

# The science of running: Follow the bouncing ball (w/ Video)

August 2 2012

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(Phys.org) -- Muscle size, genetics and training are among the countless factors that separate Olympic sprinters from the average person. On a fundamental level, however, the mechanics of running are the same for all humans. In fact, they're basically identical for animals too.

“Science has shown that [running](#) is very similar to a bouncing ball,” says Young-Hui Chang, an associate professor who oversees Georgia Tech’s “running lab,” officially called the Comparative Neuromechanics Laboratory. “When humans, horses and even cockroaches run, their center of mass bounces just like a pogo stick.”

This bouncing effect, Chang explains, means that the hip, knee and ankle [joints](#) all flex and extend at the same time when the foot hits the ground. Many of the leg muscles are turned on simultaneously, creating force and propelling the runner into the air.

“The greater the force, the greater the speed,” said Chang. “Sprinters and coaches are constantly studying ways to move leg muscles and joints as quickly as possible so that a runner can hit the ground as hard as possible.”

Elite runners and weekend joggers are able to consistently land with the same force, step after step. However, Chang’s research reveals that a stride is just like a fingerprint: no two are exactly alike. The torque generated by each joint is never the same. As a result, your legs have a mind of their own.

“Your knee, for example, automatically adjusts its own torque, each step, based on what the ankle and hip do,” said Chang. “All of this happens without your brain getting directly involved. Your joints ‘talk’ to each other, allowing you to concentrate on other things, like having a conversation or watching for cars.”

By studying how joints adapt to one another, Chang and his team will soon work with amputees to hopefully improve movement for people with prostheses. The researchers are also using their running studies to understand how people walk.

“It may seem backwards to fully understand the nuances of running before we study walking, but walking mechanics are actually more complex. Different muscles are activated at different times in a gait cycle. Joints don’t move in unison. There is no ‘bouncing ball’ phenomenon for walkers.”

Provided by Georgia Institute of Technology

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