

Study: Long legs are more efficient

Scientists have known for years that the energy cost of walking and running is related primarily to the work done by muscles to lift and move the limbs. But how much energy does it actually take to get around? Does having longer legs really make a difference?

Herman Pontzer, Ph.D., assistant professor of physical anthropology in Arts & Sciences, has developed a mathematical model for calculating energy costs for two and four-legged animals. His research was published in a recent issue of *The Journal of Experimental Biology*.

"All things being equal, leg length is one of the major determinants of cost," says Pontzer, "If two animals are identical except for leg length, the animal with longer legs is more efficient."

The fossil record shows that two million years ago, there was a big increase in leg length in early humans. Pontzer suggests that one reason for this increase could have been the energy saved by having longer legs. "If you greatly increase the distance that you travel each day, then you'd expect evolution to act on walking efficiency," he says.

"That way, the energy you save on travel can be spent instead on survival and reproduction." Pontzer's LiMB model is an equation that predicts walking and running. Importantly, the model predicts that the rate of force generation — and therefore the rate of energy use — is related to limb length. Longer legs mean less force production and lower energy cost.

To test his equation, Pontzer put people, goats and dogs on a treadmill in his lab, and measured how much oxygen each used during walking and running at various speeds. He found that the LiMB model explained more of a variation in locomotor cost than other predictors, including contact time and body mass, showing that it worked for animals with four legs as well as two.

Source: Washington University in St. Louis

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