are numerous and include revisions to the tempo of evolution of major tetrapod clades and several new additions to the Upper Carboniferous faunal record. Further detailed analyses of this material will contribute to revising our understanding of the ecosystem composition and dynamics of Upper Carboniferous tetrapod communities.

The Evolution of Body Shape, Locomotion and Ecology in Terrestrial Vertebrates

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Body shape has a fundamental impact on organismal function. Most studies on body shape in vertebrates are focused on research into squamates (mostly fossorial species) and aquatic or semi-aquatic vertebrates, but it is largely unknown (in a quantitative way) how body shape has evolved more widely in concert with changes in behavior, locomotor style and ecological niches. Here, we combine three-dimensional computer models of vertebrate skeletons with phylogenetic reconstructions to quantify the evolution of body segments and whole body shape across terrestrial vertebrates. Measures of whole body shape include a range of linear measurements, including limb bones lengths (used to calculate whole limb lengths) and gleno-acetabular distance, along with skeletal volumes (generated by automated convex hulling) for major body segments (e.g., neck, tail, thigh segments). This data is then used to generate a range of measures to describe various aspects of body shape, such as relative body length (limb length: gleno-acetabular distance), relative limb length (forelimb length: hind limb length) and proportion of total skeletal volume made up by individual body segments. We derived this data from 3D-skeletal models spanning 420 taxa across all major extinct and extant terrestrial vertebrate groups. In order to test for correlations between body shape and locomotion, behavior and ecology we assigned each taxon to a range of morpho-functional groups. To consider phylogeny in our analysis we constructed a phylogenetic tree of our sample taxa by merging the most recent consensus trees in the published literature. Statistical analysis of this data set reveals a number of strong correlations between multiple body shape metrics and both locomotor style and ecological niche. Interestingly, our analysis reveals that selectively bred animals, such as specific breeds of domestic dogs, represent statistical outliers, having body shapes that are uncharacteristic of their locomotor style and ecology, which may help explain the prevalence of musculoskeletal dysfunction in these animals. IACD are acknowledged for part-funding this research.

Ontogenetic Development of Skull Shape in *Bothrops jararaca*, with Special Emphasis on the Pit Organ and the Venom Gland

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The venomous pit viper *Bothrops jararaca* from Brazil is known to experience a dietary shift during growth, i.e., whereas juveniles initially hunt for ectothermic prey and insects, prey preference changes towards endotherms, i.e., mammals, in the adult stage. This shift is also reflected in a change in venom composition during growth. However, it remains unknown if there are also any anatomical changes resulting from this dietary change. To investigate whether this shift can be detected in the morphology of the head we generated micro-computed tomography scans of the skulls of 85 individuals of *B. jararaca* across all growth stages, and applied a geometric morphometrics approach with special focus on the imprint of the pit organ onto the maxillary bone. Also, we used Diffusible Iodine-based Contrast-Enhanced Computed Tomography Method (DiceCT) to visualize the morphology of the venom gland. Results reveal that the growth trajectory of the pit organ deviates from that of the skull, with the pit organ following a much steeper inclination and showing fast, positively allometric growth relative to the remaining skull until close to the adult stage. In addition, not only the pit organ but also the venom gland system follows its own growth trajectory. Our results suggest a relationship between ontogenetic changes in prey preference and the postnatal ontogenies of pit organ and venom delivery system in *B. jararaca.* It still remains to be tested if similar patterns are also found in other species of pit vipers without dietary shifts.

Are Rhinoceros Graviportal? Morphofunctional 3D-Analysis of Modern Rhinoceros Limb Long Bones

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Many amniote lineages display convergent evolution towards high body mass through time, which strongly impact (among others) the appendicular skeleton. Species displaying adaptations to sustain a high body mass are said to be graviportal, a term defined alternately by the relative length of limb segments, osteological features, body mass, posture or gait. Unlike elephants, rhinoceros do not fulfil all the graviportal criteria and important body mass and body size variations can be observed between the lightest rhinoceros (*Dicerorhinus sumatrensis*) and the heaviest one (*Ceratotherium simum*). Detailed study of long bone shape variation in the five living rhino species could enable to better highlight limb traits potentially linked to body mass increase in the group. Using 3D-geometric morphometrics on the six stylopod and zeugopod bones allows us to clearly discriminate the five species. The fibula displays a particularly strong intraspecific variation which questions its functional adaptive value, among other possible contributing factors. Moreover, morphological traits tend to co-vary because of common developmental origin or similar function, a tendency called integration. We completed our individual bone analysis by exploring this integrative aspect related to high body mass. While the strong differences between the lightest and the heaviest species tend to indicate an impact of body mass on the bone shape, the influence of body size, body proportions, ecology, and phylogeny are also characterized. This study allows us to propose morphofunctional interpretations of the observed shape variations between the five species and to contribute new elements to the recognition of morphological changes associated with weight bearing adaptations of the limb bones in rhinoceros.

How Informative is Joint Mobility? A 3D-Analysis of Potential *versus* Realized Joint Poses in Archosaurs

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Paleontologists have traditionally reconstructed the locomotion of dinosaurs and other extinct animals by manipulating their fossil bones and inferring the mobilities of their limb joints. But even if we could estimate the ranges of motion (ROMs) of joints perfectly, are we justified in assuming that all of an animal's potential joint poses are exploited in life, let alone in locomotion? Here, we evaluate the predictive power of joint mobility by determining what portion of a joint's full passive ROM is actually used during various behaviors. We measured the passive joint ROMs of the hip, knee, and ankle of the helmeted guineafowl (*Numida meleagris*) and the American alligator (*Alligator mississippiensis*) based on manipulations of fully intact cadavers. We then measured thousands of poses used at each of these joints during locomotor and non-locomotor behaviors using XROMM, and plotted the mobilities and poses on a common ROM map in 3D-joint pose space. We found that in all the joints studied, steady forward locomotor poses form a very small and uncentered subset of all possible joint poses. The centroid of each joint's mobility - sometimes termed the joint's "neutral pose" and thought to reflect habitual stance - has no relationship to posture or locomotion. Rather, locomotor poses, especially stance phase poses, often fall along the edges of cadaveric ROM envelopes in 3D-joint pose space. These results suggest that even well-estimated joint ROM, though critical for the elimination of impossible joint poses, is a poor predictor of the locomotor poses actually used by extinct ornithodirans such as non-avian dinosaurs and pterosaurs. Future analyses of hind limb joint surface interactions during life are necessary to further constrain paleontological reconstructions of locomotion.

A Reappraisal of the Pennsylvanian-aged Early Reptile *Cephalerpeton ventriarmatum* (Moodie, 1912) from Mazon Creek, Illinois and Linton, Ohio

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The Pennsylvanian-aged (309-307 Ma) Francis Creek Shale, 'Mazon Creek' Lagerstätte, produces some of the earliest fossils of the major tetrapod lineages. The Mazon Creek record of the early 'protorothyridid' reptile, *Cephalerpeton ventriarmatum* (YPM 796), is known from a single part concretion containing a well-preserved anterior portion of a skeleton. Aside from the reptile *Hylonomus lyelli* from the slightly older deposits of Joggins, Nova Scotia, the remains of *Cephalerpeton* are amongst the oldest known amniote fossils. *Cephalerpeton cf. C. ventriarmatum* has also been identified in the tetrapod fauna from Linton, Ohio, represented by a disarticulated cranium (CM 23055) and a single right dentary (BMNH R. 2667). Here, we re-describe the anatomy of *Cephalerpeton* from all its known fossils from Mazon Creek and the slightly younger coal deposits of Linton, Ohio, and additionally, we describe new material from the latter. Our results indicate major anatomical differences between fossils of *Cephalerpeton* from Mazon Creek and those from Linton, likely representing new taxonomic diversity. The holotype is reconfirmed as a basal eureptile sharing close postcranial skeletal similarities to other protorthyridids, such as *Anthracodromeus* and *Paleothyris*. The skull of the holotype is long and lightly built, with large orbits, and a dorsoventrally short mandible similar to most basal eureptiles. This strongly contrasts the condition seen in *Cephalerpeton cf. C. ventriarmatum* from Linton where the cranial and mandibular elements appear proportionally taller. Additionally, the anteroposteriorly narrower and dorsoventrally taller maxilla of the Linton specimen is reinterpreted as excluding the lacrimals from the nares; a similar condition is seen in 'short-faced' parareptiles such as *Colobomycter* and *Acleistorhinus*. We tentatively propose a parareptilian affinity for the reptile remains from Linton, which would represent the oldest known example of a parareptile.

Does the Muscular Anatomy of the Pelvic Fin of the Extant Coelacanth *Latimeria chalumnae* (Actinistia: Latimeriidae) Provide Information on its Mobility and Role during Locomotion?

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Coelacanths are sarcopterygian fishes that were originally known only from their fossil record and assumed extinct since the Upper Cretaceous (70My ago). The discovery of a living coelacanth, *Latimeria chalumnae*, offshore South Africa in 1938, was a surprise for the scientific community, and provides a unique opportunity to study the anatomy of this close relative to tetrapods. Its paired fins are of special interest because of their mono-basal articulation and their proximal endoskeleton, homologous to that of tetrapods. A recent study on the functional anatomy of the musculature of the pectoral fin showed that it is more complex than previously thought. Here, we focus on the pelvic fin and hypothesize that the muscles are equally complex and allow complex movements of the fins. A detailed dissection and anatomical description of the pelvic fins was undertaken on an adult specimen of *L. chalumnae* preserved in the MNHN collections, Paris. According to previous descriptions, the pelvic fin musculature presents a three-layered organization: the adductor and abductor muscles form the superficial and middle layers, whereas the pronator and supinator form the deep layer. Amongst others, our preliminary results show that the muscle bundles of the superficial and middle layers lead to adduction or abduction movements, but also to the protraction or retraction of the fin. Moreover, whereas previous studies documented about twenty muscles, we observed and described more than 70 clearly individualized muscle bundles. This complex organization of the muscle bundles