One Gene Might Explain Why Humans Are Born to Run

A single gene mutation made our ancestors freakishly good long-distance runners.

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As someone who loves ultra-distance running and is also a huge Bruce Springsteen fan, "Born to Run" has always been one of my favorite songs. Yes, I know it's cliché. But, anytime I'm out for a long jog and hear Bruce belt out, "In the day we sweat it out on the streets of a runaway American dream," I can't help but have flashbacks to another time in our evolution when our human ancestors were chasing prey on the African savanna.

Source: rangizzz/Shutterstock

Over a decade ago, I first wrote about some evolutionary reasons why "Chimps Like Us Are Born to Run" in *The Athlete's Way: Sweat and the Biology of Bliss.* For this section of my book, I referenced the findings from a landmark paper, "Endurance Running and the Evolution of *Homo*," (2004) by Dennis Bramble and Daniel Lieberman of Harvard University's Department of Evolutionary Biology.

During their 13-year-long study, Bramble and Lieberman identified 26 traits that made early humans extraordinary long-distance runners. As the authors explain in the study abstract:

"Striding bipedalism is a key derived behaviour of hominids that possibly originated soon after the divergence of the chimpanzee and human lineages. Although bipedal gaits include walking and running, running is generally considered to have played no major role in human evolution

because humans, like apes, are poor sprinters compared to most quadrupeds. Here we assess how well humans perform at sustained long-distance running, and review the physiological and anatomical bases of endurance running capabilities in humans and other mammals. Judged by several criteria, humans perform remarkably well at endurance running, thanks to a diverse array of features, many of which leave traces in the skeleton. The fossil evidence of these features suggests that endurance running is a derived capability of the genus *Homo*, originating about 2 million years ago, and may have been instrumental in the evolution of the human body form."

Now, a new study (2018) on mice from the University of California San Diego School of Medicine offers a fascinating follow-up to this pioneering research on endurance running. The potentially groundbreaking paper, "Human-Like Cmah Inactivation in Mice Increases Running Endurance and Decreases Muscle Fatigability: Implications for Human Evolution," was published in the September 12 issue of the *Proceedings of the Royal Society B.*

For this first-of-its-kind study, the UCSD researchers were able to pinpoint a specific gene mutation that may have helped our early human ancestors evolve from being tree dwellers to becoming one of the best long-distance running creatures in the animal kingdom.

Early hominids seem to have evolved with running-specific skeletal biomechanics and physiology such as stronger gluteus maximus (butt) muscles, bigger feet, skulls with overheating protection, a nuchal joint to keep the head steady when bobbing up and down, and an expansive network of sweat glands that cooled the body to a degree not seen in other large mammals.

Among mammals, humans are among the most efficient ultra-distance endurance runners. Only horses, dogs, and hyenas can outrun us over the long haul. And our ability to run farther and faster without fatigue made us exceptionally good hunters. Our ancestors could chase prey in scorching hot heat during the middle of the day, when other carnivores were asleep. And, they were able to chase prey over extremely long-distances which pushed any mammal with less endurance to a breaking point of exhaustion. This survival-of-the-fittest technique of wearing down prey is called "persistence hunting."

As part of human evolution, scientists speculate that about 2 or 3 million years ago the functional deletion of a gene called "CMP-Neu5Ac hydroxylase (CMAH)" triggered a chain reaction in the genus *Homo* that would eventually lead to modern *Homo sapiens*. The original genus *Homo* also included extinct species such as *Homo habilis* and *Homo erectus*.

For the latest UCSD study on endurance running, the researchers engineered a strain of mice that lacked the CMAH gene and then tested their ability to run long distances in comparison to a control group of mice with this gene still intact. First author Jon Okerblom, who is a graduate student, spearheaded the construction of treadmill-like machines along with long distance running wheels for mice. "We evaluated the exercise capacity (of mice lacking the CMAH gene), and noted increased performance during treadmill testing and after 15 days of voluntary wheel running," Okerblom said in a statement.

After this initial finding, Okerblom and senior author Ajit Varki consulted with their colleague, Ellen Breen, a research scientist in the division of physiology at the UC San Diego School of Medicine. Breen observed that mice lacking the CMAH gene displayed greater endurance and less fatigue along with better mitochondrial respiration and hind-limb muscle strength. Notably, they also appeared to have more capillaries for supplying blood and oxygen to running muscles.

Varki speculates that these findings suggest that the mutation of the CMAH gene millions of years ago may have helped early humans become exceptionally good long-distance, endurance runners.

The authors sum up the significance of this research: "Taken together, these data suggest that CMAH loss contributes to an improved skeletal muscle capacity for oxygen use. If translatable to humans, CMAH loss could have provided a selective advantage for ancestral *Homo* during the transition from forest dwelling to increased resource exploration and hunter/gatherer behaviour in the open savannah."

References

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