

GENERATE

MarketWatch

VISIT NOW &gt;

Dow Jones Reprints: This copy is for your personal, non-commercial use only. To order presentation-ready copies for distribution to your colleagues, clients or customers, use the Order Reprints tool at the bottom of any article or visit [www.djreprints.com](http://www.djreprints.com)

See a sample reprint in PDF format.

Order a reprint of this article now

**THE WALL STREET JOURNAL.**

WSJ.com

HEALTH JOURNAL | FEBRUARY 23, 2010

## Obesity? Big Feet? Blame Darwin



*Evolution Helped Humans Have Children and Survive, But It Also Led to Modern-Day Maladies, Scientists Say*

By MELINDA BECK

Evolution, the theory goes, guarantees survival to the fittest. But we can blame evolution for some of today's most pressing health problems, such as cancer, obesity, diabetes and cardiovascular disease.

A 2009 Gallup poll found that 44% of Americans believe that God created human beings in their present form within the past 10,000 years. Many of them also think the human body is perfectly designed.

But most scientists—including biologists, anthropologists, paleontologists and geneticists—see the 21st century human body as a collection of compromises, jury-rigged by evolution as our ancestors adapted to changing conditions.

"In many ways, we are maladapted for modernity," says Stephen Stearns, a Yale evolutionary biologist. He and others in the field are urging medical schools to include more evolutionary thinking when teaching doctors about modern diseases.

For example, the immune system was honed to fight off epidemics like malaria and cholera, which proliferated along with urbanization. According to the "hygiene hypothesis," asthma and auto-immune diseases are increasing because the human immune system doesn't face enough challenges in today's cleaner environments and is picking fights with the body's own systems instead.

The current epidemic of obesity also has prehistoric roots. Our hunter-gatherer forbearers were tall, lean long-distance runners who subsisted on plants and protein. When populations shifted to agriculture about 10,000 years ago, a carbohydrate-rich diet became the norm. Early farmers had more calories but less nutrition, and average heights dropped from 5-foot-9 to 5-foot-3 for men, and from 5-foot-5 to 5-feet for women. Metabolisms adjusted over the millennia—but populations that shifted to agriculture more recently, like Polynesians and American Indians, have the highest rates of obesity and Type 2 diabetes today.

Evolution even plays a role in yo-yo dieting, according to Rudolph Leibel, an obesity expert at Columbia University Medical Center and one of the discoverers of leptin, the hormone that usually signals the body to stop eating. Leptin levels fall rapidly when people lose weight, setting off a cascade of physiological changes that burn fewer calories and act to pile weight back on. "That was great during times of famine, but these days, it's counterproductive," says Dr. Leibel.

With fewer predators and more resistance to disease, humans are now living long enough that cells have more chance to go haywire. Reproductive cancers may be a function of longer lives and changing cultures. For long stretches of history, the average woman had only about 100 menstrual cycles in her lifetime, because frequent pregnancies and breastfeeding kept her from menstruating. A typical woman today has 400 cycles, creating more stress on her ovaries and subjecting her breasts to more hormonal swings.

### *Outrunning Mastodons*

One of the best known holdovers is the "fight-or-flight" mechanism that pumps out adrenaline, cortisol and other

hormones when the brain senses danger, making muscles tense up, blood vessels constrict, the digestive tract slow and the heart beat faster. That was useful for outrunning mastodons—but counterproductive for sitting at the computer.

Even anxiety dreams—where you're unprepared for a test or falling off a cliff—may be a leftover from ancient times when people had to be constantly on guard for predators in the night, says Deirdre Barrett, a Harvard psychologist and editor of the journal *Dreams*.

"Some of this stuff we're carrying around is from the Pleistocene era," says Dr. Stearns of the period roughly 2 million to 10,000 years ago. He warns that the gap between human anatomy and modern culture may get wider in the years ahead. "My students keep asking me, 'Are we adapting to the computer age?' But technology and culture are changing so fast that our genes can't keep up with it."

Scientists studying genetic variations around the world say that about 1,800 genes—some 7% of the human genome—have been evolving rapidly in the past 10,000 to 40,000 years. The precise function of many isn't known, but researchers have identified several that provided a key advantage for survival and got passed along.

For example, dark skin that protected humans from the sun's ultraviolet rays in Africa was less needed as they migrated north beginning about 50,000 years ago. Gene variations for light skin identified in European and Asian populations would have allowed them to absorb more vitamin D, needed for strong bones and other body functions and been passed along.

A gene variation that enabled people to digest lactose—an enzyme in dairy products—provided a big advantage for survival when they began herding and milking cattle. It cropped up in Europe about 7,000 years ago. Today 90% of people of Northern European descent are able to digest dairy products.

Many recent mutations developed in response to infectious diseases, particularly as people started living in large communities. In Africa, some 25 new gene variations and an entire blood type have emerged to help people resist malaria in the past 10,000 years. About 10% of people in Europe today have a gene variation that makes them resistant to HIV/AIDS.

But many evolutionary advantages came with trade-offs. It has long been known, for example, that gene variations that protect some Africans from malaria make them vulnerable to sickle-cell anemia. Genes that helped early Africans retain salt guarded against dehydration in tropical climates now put some African-Americans at risk for high blood pressure today.

And some body parts that provided a benefit at some time in human history pose challenges today—a phenomenon Texas Tech University geneticist Lewis I. Held Jr. calls "bislagiatt," an acronym for "but it seemed like a good idea at the time."

Among the body's bislagiatt parts Dr. Held catalogs in his book, "Quirks of Human Anatomy," are men's testicles that hang outside the body because sperm develop best at slightly cooler temperatures—but that makes them vulnerable to injury.

In women, the mismatch between mother's narrow pelvis (which facilitates walking upright) and a newborn's large head (which facilitates cognitive development) makes childbirth a painful and sometimes dangerous process.

The appendix, which scientists think served as a fermentation chamber for helpful intestinal bacteria in primates, is less needed now that people have varied diets and cook food.

The human mouth has also evolved unevenly. Teeth shrank considerably as agriculture changed our ancestors' diets from mostly meat and plants to mostly carbohydrates. The human jaw shrank even faster, making wisdom teeth largely useless and creating the overcrowding that people face today.

Why haven't years of evolution corrected these quirks? "Many features of our anatomy operate 'under the radar' of natural selection," says Dr. Held. That is, they generally aren't problematic enough to affect people's survival before they reach reproductive age, so they keep getting passed on. Some experts think that wisdom teeth and the appendix may be slowly on their way out—some people are already born without them—since they do sometimes cause life-

threatening infections.

These days, the key driver of evolutionary change isn't who survives long enough to have children, but who has the most children and how soon they start. It's those who procreate early and often who have the most genetic impact on future generations.

In an effort to see contemporary evolution at work, Dr. Stearns and colleagues tracked the health habits and fertility patterns of 2,238 women involved in the Framingham Heart Study, which has studied the medical histories of 14,000 residents of the Massachusetts town since 1948. The women who had the most children were slightly shorter and plumper than average. They also had lower cholesterol and lower blood pressure. If those trends continue, the researchers predicted that by 2409, the typical Framingham woman would be 0.8 inches taller, 2.2 pounds heavier and have a healthier heart.

### *Small Brains, Big Feet*

Other changes are happening, but the reasons aren't completely clear. Brains have shrunk by about 10% in the past 5,000 years. Average shoe sizes have grown four sizes for men and women since 1900, and heights are all over the map. Americans, who were among the world's tallest people in 1900, have leveled off in the past 25 years (averaging 5-foot-10 for men and 5-foot-4 for women). Europeans have continued growing—particularly in Holland, where men now average over 6-feet tall. The Japanese, among the world's shortest people in 1950, have grown nearly 5 inches, on average, since then, to 5-foot-7 for men. "They could equal American height standards in the next generation," says Richard Steckel, an Ohio State University economist and anthropologist.

Where the species is going from here is anyone's guess. Problems that affect fertility could become moot in future generations. "Diabetes and metabolic syndrome does cause a lot of infertility, male impotence and premature death," says Henry Harpending, a University of Utah anthropologist and co-author of "The 10,000 Year Explosion," on recent evolutionary changes. "I expect we will all be slimmer and trimmer in 1,000 years."

Some demographers are concerned that these days, in contrast to most of human history, the most educated and affluent people are having the fewest children. Fertility rates have dropped significantly in almost every industrialized country.

Futurologists have even predicted that the human race could diverge into two parts—tall, fit elites and a larger pool of shorter, less educated laborers. "But who knows—having big families could become fashionable again," says Gregory Cochran, co-author of "The 10,000 Year Explosion." "Stranger things have happened—just look at pointy shoes."

In the meantime, some anthropologists say the world's populations are becoming more diverse and that the growing global population will mean many more gene variations in the years ahead. Others say just the opposite—that evolution moved quickly when people lived in small, isolated communities competing with each other for survival. Now, travel, trade and intermarriage are making us more homogenous.

"We are one big reproductive pool," says paleoanthropologist Ian Tattersall, a curator at the American Museum of Natural History in New York. "The bigger the population is, the less likely it is to change in any one direction. I don't see anything that will stop that from happening—unless we get hit by an asteroid."

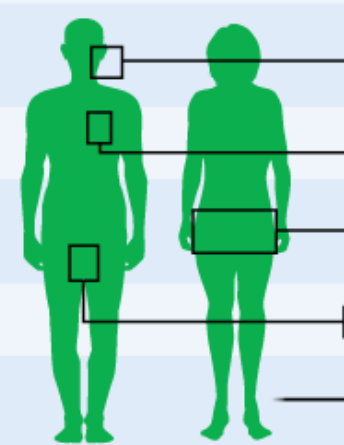
**Write to Melinda**

Beck at [HealthJournal@wsj.com](mailto:HealthJournal@wsj.com)

Copyright 2009 Dow Jones & Company, Inc. All Rights Reserved

This copy is for your personal, non-commercial use only. Distribution and use of this material are governed by our [Subscriber Agreement](#) and by copyright law. For non-personal use or to order multiple copies, please contact Dow Jones Reprints at 1-800-843-0008 or visit [www.djreprints.com](http://www.djreprints.com)

### Evolution's Trade-Offs



	BENEFIT	DRAWBACK
Head	Light skin enables people in northern climates to absorb more vitamin D.	It raises risk of skin cancer.
Arms	Gene variation that retains salt prevents dehydration.	It raises risk of high blood pressure.
Pelvis	A woman's pelvis must be narrow for walking.	It makes a tight squeeze for baby's head during childbirth.
Testicles	Sperm develop better at lower than body temperature.	Testicles risk injury.
Genes	Gene variation makes some Africans immune to malaria.	It raises risk of sickle-cell anemia.

Source: WSJ research