Ostriches run fast because of 'springy' tendons

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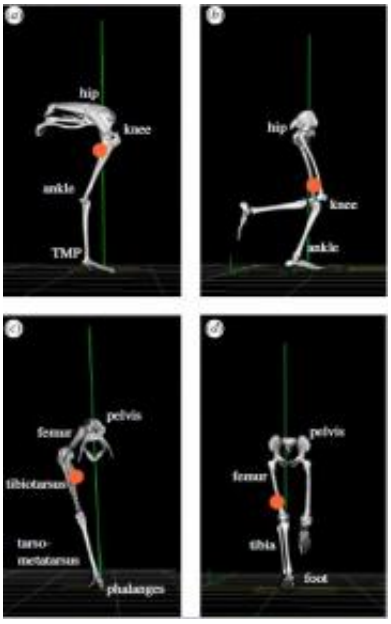

Human and ostrich hind-limb postures during mid-stance of running: (a,b) sagittal plane; (c,d) frontal plane. Image: [i]Journal of the Royal Society Interface[/i], doi:10.1098/rsif.2010.0466

Australian and U.S. researchers studying the movement of ostriches have discovered the giant flightless birds can store double the elastic energy per step in their tendons than humans can. This considerably reduces the effort needed by the muscles, and enables the ostrich (and perhaps also the emu) to run twice as fast as humans while requiring only half the energy.

Leader of the study, Assistant Professor Jonas Rubenson of the School of Sports Science, Exercise and Health at the University of Western Australia, said the aim of the research was to find out what mechanical adaptations were made by species able to run fast and efficiently. He said that while lions and cheetahs can outrun the ostrich on short sprints, they use a great deal of energy, and other species such as ostriches, antelopes and horses, can run fast over long distances.

Two hypotheses had been proposed to explain how some animals are able to run economically: the first was that they used a particularly efficient mechanical action in their limbs, and the second was the animals were able to store more elastic energy in their joints than sprinters.

To test these hypotheses the researchers fitted reflective markers to the joints of five humans and five tame ostriches to enable them to carry out a detailed analysis of their gait and movements as they ran on a custom-built running track 50 meters long. They also measured the forces applied to the ground during running. They selected the ostrich rather than the lighter Australian emu because the ostrich and humans have a similar mass, and because the ostrich is the fastest bird on the land.

The results demonstrated that both humans and ostriches need the almost exactly the same amount of mechanical work to swing their limbs during running, and the major difference was in the storage and release of energy by the tendons. They calculated the release of this elastic energy generated 83% more work in the ostrich than in the human, which meant the ostrich uses less metabolic energy and is less fatigued.

The findings of the research, described in the *Journal of the Royal Society Interface*, may enable engineers to design better prosthetic limbs by focusing on elastic propulsion. They could also help robot researchers to design more agile robots. The results could also provide some insight

into the evolution of bipedalism.

More information: Adaptations for economical bipedal running: the effect of limb structure on three-dimensional joint mechanics, *Journal of the Royal Society Interface*, Published online before print October 28, 2010, doi:10.1098/rsif.2010.0466