk about populations. We talk about local, fluid, biocultural units. Those are what are really out there in nature, as far as we can tell.

Now, because what we have are fluid, biocultural, historical populations, not discrete subspecies, we run into a problem when we superimpose our preconceptions about heredity on genetic data. Let’s imagine that Mom and Dad have a baby girl. For some reason Baby Girl either wants to, or has to, prove her racial identity. The ultimate arbiter of hereditary issues is science, the science of genetics. Mom and Dad look racially appropriate as does Baby Girl, but for some reason that’s not enough. So Baby Girl is subjected to a genetic test to look for a specific genetic marker that her race has and that others don’t.

If we take her family back two more generations, we know she has four grandparents and eight great-grandparents. Did all eight have that genetic marker? Because if one of them didn’t have it, there is a small but significant chance that Baby Girl inherited that racially “wrong” genetic marker. And that’s precisely the problem. If one great-grandma was different—either she was from somewhere else, or she just inherited a different marker from one of her ancestors, or the genetic generalization was incorrect—then the “wrong” marker has a fifty-fifty chance of being passed on in each generation.

In other words, you could have a child who looks just like you and your spouse, but fails a genetic test to match her to your racial category on account of one great-grandparent (who may have been just as racially “correct” as the other seven). That’s why you can’t do a genetic test for race; race and genetics don’t map on to one another particularly well.

This parallels, of course, the old miscegenation laws, which prohibited marriage between blacks and whites. If you're going to prohibit intermarriage, you have to define precisely who is black and who is white. The classic definition came to be known as the "one drop of blood rule"—any nonwhite ancestry made you nonwhite. In practice, one black great-grandparent defined you as legally black; seven white great-grandparents weren't enough to make you white (Wright 1994; Pascoe 1996).

The technology is different today, but the cultural mind-set is the same. The problem is simple and anthropological. Race is inherited, but in a different fashion from biological heredity. Race is inherited according to no scientific laws, but rather by a commonsense or folk-cultural system.

Like the way we name our relatives, racial divisions are not determined by biology, and they don't map very well onto genetic relationships. In fact races are simply named groups, nothing more. Naming is what confers meaning, and this is wonderfully illustrated by a photomontage from *Newsweek* a couple of years ago. They asked "What Color Is Black?" and showed that the category "black people" subsumes people who look very different. And that's precisely the point. A genetic test for "black" would be failed by half the people on that page of photographs (and not necessarily the lightest complected half, either) and would even be failed by half the inhabitants of Africa. On the other hand, many non-Africans would "pass" the test.

The key thing to appreciate is that race and genetics aren't from the same worlds. It's not that one is good and the other is bad. It's that one is scientific, and the other provides a means of localizing yourself and others in a very subjective world of social relations. The difficulty comes when we confuse them for one another. It's not that race doesn't exist, an idea I occasionally see espoused in the newspaper; it's that race doesn't exist as a "biological entity." It certainly exists as a symbolic, social category; actually that makes it culturally more real and more important than if it were biological.

Race is not a category derived from genetics. But our folk views are very deep-rooted and very persuasive. For example, I can see the sun rise, traverse a path across the heavens, and set over the opposite horizon; yet we now know, of course, that the sun doesn't go around the earth. It's an optical illusion. To a large extent the growth of science involves overturning commonsense ideas and showing them to be better explained in other ways that aren't immediately apparent.

There are four major categories of folk ideologies of heredity. The first is the one we've already discussed—the existence of human

subspecies, or “taxonomism.” The second is “racism,” the belief that a person is simply the embodiment of the group and thereby possesses whatever attributes are assigned to the group. It’s a folk theory of heredity because it confers innate properties upon people based on group membership, rather than through observation of what the person is really like.

There is another component to this fallacy, and that is the relationship between what people *don’t* do and what they *can’t* do. *The Bell Curve* (Herrnstein and Murray 1994) argued from test scores to what the authors called “cognitive ability.” In fact, however, we can’t study abilities, we can only study performance; and the relationship between them contains an important asymmetry—ability is only one component of the performance you observe. Good performance implies abilities, but poor performance does not imply the lack of abilities. The very concept of ability—something endowed at birth, yet perceptible only after it has been developed—is not scientific, not genetic, not empirical, and exists simply as folk wisdom (Marks 1997).

Third is “hereditarianism,” the idea that you are whatever is in your cells, that “blood will tell” because “like begets like.” This idea goes back a long way in human history. The royal family is treated better than the average Londoner for that very reason. This mode of thought, obviously, has provided a justification for hereditary aristocracies for millennia.

We see it in high-tech forms now, in the idea that genes, rather than blood, will tell. The problem here is that we know very little about the development of normal traits in people. Much of what we know comes from the study of pathology, and it’s very tricky to infer normal function from the study of its breakdown. Imagine trying to figure out what the fuel injector in your car actually does by opening the hood, smashing the device with a hammer, and observing the results. Since previously there was little coming out of your exhaust but now you see billows of black smoke, you might come to believe that you have isolated the “smoke controller.” Well, of course, that’s not what the fuel injector actually does—smoke emission is just a side effect of screwing it up.

Let me give a more concrete example. There is a rare disease called the Lesch-Nyhan syndrome. It results from mutation of a gene located on the X chromosome that codes for the production of an enzyme called hypoxanthine-guanine phosphoribosyl transferase (HGPRT). The mutated gene cannot produce HGPRT, and without this enzyme you have the Lesch-Nyhan syndrome. Boys afflicted with this

syndrome have an irresistible compulsion to flail and bite. They end up biting their lips and fingers and require strong restraint.

Now, the failure of this gene has a behavioral effect—a terrible, horrible effect. But what does this tell us about normal people who self-mutilate? What does it tell us about nail-biters like me? Or rituals of scarification? Or punks with pierced body parts? Or teenage girls with low self-image who cut themselves? Absolutely nothing. The vast majority of self-mutilatory behavior in our species occurs in people who don't have Lesch-Nyhan syndrome, people who are genetically normal. The gene for a bizarre pathological behavior tells us virtually nothing about the general occurrence of the behavior.

Nevertheless, a geneticist can be quoted making precisely that connection in *Scientific American* (Beardsley 1995). It is actually a non sequitur, an inference from folk heredity. And now we learn that social graces are controlled by a gene on the X chromosome based on a study of girls with Turner's syndrome (Angier 1997).

The last major component of modern folk heredity is "essentialism," the idea that we have to ignore apparent differences to find an invisible underlying uniformity. That is the basis for thinking there might be a genetic test for race, as we discussed earlier.

In a recent study (Skorecki et al. 1997), it was determined that 54 percent of self-designated Hebrew priests, many of whom have the surname Cohen, had the same configuration of two genes on the Y chromosome, as opposed to only 33 percent of Jews who did not think they were priests. On this basis the authors inferred that this was the real genetic constitution of the Jewish priestly line inherited directly from biblical Aaron.

Of course, often people with the same last name are going to be more closely related than people with different last names, reflecting recent common ancestry (known as isonymy). If you survey their Y chromosomes, you're going to find more homogeneity than you'd find in a random sample. Without a control group, to look at the Y chromosome in a sample of Horowitzes or Steinbergs for example, the inference that the one represented at 54 percent rather than 33 percent in Cohens is somehow distinguishing and authentic is dubious at best. But the result was reported in the *New York Times* nevertheless (Grady 1997a, 1997b).

More important, the authors of that report find themselves in the middle of an identity controversy; after all, people want to know authoritatively if they are "really" Hebrew priests or not. Of course, nobody's a Hebrew priest; there hasn't been a priesthood for centuries. Even so, these genetic data are invested with cultural authority, in spite

of how shaky the inference is. The construction of identity is a political arena in which geneticists are uniquely unqualified to work. The failure to appreciate the responsibilities thus incurred contributed to the demise of the Human Genome Diversity Project (Cavalli-Sforza et al. 1991; Mead 1996).

Let me conclude, then, with a diagnosis and a prescription. Genetics is a very important area of scientific research; we need it, and we need public understanding of it. But what is even more pressing is the need to understand the differences between scientific heredity (or genetics) and folk ideas on heredity. Geneticists should contribute to educating the public about these distinctions. There are three reasons why they haven't lived up to that responsibility. One, as cultural beings, geneticists have assimilated the same folk ideas as everyone else, and it is very hard for them to step out of their mind-set. Two, this is largely humanistic knowledge, outside the formal training of the average geneticist.

The third reason is a bit more insidious. When geneticists tell you that genetics is the solution to social problems, personality problems, global problems, they may have a conflict of interest. In other words, sometimes geneticists are willing to exploit cultural ideas to justify scientific ones.

To get the HGP off the ground, its first director, James Watson, told *Time* (Jaroff 1989), "We used to think our fate was in the stars. Now we know, in large measure, our fate is in our genes."

Now that, as Clarence Darrow used to say, would be interesting if true. But it raises a lot of questions. Do we have fates, in any significant sense of that term? Do we know they have been localized to our cellular nuclei? Is genetics really just hi-tech astrology, although presumably more accurate?

The problem is that such a statement might be a true inference about nature; but obviously it's more than that. It's also a political statement about the immutability of one's place in the fabric of society. If we have fates and they are in our genes, then by implication the differences between a Harvard professor and an urban teenage gang member can be explained by recourse to bands and blots and gels, and there would be little hope to change life trajectories. Also, the statement encodes a sociopolitical philosophy towards the social problems out there requiring solutions.

To appreciate Watson's statement fully, you have to realize that it was also a grant proposal. It was made in the context of trying to raise \$10 billion of federal money to study genetics. Of course geneticists are going to tell you that what they study is the most

important thing in your life. To the extent that folk ideologies about heredity reinforce the importance of genetics in the public eye, there's not much incentive to distinguish between them. It was true in the 1920s and it's true now.

We face two questions. First, how do we get geneticists to distinguish between scientific and nonscientific ideas about heredity? (Because if they don't, the rest of us certainly can't be expected to.) And, second, how can we believe what geneticists say when they have an economic stake in the outcome of the research? It is the responsibility of the genetics community to confront these two problems, and it may require rethinking how geneticists are trained.

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