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Scaling effects in theropod dinosaurs SCOTT A. LEE, University of Toledo — For geometrically similar animals, the length of the leg bones ℓ would scale as the diameter of the leg bone d: d $\sim \ell$. In order to maintain the same stresses in the leg bones when standing (i.e., elastic similarity), ℓ^3 must scale as d^2, yielding d $\sim \ell^{3/2}$. Sixty-six femora from more than 30 different species of theropod dinosaurs were studied. Our results yield d $\sim \ell^{1.16}$, well below the prediction of elastic similarity. The maximum stresses on the leg bones would have occurred during locomotion when forces on the order of several times the body weight would have been present. Bending and torsional stresses of the femur would have been more likely to break the bone than compression. The ability of the bone to resist bending stresses is given by its section modulus Z. From our data, we find that Z $\sim \ell^{3.49}$. The bending torque applied to the femur is expected to scale as roughly ℓ^4. Both results indicate that larger theropods had smaller cursorial abilities than smaller theropods, as is observed in extant animals. Assuming that all theropod bones have the same shear modulus, the ability for the femora to resist torsion is given by Q = J/ ℓ where J is the second polar moment of the area. From our data, we find that Q $\sim \ell^{3.66}$.

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