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Not Really, DNA Shows

By NATALIE ANGIER

In these glossy, lightweight days of an election year, it seems, they can't build metaphorical tents big or fast enough for every politician who wants to pitch one up and invite the multicultural folds to "Come on under!" The feel-good message that both parties seek to convey is: regardless of race or creed, we really ARE all kin beneath the skin.

Yet whatever the calculated quality of this new politics of inclusion, its sentiment accords firmly with scientists' growing knowledge of the profound genetic fraternity that binds together human beings of the most seemingly disparate origins.

Scientists have long suspected that the racial categories recognized by society are not reflected on the genetic level.

But the more closely that researchers examine the human genome -- the complement of genetic material encased in the heart of almost every cell of the body -- the more most of them are convinced that the standard labels used to distinguish people by "race" have little or no biological meaning.

They say that while it may seem easy to tell at a glance whether a person is Caucasian, African or Asian, the ease dissolves when one probes beneath surface characteristics and scans the genome for DNA hallmarks of "race."

As it turns out, scientists say, the human species is so evolutionarily young, and its migratory patterns so wide, restless and rococo, that it has simply not had a chance to divide itself into separate biological groups or "races" in any but the most superficial ways.

"Race is a social concept, not a scientific one," said Dr.

J. Craig Venter, head of the Celera Genomics Corporation in Rockville, Md. "We all evolved in the last 100,000 years from the same small number of tribes that migrated out of Africa and colonized the world."

Dr. Venter and scientists at the National Institutes of Health recently announced that they had put together a draft of the entire sequence of the human genome, and the researchers had unanimously declared, there is only one race -- the human race.

Dr. Venter and other researchers say that those traits most commonly used to distinguish one race from another, like skin and eye color, or the width of the nose, are traits controlled by a relatively few number of genes, and thus have been able to change rapidly in response to extreme environmental pressures during the short course of Homo sapiens history.

And so equatorial populations evolved dark skin, presumably to protect against ultraviolet radiation, while people in northern latitudes evolved pale skin, the better to produce vitamin D from pale sunlight.

"If you ask what percentage of your genes is reflected in your external appearance, the basis by which we talk about race, the answer seems to be in the range of .01 percent," said Dr.

Harold P. Freeman, the chief executive, president and director of surgery at North General Hospital in Manhattan, who has studied the issue of biology and race. "This is a very, very minimal reflection of your genetic makeup."

Unfortunately for social harmony, the human brain is exquisitely attuned to differences in packaging details, prompting people to exaggerate the significance of what has come to be called race, said Dr. Douglas C. Wallace, a professor of molecular genetics at Emory University School of Medicine in Atlanta.

"The criteria that people use for race are based entirely on external features that we are programmed to recognize," he said.

"And the reason we're programmed to recognize them is that it's vitally important to our species that each of us be able to distinguish one individual from the next.

Our whole social structure is based on visual cues, and we've been programmed to recognize them, and to recognize individuals."

By contrast with the tiny number of genes that make some people dark-skinned and doe-eyed, and others as pale as napkins, scientists say that traits like intelligence, artistic talent and social skills are likely to be shaped by thousands, if not tens of thousands, of the 80,000 or so genes in the human genome, all working in complex combinatorial fashion.

The possibility of such gene networks shifting their interrelationships wholesale in the course of humanity's brief foray across the globe, and being skewed in significant ways according to "race" is "a bogus idea," said Dr. Aravinda Chakravarti, a geneticist at Case Western University in Cleveland.

"The differences that we see in skin color do not translate into widespread biological differences that are unique to groups."

Dr. Jurgen K. Naggert, a geneticist at the Jackson Laboratory in Bar Harbor, Me., said: "These big groups that we characterize as races are too heterogeneous to lump together in a scientific way.

If you're doing a DNA study to look for markers for a particular disease, you can't use 'Caucasians' as a group. They're too diverse.

No journal would accept it."

Yet not every researcher sees race as a meaningless or antediluvian notion.

"I think racial classifications have been useful to us," said Dr. Alan Rogers, a population geneticist and professor of anthropology at the University of Utah in Salt Lake City. "We may believe that most differences between races are superficial, but the differences are there, and they are informative about the origins and migrations of our species. To do my work, I have to get genetic data from different parts of the world, and look at differences within groups and between groups, so it helps to have labels for groups."

And there are a handful of researchers who continue to insist that there are fundamental differences among the three major races that extend to the brain.

Dr. J. Philippe Rushton, a psychologist at University of Western Ontario in Canada and author of "Race, Evolution and Behavior," is perhaps the most tireless proponent of the belief that the three major races differ genetically in ways that affect average group I.Q. and a propensity toward criminal behavior.

He asserts that his work reveals east Asians to have the largest average brain size and intelligence scores, those of African descent to have the smallest average brains and I.Q.'s, and those of European ancestry to fall in the middle.

Yet many scientists have objected to his methods and interpretations, arguing, among other things, that the link between total brain size and intelligence is far from clear. Women, for example, have smaller brains than men do, even when adjusted for their comparatively smaller body mass, yet average male and female I.Q. scores are the same.

For that matter, fossil evidence suggests that Neanderthals had very sizable brains, and they did not even last long enough to invent standardized tests.

Dr. Eric S. Lander, a genome expert at the Whitehead Institute in Cambridge, Mass., admits that, because research on the human genome has just begun, he cannot deliver a definitive, knockout punch to those who would argue that significant racial differences must be reflected somewhere in human DNA and will be found once researchers get serious about looking for them. But as Dr.

Lander sees it, the proponents of such racial divides are the ones with the tough case to defend.

"There's no scientific evidence to support substantial differences between groups," he said, "and the tremendous burden of proof goes to anyone who wants to assert those differences."

Although research into the structure and sequence of the human genome is in its infancy, geneticists have pieced together a rough outline of human genomic history, variously called the "Out of Africa" or "Evolutionary Eve" hypothesis.

By this theory, modern Homo sapiens originated in Africa 200,000 to 100,000 years ago, at which point a relatively small number of them, maybe 10,000 or so, began migrating into the Middle East, Europe, Asia and across the Bering land mass into the Americas. As they traveled, they seem to have completely or largely displaced archaic humans already living in the various continents, either through calculated acts of genocide, or simply outreproducing them into extinction.

Since the African emigrations began, a mere 7,000 generations have passed. And because the founding population of émigrés was small, it could only take so much genetic variation with it.

As a result of that combination -- a limited founder population and a short time since dispersal -- humans are strikingly homogeneous, differing from one another only once in a thousand subunits of the genome.

"We are a small population grown large in the blink of an eye," Dr. Lander said.

"We are a little village that's grown all over the world, and we retain the genetic variation seen in that little village."

The human genome is large, though, composed of three billion-odd subunits, or bases, which means that even a tiny percentage of variation from one individual to the next amounts to a sizable number of genetic discrepancies.

The question is, where in the genome is that variation found, and how is it distributed among different populations?

Through transglobal sampling of neutral genetic markers -- stretches of genetic material that do not help create the body's functioning proteins but instead are composed of so-called junk DNA -- researchers have found that, on average, 88 percent to 90 percent of the differences between people occur within their local populations, while only about 10 percent to 12 percent of the differences distinguish one population, or race, from another.

To put it another way, the citizens of any given village in the world, whether in Scotland or Tanzania, hold 90 percent of the genetic variability that humanity has to offer.

But that 90/10 ratio is just an average, and refers only to junk-DNA markers.

For the genetic material that encodes proteins, the picture is somewhat more complex. Many workhorse genes responsible for basic organ functions show virtually no variability from individual to individual, which means they are even less "race specific" than are neutral genetic markers.

Some genes, notably those of the immune system, show enormous variability, but the variability does not track with racial groupings. Then there are the genes that control pigmentation and other physical features.

These also come in a wide assortment of "flavors," but unlike immune-related genes, are often distributed in population-specific clusters, resulting in Swedes who look far more like other Swedes than they do like Australian Aborigines.

A few group differences are more than skin deep.

Among the most famous examples are the elevated rates of sickle-cell anemia among African-Americans and of beta-thalassemia, another hemoglobin disorder, among those of Mediterranean heritage.

Both traits evolved to help the ancestors of these groups resist malaria infection, but both prove lethal when inherited in a double dose. As with differences in skin pigmentation, the pressure of the environment to develop a group-wide trait was powerful, and the means to do so simple and straightforward, through the alteration of a single gene.

Another cause of group differences is the so-called founder effect. In such cases, the high prevalence of an unusual condition in a population can be traced to a founding ancestor who happened to carry a novel mutation into the region.

Over many generations of comparative isolation and inbreeding, the community, like it or not, became "enriched" with the founder's disorder. The founder effect explains the high incidence of Huntington's neurodegenerative disease in the Lake Maracaibo region of Venezuela, and of Tay-Sachs disease among Ashkenazi Jews.

But Dr. Naggert emphasized that medical geneticists had a much better chance of unearthing these founder effects by scrutinizing small, isolated and well-defined populations, like the northern Finns, the Basques of Spain, or the Amish of Pennsylvania, than they did by going after "races."

Dr. Sonia S. Anand, an assistant professor of medicine at McMaster University in Ontario, proposed that clinicians think about ethnicity rather than race when seeking clues to how disease patterns differ from one group to the next.

"Ethnicity is a broad concept that encompasses both genetics and culture," Dr. Anand said. "Thinking about ethnicity is a way to bring together questions of a person's biology, lifestyle, diet, rather than just focusing on race. Ethnicity is about phenotype *and* genotype, and, if you define the terms of your study, it allows you to look at differences between groups in a valid way."

In investigating the reasons behind the high incidence of cardiovascular disease among people from the Indian subcontinent, for example, Dr. Anand discovered that Indians had comparatively elevated amounts of clotting factors in their blood.

Beyond tallying up innate traits, she also takes into account how Indian culture and life habits may pose added risks for heart disease -- noting, for example, that a woman's status in India is directly proportional to her number of belly rolls.

In Dr. Freeman's view, the science of human origins can help to heal any number of wounds, and that, he says is sweet justice.

"Science got us into this problem in the first place, with its measurements of skulls and its emphasis on racial differences and racial classifications," Dr. Freeman said.

"Scientists should now get us out of it. They need to be leaders in promoting an evolutionary understanding of the human race."

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