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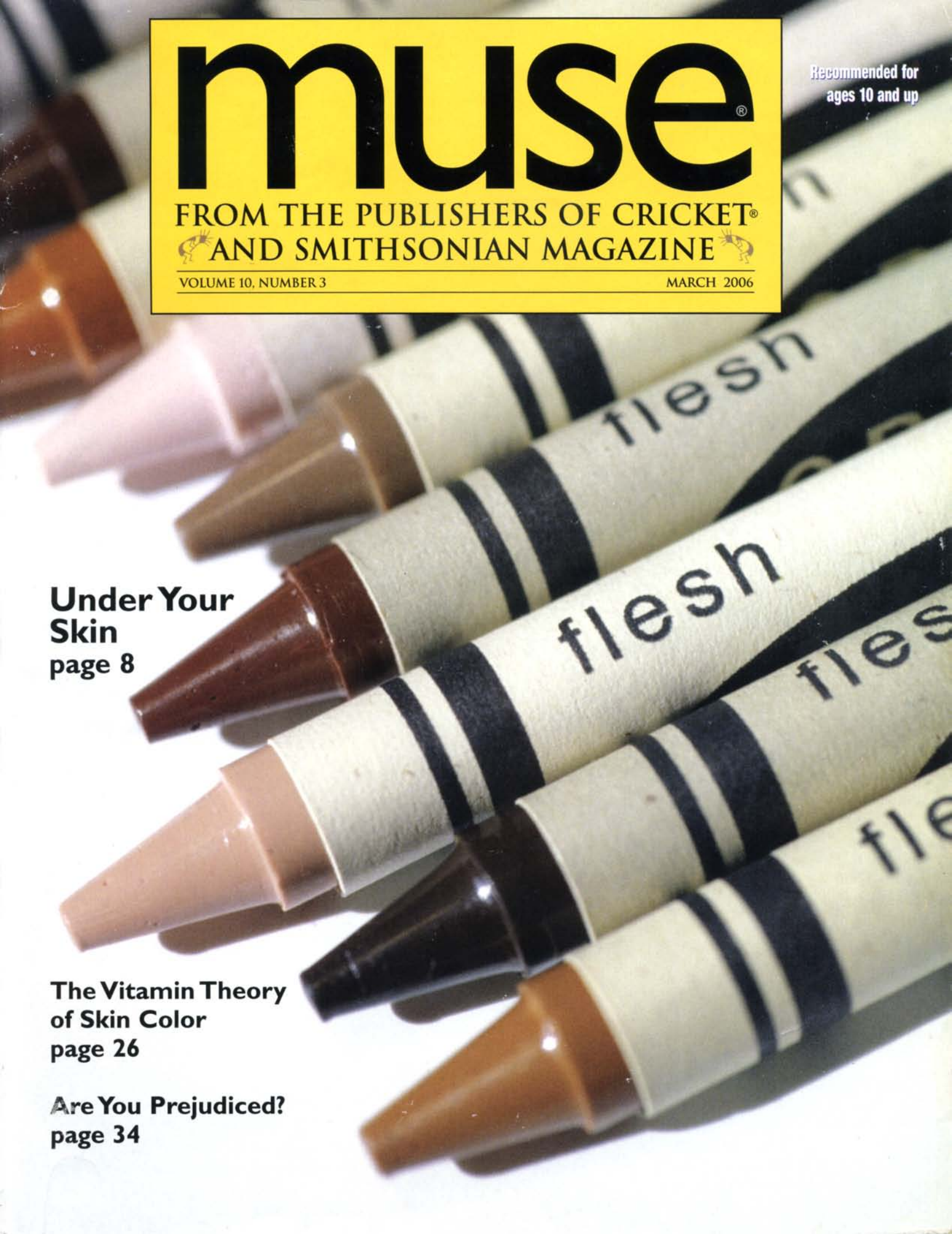
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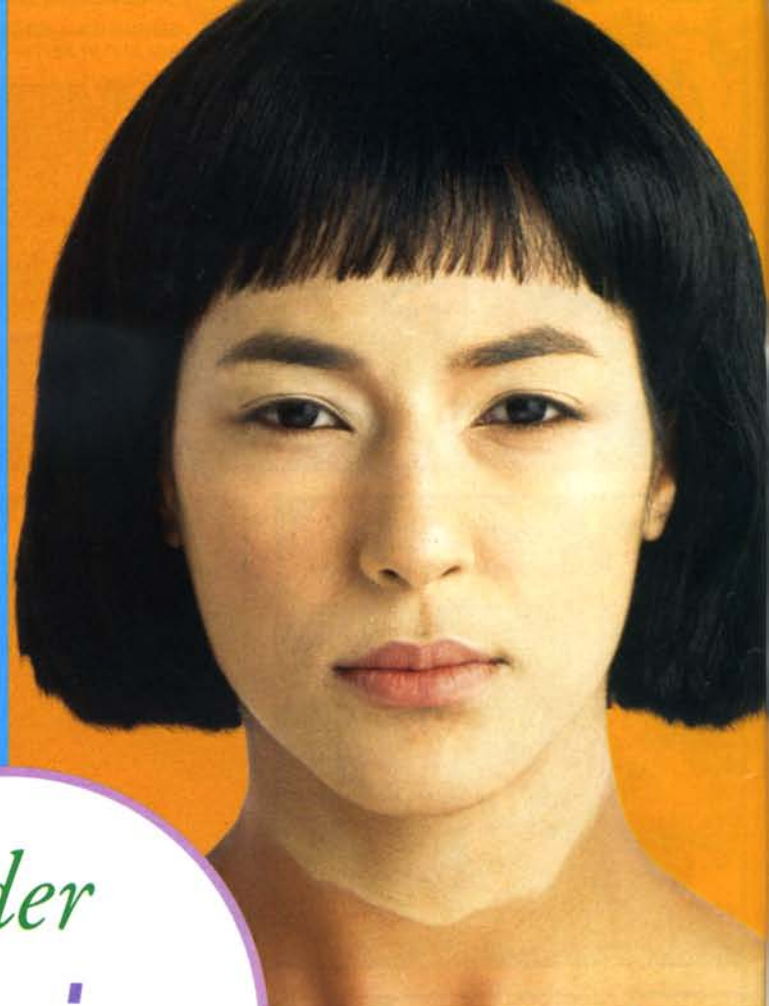
Recommended for
ages 10 and up

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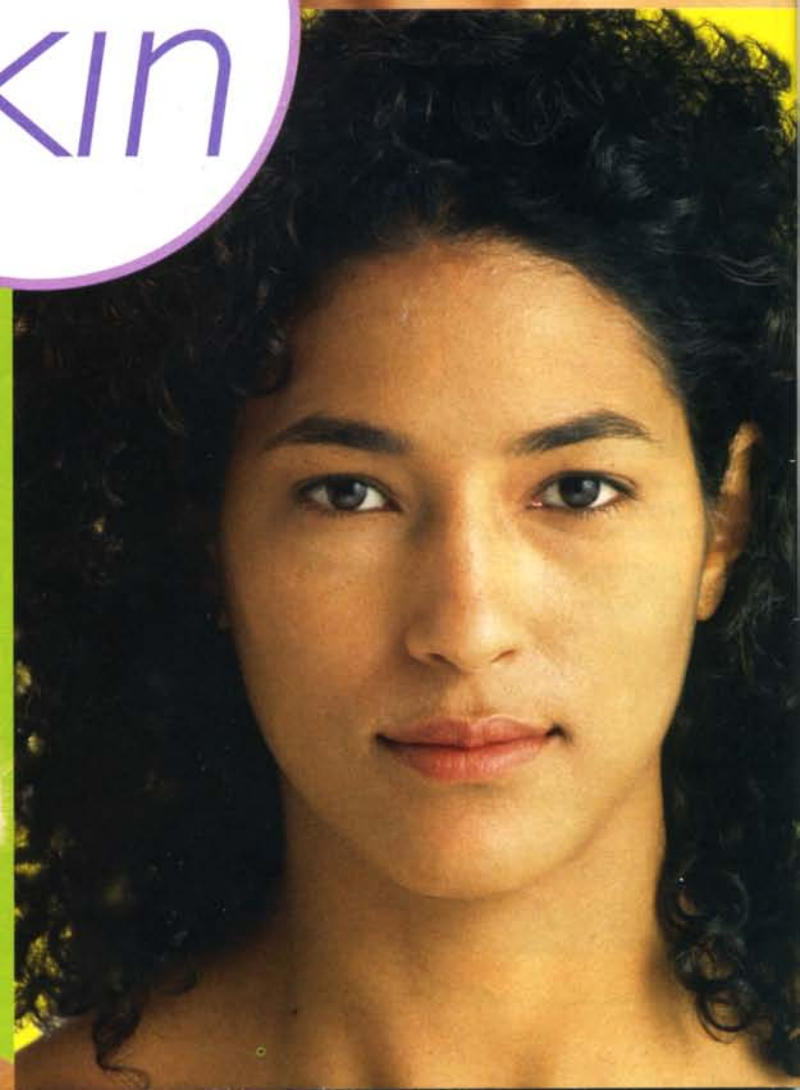
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your Under
Skin



Carol Linnaeus, an 18th-century naturalist, divided humans into seven races, including *Homo sapiens europeanus* and *Homo sapiens afer* (Africans). He claimed that *Homo sapiens europeanus*'s distinguishing traits included not just white skin but also long flowing hair, blue eyes, a muscular body, and a capacity for invention and for governing by laws. The distinguishing traits of *Homo sapiens afer*, by contrast, were black skin, as well as cunning and a personality ruled by impulse. If you believe Linnaeus, people of different races are so unlike they are close to being different species. And surface differences, such as the color of the skin, are signs of broader and deeper differences in intelligence and character.

Today few people would split up humanity as radically as Linnaeus did. And yet the idea that there is a biological basis to race remains powerful. Many people still believe there are essential differences between groups of people that warrant sorting them according to race. After all, the U.S. Census Bureau asks each citizen to indicate his or her race, as well as age and sex.

Biologists who have taken a close look at the genetic variations among

humans disagree. Because biologists have learned how to read long stretches of DNA very fast, they've been able to compare the DNA of many different people in detail. Their work shows that people are not divided into races. There are many differences among groups of people, but none of them amounts to a biological basis for race.

To understand why race is biologically meaningless, you have to understand the history of our species. By about 50,000 years ago our ancestors had acquired all the fundamental ingredients of modern human existence. We have not undergone any awesome evolutionary transition since then. An extra pair of eyes has not evolved on our foreheads. We have not sprouted wings. Our lives may be very different today from those of the first *Homo sapiens*, but our anatomy—including the size and shape of our brains—is practically identical. Although evolution has sometimes produced some pretty wild adaptations, such as the anteater's snout, if the basic design works, sometimes it just leaves well enough alone.

On the other hand, we have not stopped evolving entirely. As *Homo sapiens* spread across the planet, new

LINNAEUS, LINNAEUS, WHAT DO YOU KNOW?
FINNY IS FISH AND FEATHERED THE CROW.
BUT ABOUT HUMAN BEINGS, DEAR LINNY, YOU'RE DUMB,
AS IGNORANT, BIASED, AND WRONG AS THEY COME!



All four photos to the left show the same model, Andrea Searcy. Half black and half Native American, she appears as herself in the bottom-right image.



Nothing much has happened to the human race in the past 50,000 years. To the regret of children everywhere, we haven't evolved wings, which would seem, at least on paper, to be an adaptive trait.

mutations continued to emerge, spread, and disappear. Humans carried some of these mutations with them across continents and oceans. Deciphering this genetic history isn't easy, because all living humans descend from only a few thousand Africans. Even smaller groups made the initial migrations out of Africa, becoming the earliest ancestors of Asians and

Europeans. These tiny groups gave rise to the six billion people living on earth today, and did so in only a few thousand generations. That hasn't been long enough to accumulate many genetic differences. The wildebeests in Kenya alone have twice as much genetic variation as our entire species.

Yet despite this genetic similarity, our species is not just a collection of six billion clones. People vary, and scientists today are keenly interested in the genetic basis for these variations.

Every human being has the same 30,000 or so genes, but there are many alternative versions of each of those genes in circulation. For example, scientists have found a distinctive sequence on the Y chromosome of most men in the world, except for Africans. That sequence may have been acquired by the first people to spread out of Africa some 50,000 years ago. Variants such as these provide the only clues besides fossils to the deep past of our species.

In fact, genetic markers can be used to predict where your ancestors came from. In 2003, University of Utah geneticists proved this by scanning the human genome for short sequences that tend to vary a lot between people. These stretches of DNA, known as Alu sequences, are

Can You Tell Someone's Race by Their Looks?

We've just told you that race is not biological, but anyone who has eyes knows people look different. The difficulty is putting them into racial groups. Racial categories have changed over time. For example, until 1960 U.S. census takers classified people into races just by looking at them. In 1970, after many civil rights laws were passed, U.S. citizens were able to choose their own classification. Can you guess how the following people identified themselves for the census? Enter the letter corresponding to each photo into a box on your scorecard. Check page 15 to see how you did.

This activity is taken from the companion Web site for the documentary series "RACE—The Power of an Illusion" produced by California Newsreel. You can find the site at www.pbs.org/race.



your

Scorecard

American Indian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Asian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Black	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hispanic/Latino	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



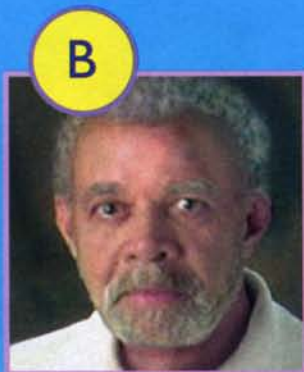
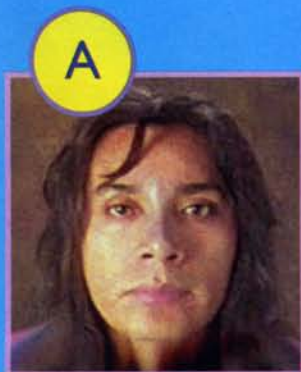
Hard as it may be to believe, wildebeests have a greater variety of genes than people do.

prone to harmless mutations, which means that natural selection doesn't remove them from our species. The scientists identified 100 Alu markers and then gathered them from the DNA of 107 sub-Saharan Africans, 67 East Asians, and 81 Western Europeans. The individuals in each group shared an almost identical set of markers. The differences among the groups were so clear that the researchers could predict an individual's ancestry with nearly 100 percent accuracy.

But the existence of these markers does not mean that people from different continents belong to different races. To a biologist, a race is a population of individuals that

differ significantly from other individuals of their species. According to the latest studies on the DNA of Africans, Europeans, and Asians, only about 15 percent of genetic variation exists *between* these groups, while 85 percent can be found *within* them. That means that someone living in Sweden might share many gene variants with someone in Africa—even variants that many other Swedes don't share. The human species is just not divided up into distinct groups that can be called races.

Some of the genetic differences among ethnic groups are little more than historical accidents. The random hand of





A Swede may have more in common genetically with an African than another Swede.



fate—technically called genetic drift—is a powerful force in recent human history. Humans have migrated around the entire world, often in small numbers. Those small numbers boost some genes at random and eliminate others. Among some Native American groups, such as the Hopi of the southwest United States, for example, a gene that makes people albino

is unusually widespread. Genetic studies indicate that it emerged in a small population that lived in Mexico more than a thousand years ago.

On the other hand, recent research has indicated that some differences among groups of people are not random, but rather the result of natural selection. In some cases, natural selection may alter the DNA of an enclave of people who live in a small region. In others, it operates across an entire continent.

The most obvious example of natural selection is skin color. Nina Jablonski and George Chaplin at the California Academy of Sciences argue that natural selection favored darker skins near the equator, where ultraviolet exposure is high, and paler skins closer to the poles, where there is less ultraviolet exposure. (You can read about their theory in “It’s All About Vitamins” on page 26.) They’ve found that the worldwide pattern of skin color matches pretty well with their predictions.

There are exceptions, but most seem to prove the rule rather than undermine it. People with the “wrong” skin color tend to belong to groups that have migrated long distances within the past

E



F



G



H





Freckles, being able to split your palm, and the ability to do fancy things with your tongue are all genetic traits. But unlike skin color, it isn't clear what purpose they serve. Not all genetic traits are useful traits.

few thousand years. The Inuit ought to be as pale as Scandinavians, but they arrived in the Arctic only a few thousand years ago.

Natural selection has produced other differences among peoples that are less obvious, but no less significant. In 2004, Douglas Wallace of the University of California, Irvine, and his colleagues reported signs of natural selection in human mitochondria—the fuel-generating factories of the cell. Studying more than

1000 people, Wallace and his colleagues discovered that people in Europe and northeastern Siberia have inherited unusual mutations in their mitochondrial DNA that can't be found in the genes of Africans. These mutations appear to make European and Siberian mitochondria produce more heat. Wallace and his colleagues suggest that these mutations brought benefits to humans as they moved into cold climates.



M



N



O



P



In these cases, humans have simply adapted to their physical surroundings just as other animals have. But some recent human adaptations are unusual, because they are the product of our own cultural evolution. As humans invented new ways of surviving, they altered the evolutionary landscape, encouraging the spread of genes that were previously rare. The best-

AND DON'T YOU FORGET IT!



documented example of culture driving biology this way occurred roughly 10,000 years ago, as humans in Europe, parts of Africa, and a few other regions began to domesticate cows.

Cattle herding provided people with an immediate benefit in the form of a reliable supply of meat. Cows also produce milk, which is a good source of nutrition, but the first cattle herders probably couldn't drink much of it. As infants, most mammals digest their mothers' milk with the help of a protein they produce, called lactase, that breaks down lactose, the sugar in milk. But as mammals grow older, they stop producing lactase, with the result that they can no longer digest milk. Humans started out the same way, and many humans today remain lactose intolerant. They get indigestion when they try to drink milk or eat cheese.

One useful trait that has evolved in the last 50,000 years is the ability to set your thermostat higher if you live in the deep cold.

Another is the ability to drink milk without getting indigestion.



Q



R



S




T

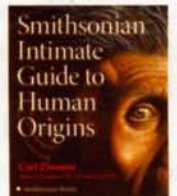


But many people who descend from traditional cattle herders can still digest lactose. That's because they have inherited a mutation to a gene called LCT. It appears that thousands of years ago, the LCT mutation randomly emerged in cattle-herding people. It somehow disabled the off-switch for lactase production, and allowed people who carried it to drink milk into adulthood. The extra calories and protein from the milk ultimately translated into extra children for people who had the mutation.

If you look back over the past 50,000 years, what you see is gradual and relatively minor tinkering with the human solution

to the problem of survival. Some people have become lighter skinned as they moved north; others began to produce more heat or to digest milk. Early in our history people were stuck on their separate continents long enough that they began to share more variations with other people on that continent than with those on the next continent. But now that most people travel frequently and far, even these blurry groups are vanishing. We are truly, at the genetic level, becoming one people. 

Carl Zimmer is the author of Smithsonian Intimate Guide to Human Origins and other books. Carl, whose ancestors come from Ireland, Wales, England, Germany, Hungary, Poland, Ukraine—and ultimately from Africa—is a proud member of the species Homo sapiens.



How Did You Do?

As you can see, appearance doesn't always tell you about someone's ancestry or self-identity.

Classifying people isn't necessarily good or bad. It depends on the purpose. "Race" can't tell

you where somebody is from, what they're naturally good at, or how they might behave. But it can tell you who is being discriminated against and who lacks certain opportunities.

For more information, visit www.pbs.org/race.

Answers



White

Hispanic/
Latino

Black



Asian

American
Indian