# African wild dogs have vestigial first digit and muscular adaptations for life on the run

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African Wild Dog, Lycaon pictus at Savuti Chobe National Park, Botswana. Credit: Derek Keats/ Wikimedia, Creative Commons Attribution Generic 2.0 license

Anatomists identify a vestigial first digit in the forelimb of the African

wild dog and document anatomical adaptations to its unique lifestyle of long-distance running and exhaustive predation

African wild dogs (Lycaon pictus) are known for their unique hunting style, often referred to as "exhaustive predation", in which they chase their prey to exhaustion, rather than hunting using speed, strength, or stealth. They are also unique among the dog clade in having only four full digits on their front paws. Until recently, it was unclear how these unique behavioral and anatomical features would affect their forelimb morphology.

The African wild dog, also known as the African painted dog or Cape hunting dog, is native to southern and eastern Africa, and classified as Endangered by the International Union for the Conservation of Nature (IUCN). They use sophisticated, coordinated hunting behaviors in which some packs decide as a group to hunt and communicate their vote via "sneezing". They also have a nomadic lifestyle with packs traveling up to 50 km per day and geographically extensive home ranges of 560 to 3000 $km^2$. African wild dogs also differ from other canid (dog) species in the absence of a fully formed first digit (tetradactyly), which may allow for increased speed and stride length, facilitating long-distance pursuit of prey.

In a recent study published in *PeerJ*, a team of anatomists discovered a small, vestigial first metacarpal deep to the skin of the African wild dog. Surprisingly, this species is not fully tetradactyl as previously thought, but instead has a rudimentary digit 1. Prior to this study, the vestigial first digit of the African wild dog had never been described. The unexpected reduced digit results in a reconfiguration of some of the associated forelimb muscles to assist with proprioceptive functions (the body's perception of its own position and movement). According to Heather F. Smith, the study's lead author, "We now not only know that this vestigial digit exists, but how its presence completely reorganizes

and repurposes the muscles typically associated with the first digit."

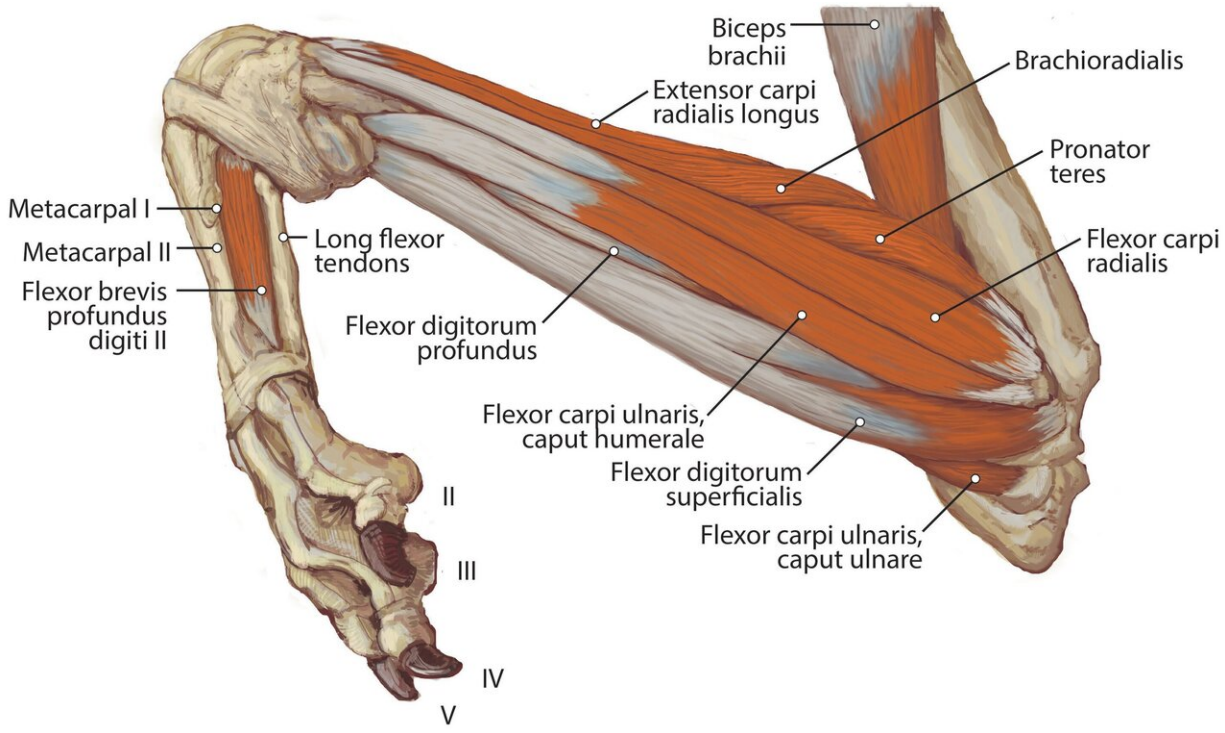


Illustration of the muscles and bones of the African wild dog forepaw. The bone labeled "metacarpal 1" is the vestigial first digit. The muscles attached to this bone are smaller and reorganized compared to other species and function to stabilize the wrist during long-distance running. Credit: Illustrations drawn by Brent Adrian of Midwestern University

The authors have also discovered a stout ligament in the wrist which may act as a strut, assisting with passive flexion and rebound of the forefoot. This taut ligament provides non-muscular propulsion during push-off of the forepaw, which may help sustain endurance running and prevent the wrist muscles from tiring. This morphology is similar in function to the suspensory ligaments of the horse "spring foot", which provides passive

"spring" action by absorbing and transferring forces experienced during locomotion.

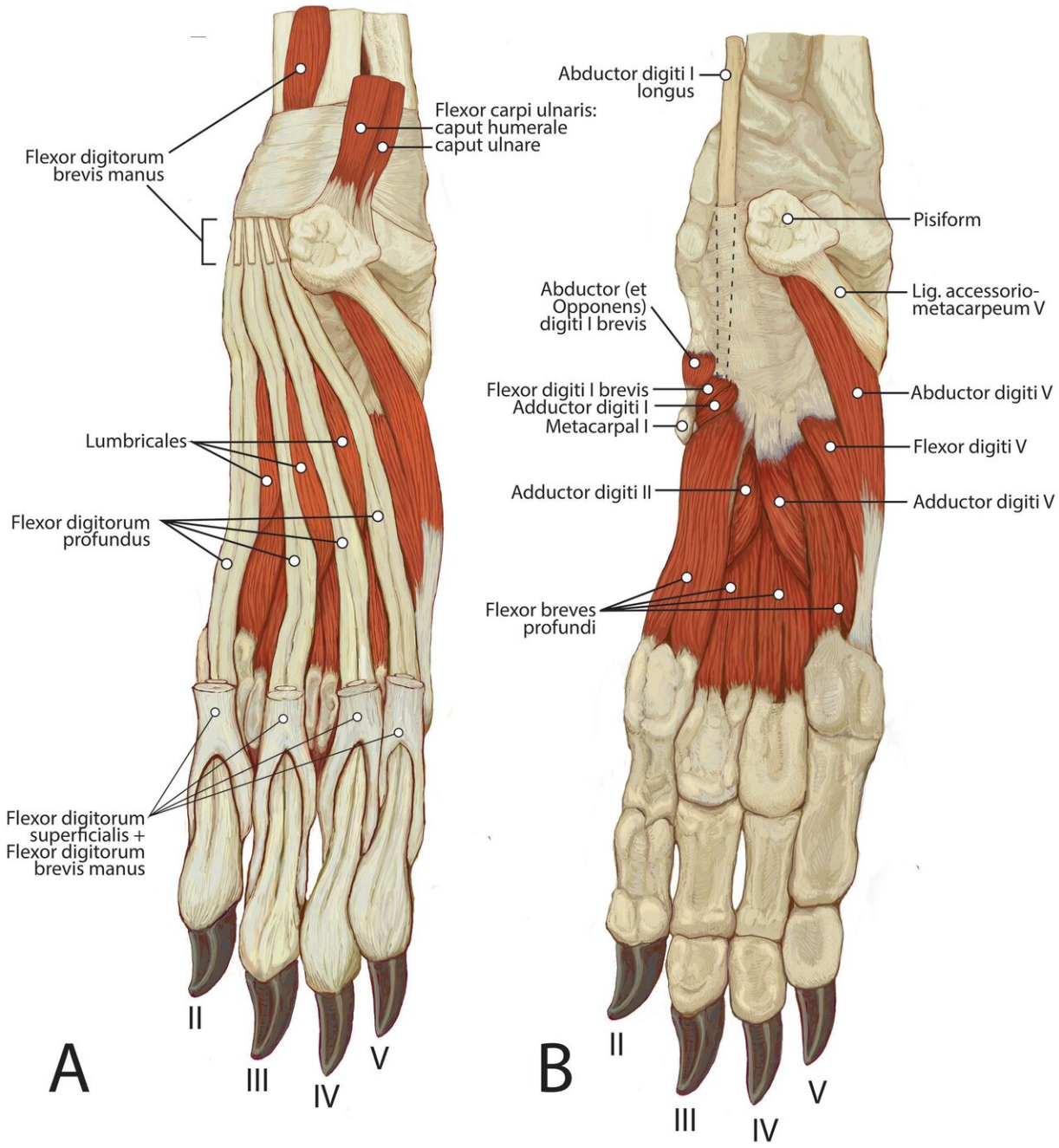


Illustration of the muscles and bones of the African wild dog forearm. The bone labeled "metacarpal 1" is the vestigial first digit. Muscles of the forearm are

adapted to provide stability to the wrist and elbow, which assists with endurance running. Credit: Illustrations drawn by Brent Adrian of Midwestern University (one of the co-authors of the article)

Several other muscular adaptations to long-distance endurance running in the forelimb muscles have also been identified, including relatively reduced wrist rotator muscles and thick ligaments binding the radius and ulna (the two forearm bones), resulting in greater wrist and forearm stability. Several muscles associated with joint stability elastic energy storage during locomotion are also expanded compared to other species.

According to Smith, "This is the first in-depth study of African wild dog forelimb anatomy, and it demonstrates multiple adaptive mechanisms of endurance running, including reconfiguration of forelimb muscles, ligaments, and even bones, which function synchronously to facilitate the highly cursorial lifestyle of this fascinating species".

**More information:** Smith HF, Adrian B, Koshy R, Alwiel R, Grossman A (2020). Adaptations to cursoriality and digit reduction in the forelimb of the African wild dog (Lycaon pictus). *PeerJ* 8:e9986. , DOI: 10.7717/peerj.9866

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