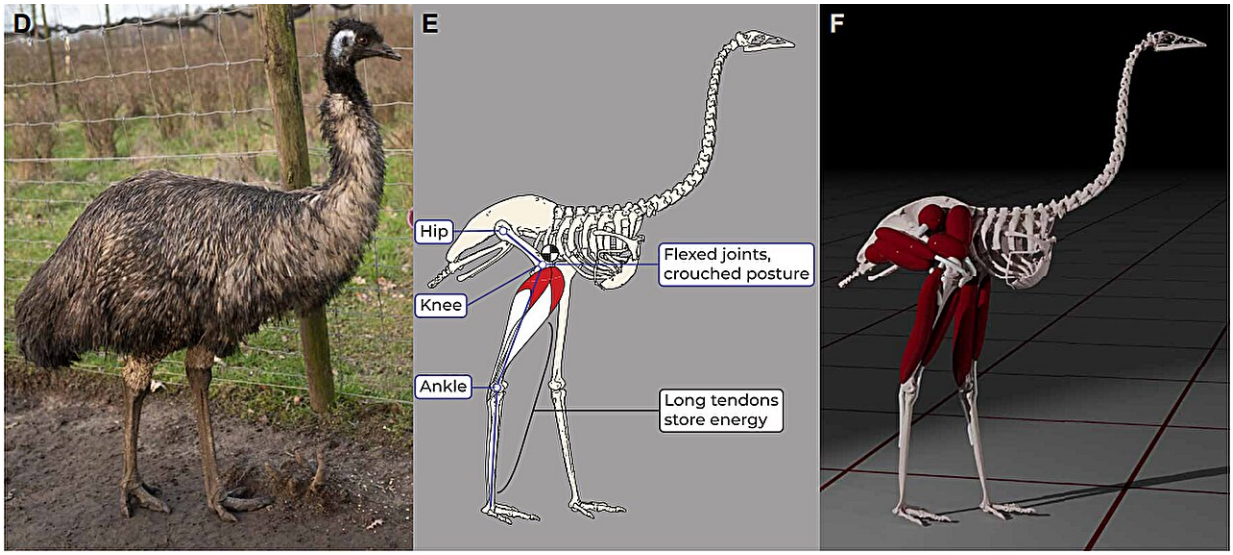
Bird study shows that grounded running styles conserve energy

September 26 2024, by Bob Yirka



Features of walking and running in birds and humans focused on in this study. (D) In the emu (D. novaehollandiae), as in most birds, the hip and knee joints are enveloped in feathers, obscuring the fact that (E) most birds habitually keep their three functional leg segments in crouched postures because their muscles are strongest near these postures. A fully extended posture is impossible for birds due to the forward placement of the COM (checkered circle). (F) Our musculoskeletal model of the emu enabled us to decouple the effects of posture and tendon elastic storage on running gaits. Credit: *Science Advances* (2024). DOI: 10.1126/sciadv.ado0936

A small team of biologists and animal movement specialists in the

Netherlands and the U.K. has found that birds such as the emu have a grounded running style at medium speeds, allowing them to conserve energy compared to the ungrounded running style of other animals such as humans.

In their study published in the journal *Science Advances,* the group simulated the running style of emus to better understand it.

When a bird such as an emu runs at medium speed, it never becomes airborne—it always has one foot firmly planted on the ground. This grounded running style, the researchers found, uses less energy than one in which a runner leaps into the air with each stride—again, at medium speed.

In this new study, the researchers investigated why birds have adopted such a running style when most other bipedal animals have an ungrounded style regardless of speed.

To simulate the running style of an emu, the research team created what they describe as a digital marionette made of just muscle, bone and tendons. It also had modifiable rigidity of the tendons to change its running style. They then taught their model to walk, and after that, to run.

Next, the team prompted the model to run using as little energy as possible—it responded by running at medium speed with a grounded style. The researchers noted that the simulated running looked remarkably like the real thing.

The researchers also found that emu anatomy, because it has evolved with the need for crouching, prevents the bird from fully straightening its legs, likely contributing to its running style. With this type of muscle, they note, it would take more energy to use an ungrounded style at

intermediate speeds. They suggest the running style of birds likely first evolved with non-avian dinosaurs due to their similar anatomy.

More information: Pasha A. van Bijlert et al, Muscle-controlled physics simulations of bird locomotion resolve the grounded running paradox, *Science Advances* (2024). DOI: 10.1126/sciadv.ado0936

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