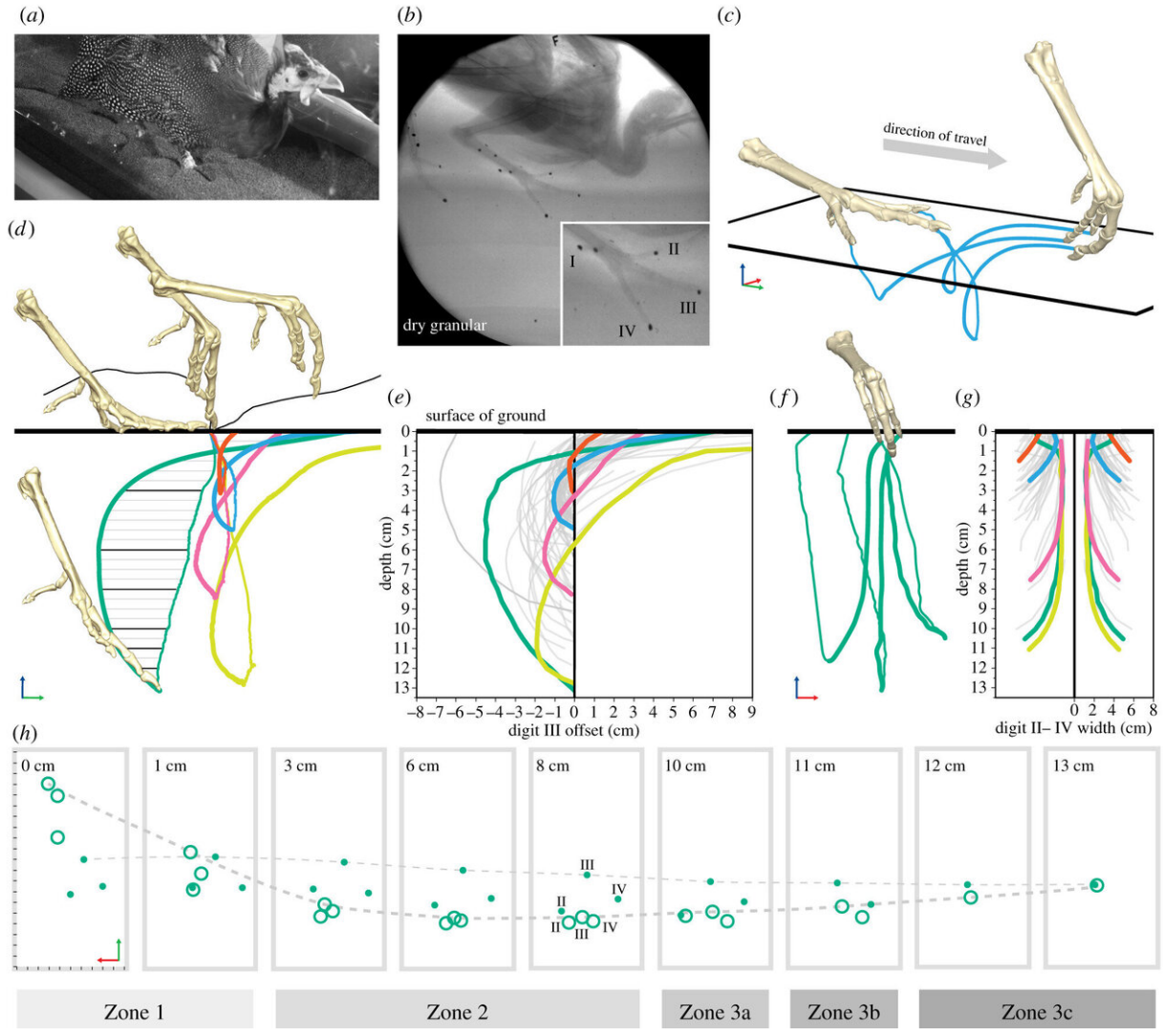
Looping footstep pattern in modern guineafowl sheds light on dinosaur tracks

July 1 2020, by Bob Yirka



Sub-surface foot kinematics through a volume of substrate. Synchronized standard (a) and X-ray (b) video frames of a guineafowl walking through a dry granular substrate. Toes and markers are clearly revealed sub-surface (inset). (c)

Oblique view of digit claw marker motion trails for one step through dry grains. (d) Lateral view of a sample of digit III motion trails on several deformable substrates (coloured lines; thin = entry, bold = exit) and one solid substrate (black line). Digit III offset (e) measured at 5 mm depth horizons (horizontal lines in (d)) and are plotted for 81 steps from all three individuals. (f) Anterior view of claw motion trails showing the toes widely spread when sinking (thin), and smoothly collapsing upon withdrawal (bold). (g) Digit II–IV width are plotted from 49 steps of two individuals (equal scales in d–g). (h) Selected horizons for the green step (d–g) showing changing locations of claw entry (filled circles) and exit (open circles). The looping entry (thin) and exit (bold) path of digit III is indicated by a dashed line. Grey bars indicate zones for this track volume. Vertical and horizontal scales in (d–g) shown by axes in (e) and (g). Tick marks in (h) equal 1 cm. Credit: *Biology Letters* (2020). DOI: 10.1098/rsbl.2020.0309

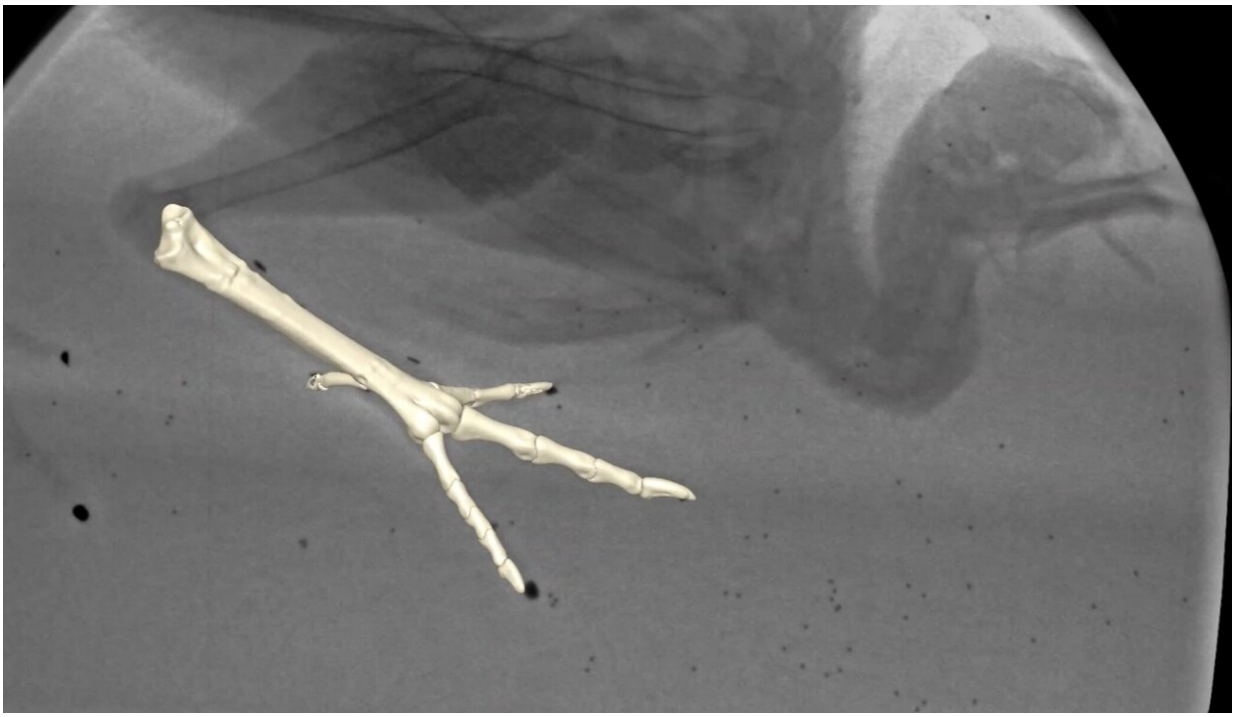
A trio of researchers, two with Brown University, the other with Liverpool John Moores University, has found that a looping pattern in modern guineafowl footsteps is similar to those of certain dinosaurs. In their paper published in *The Royal Society Biology Letters,* Morgan Turner, Peter Falkingham and Stephen M. Gatesy describe their study of tracks made by modern guineafowl and how they compared to dinosaur tracks left in modern Connecticut.

Prior research has shown that many dinosaurs walked upright, including some that left three-toed tracks in a part of modern Connecticut. To learn more about how such dinosaurs might have walked, the researchers looked to modern guineafowl—birds that are endemic to Africa and are believed to represent one of the oldest gallinaceous birds. One species of guineafowl, the helmeted guineafowl, has been widely dispersed and domesticated around the world. It was this species that the researchers chose to study because it not only has a three-toed foot similar to the dinosaur tracks found in Connecticut, but is also flightless.

The work involved filming several guineafowl with high-speed cameras as they walked across a variety of surfaces, from hard to granular to firm and semi-liquid so that the action could be seen in slow motion. The researchers also X-rayed the tracks left behind by the birds.

In studying the film and X-ray images, the researchers were able to follow the path of all parts of the birds' feet as they touched the ground and then dug in when the surface was not hard, and then as the foot was extracted from the ground The team then made animations of the footsteps showing that the tips of the birds' toes executed a looping motion as they moved first into the ground and then as they were retracted. The team then compared their guineafowl findings with the footprints left by dinosaurs in Connecticut, and found them to be very similar—enough so to conclude that the dinosaurs likely walked with looping footsteps, as well.

The researchers suggest the looping pattern they observed likely made walking in mucky water less difficult. They further suggest that its expression in modern birds demonstrates how successful the foot shape observed in dinosaurs has been.



Using sophisticated X-ray-based technology, a team of Brown University researchers tracked the movements of guineafowl to investigate how their feet move below ground through various substrates and what those findings could mean for understanding fossil records left behind by dinosaurs. Credit: Brown University

More information: Morgan L. Turner et al. It's in the loop: shared sub-surface foot kinematics in birds and other dinosaurs shed light on a new dimension of fossil track diversity, *Biology Letters* (2020). DOI: 10.1098/rsbl.2020.0309

Press release