Humans hot, sweaty, natural-born runners

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Hairless, clawless, and largely weaponless, ancient humans used the unlikely combination of sweatiness and relentlessness to gain the upper hand over their faster, stronger, generally more dangerous animal prey, Harvard Anthropology Professor Daniel Lieberman said Thursday (April 12).

Just days before Monday's 111th running of the Boston Marathon, Lieberman presented his theories of the importance of running to ancestral humans to explain why we're the only species that voluntarily runs extraordinarily long distances, such as the 26.2 miles in the marathon.

The talk, "Why Humans Run: The Biology and Evolution of Marathon Running," was delivered at the Geological Lecture Hall as part of the Harvard Museum of Natural History's spring lecture series, "Evolution Matters."

While more than a million humans run marathons voluntarily each year, most animals we consider excellent runners — antelopes and cheetahs, for example — are built for speed, not endurance. Even nature's best animal distance runners — such as horses and dogs — will run similar distances only if forced to do so, and the startling evidence is that humans are better at it, Lieberman said.

Modern humans and their immediate ancestors such as Homo erectus sport several adaptations that make humans, instead of some ferocious, furry, or fleet creature, the animal world's best distance runners.

“Humans are terrible athletes in terms of power and speed, but we’re phenomenal at slow and steady. We’re the tortoises of the animal kingdom,” Lieberman said.

That evidence belies the long and firmly held belief that humans are the animal world’s biggest wimps and, if not for our big brains and advanced weapons, we’d be forced to subsist on fruits and vegetables, always in danger of being gobbled up by fiercer predators.

The problem with that theory, Lieberman said, is that we began adding meat to our diets around 2.6 million years ago, long before we developed advanced weapons like the bow and arrow, which was developed as recently as 50,000 years ago.

While some of our ancestors’ meat-eating may have been due to scavenging, Lieberman said the appearance about 2 million years ago of physical adaptations that have no impact on walking but that make humans better endurance runners provide evidence that early scavengers became running hunters.

Specifically, we developed long, springy tendons in our legs and feet that function like large elastics, storing energy and releasing it with each running stride, reducing the amount of energy it takes to take another step. There are also several adaptations to help keep our bodies stable as we run, such as the way we counterbalance each step with an arm swing, our large butt muscles that hold our upper bodies upright, and an elastic ligament in our neck to help keep our head steady.

Even the human waist, thinner and more flexible than that of our primate relatives allows us to twist our upper bodies as we run to counterbalance the slightly-off-center forces exerted as we stride with each leg.

Once humans start running, it only takes a bit more energy for us to run

faster, Lieberman said. Other animals, on the other hand, expend a lot more energy as they speed up, particularly when they switch from a trot to a gallop, which most animals cannot maintain over long distances.

Though those adaptations make humans and our immediate ancestors better runners, it is our ability to run in the heat that Lieberman said may have made the real difference in our ability to procure game.

Humans, he said, have several adaptations that help us dump the enormous amounts of heat generated by running. These adaptations include our hairlessness, our ability to sweat, and the fact that we breathe through our mouths when we run, which not only allows us to take bigger breaths, but also helps dump heat.

“We can run in conditions that no other animal can run in,” Lieberman said.

While animals get rid of excess heat by panting, they can’t pant when they gallop, Lieberman said. That means that to run a prey animal into the ground, ancient humans didn’t have to run further than the animal could trot and didn’t have to run faster than the animal could gallop. All they had to do is to run faster, for longer periods of time, than the slowest speed at which the animal started to gallop.

All together, Lieberman said, these adaptations allowed us to relentlessly pursue game in the hottest part of the day when most animals rest. Lieberman said humans likely practiced persistence hunting, chasing a game animal during the heat of the day, making it run faster than it could maintain, tracking and flushing it if it tried to rest, and repeating the process until the animal literally overheated and collapsed.

Most animals would develop hyperthermia — heat stroke in humans — after about 10 to 15 kilometers, he said.

By the end of the process, Lieberman said, even humans with their crude early weapons could have overcome stronger and more dangerous prey. Adding credence to the theory, Lieberman said, is the fact that some aboriginal humans still practice persistence hunting today, and it remains an effective technique. It requires very minimal technology, has a high success rate, and yields a lot of meat.

Lieberman said he envisions an evolutionary scenario where humans began eating meat as scavengers. Over time, evolution favored scavenging humans who could run faster to the site of a kill and eventually allowed us to evolve into persistence hunters. Evolution likely continued to favor better runners until projectile weapons made running less important relatively recently in our history.

“Endurance running is part of a suite of shifts that made Homo [the genus that includes modern people] human,” Lieberman said.

Source: Harvard University