

Wyoming Tribune Eagle, Jan 28, 2016. Editor's headline: "Answering three questions" Casper Star Tribune, Jan 30: "Finding answers to origin questions"

Where did we come from? What are we doing here? Where are we going? The French painter Paul Gauguin (1848-1903) affixed these questions to one of his paintings.

For many years now, archeologists have unearthed compelling evidence that the human race originated in Africa, whence we migrated and spread out across the globe. Additionally, thanks to advances in genetic research, we now have the definitive answer to Gauguin's first question. Genome research has added valuable information to archeological finds.

Human fossils indicate that a large increase in brain size happened about 1.8 million year ago, when *Homo erectus* first wandered the African savannas. Before this, the brains of our human ancestors were like those of gorillas or chimpanzees. It may have been the shift to eating meat that allowed greater brain development, thus meeting the energy requirements of a larger brain. The taming of fire and roasting of meat may have contributed, since cooking increases the energy content of foods and makes them more efficient to digest. Evolving genes also helped in more efficient uses of energy.

As we develop from fetus into adult, the human brain calls on different sets of genes to further its growth. Adult brains show increased expression of energy-related genes, "mostly trying to sequester enough energy to efficiently run these expensive machines," writes Eugene Harris in "Ancestors in our Genome." The brain is the most energy-consuming entity within the human body.

As *Homo erectus* evolved, a gene linked to the development of chewing muscles mutated and caused these muscles to become weaker, which may have allowed further expansion of the brain. Jaw and tooth sizes of the time suggest that these humans applied less force to chewing. Eventually the shortened chewing muscles reduced the protrusion of the chin. Furthermore, "*Homo erectus*' more linear form, indicated by its skeleton, also suggests a digestive tract appreciably reduced in size from that of its ancestors," probably because of diminished intake of roughage, observes the author.

At this point anatomically modern humans were ready to leave their ancestral lands. But Africa is a massive continent. The United States would fit into it alongside China and India—and still leave room for several smaller countries. The question arises: Where in Africa did the great uptake to the modern human form begin? Where did the exodus originate? Scientists are debating a number of possibilities.

We now know, there wasn't just one great exodus. Our African ancestors left their birthplace repeatedly, in groups large and small—and in their migrations they nearly died out. This is known as "population bottleneck."

One such bottleneck may have been caused by an almost unimaginable eruption of Volcano Toba on the northern part of Sumatra. "In the past million years or so, Toba has

erupted four times, culminating in the one 74,000 years ago,” write the authors of “Island of Fire.” That gigantic eruption blasted an ash cloud across most of Southeast Asia. Daytime skies darkened to “a moonlit night.” Temperatures plummeted by as much as 10 degrees Celsius for a year or more, and it stayed dramatically colder for an entire decade. “For early humans desperately looking for things to eat, the big chill would have been just too much to handle,” the authors quote the researcher who put forth the hypothesis.

Genetic studies have established that our closest cousins are chimps and bonobos. We know where we originated, yet answers to Gauguin’s two other conundrums remain debatable. In the half-million years of recent evolution humans have managed to inflict serious damage to our fellow creatures and to the planet that sustains them and us. We have loaded the atmosphere with enough carbon to affect the climate for centuries to come. Since 1991 alone, carbon levels increased from 361.5 parts per million to over 400 ppm. Past 450 ppm we’ll be at “game over,” yet we seem unable or unwilling to reverse direction. Continued population growth exacerbates the problem.

Interestingly, Americans have actually decreased their carbon output, which “by 2012 dropped to the lowest level in nearly twenty years,” writes Seamus McGraw in “Betting the Farm on a Drought.” Power plants switching from coal to gas is a huge factor; another is renewables. “The increase in renewable energy in the United States in the past six or seven years is around one and a half times larger than the (total) wind and solar production of Germany,” McGraw quotes Laszlo Varro, head of the International Energy Agency’s market division.

Another factor, however, was the 2007 collapse of the economy, which has remained stagnant. Even when the price of oil fell to recent lows, consumers kept tightening their belts; hence, the U.S. has received little gain from the decline. Everyone hopes, of course, the economy is on the rebound, but if so, where will we be going with it?