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skeleton is preserved. The teeth have been compared with a Santonian specimen of *S. lewisii* ([EB1] MNHN 1946-18-1620) and correspond in morphology but are almost double the size, similar to those of Cappetta's *Scapanorhynchus* sp. (MNHN 1946-18-1462).
Preliminary conclusions: The new NHMUK specimen is the first known example of an exceptionally preserved *Scapanorhynchus* outside the Lebanese Santonian. It confirms Cappetta's suggestion that either most of the Sahel Alma *Scapanorhynchus* specimens are juveniles or there is another dentally similar species present.

Dinosaur Systematics, Diversity & Ecology

A TAIL TALE: INJURIES IN CAUDAL NEURAL SPINES OF HADROSAURIDAE REVEALED BY AN EXTENSIVE PALEOPATHOLOGICAL REVISION OF ORNITHOPODA

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Ornithopods show the highest frequency of paleopathological lesions in the dinosaurian fossil record. They were affected by a wide range of conditions, from injuries and infections to developmental disorders and even tumors. Until now a systematic overview of their distribution in the clade has not been undertaken. The current research addresses this issue and an extensive review of fossilized lesions is reported, ranging from Late Jurassic taxa, such as *Camptosaurus* and *Dryosaurus*, to Late Cretaceous hadrosaurids, with a wide range of conditions and patterns identified. The highest levels of pathological changes are detected in Hadrosauridae, localized in the trunk region, pedal elements and the tail. Basal taxa show a lower frequency due to the 'scaling effect' from basal, smaller forms to derived, larger taxa. Hadrosaurid material is also more abundant than non-hadrosaurid ornithopods, with a broader pool of individuals and therefore a higher likelihood of finding lesions. In particular, the tail of hadrosaurids displays a common pattern of injured neural spines in the proximal and middle caudals. Ten near-complete tails and approximately 300 isolated proximal and middle caudals of adult individuals from at least four different species show vertical or diagonal fractures and/or oblique bending of the neural spines. The location of the injuries also corresponds to the apical portion of the spine that lacks coverage of the interlaced lattice of ossified tendons. The injuries generally displayed bone resorption and proliferation indicative of healing, hence they did not affect the survival of the individuals. These conditions account for 32% of the pathologies recorded in the caudal regions, and 22% of the total pathologies identified in Hadrosauridae. It can be assumed that the occurrence of similar lesions at the same location in the tail, but in different taxa separated in time and space, may result from a similar event, perhaps a similar behavior. Finite Element Analyses have been performed on a scanned caudal vertebra and on a modelled caudal series to determine the possible etiology of the trauma. The results show that the neural spine could have been bent and/or broken by a vertical, slightly oblique, heavy loading, presumably from another hadrosaur, on the proximo-middle region of the tail. It is tentatively suggested that these injuries could have resulted from mating, and that individuals with such pathologies were female.
Funding Sources Marie Sklodowska-Curie Actions, Horizon 2020 SPaRK Cohort.

Symposium: Paleoneurology

BRAIN EVOLUTION OF EARLY PLACENTAL MAMMALS: THE IMPACT OF THE END-CRETACEOUS MASS EXTINCTION ON THE NEUROSENSORY SYSTEM OF OUR DISTANT RELATIVES

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The end-Cretaceous mass extinction, 66 million years ago, profoundly reshaped the biodiversity of our planet. After likely originating in the Cretaceous, placental mammals (species giving live birth to well-developed young) survived the extinction and quickly diversified in the ensuing Paleocene. Compared to Mesozoic species, extant placentals have advanced neurosensory abilities, enabled by a proportionally large brain with an expanded neocortex. This brain construction was acquired by the Eocene, but its origins, and how its evolution relates to extinction survivorship and recovery, are unclear, because little is known about the neurosensory systems of Paleocene species.

We used high-resolution computed tomography (CT) scanning to build digital brain models in 29 extinct placentals (including 23 from the Paleocene). We added these to data from the literature to construct a database of 98 taxa, from the Jurassic to the Eocene, which we assessed in a phylogenetic context.
We find that the Phylogenetic Encephalization Quotient (PEQ), a measure of relative brain size, increased in the Cretaceous along branches leading to Placentalia, but then decreased in Paleocene clades (taeniodonts, phenacodontids, pantodonts, periptychids, and arctocyonids). Later, during the Eocene, the PEQ increased independently in all crown groups (e.g., euarchontoglirans and laurasiatherians). The Paleocene decline in PEQ was driven by body mass increasing much more rapidly after the extinction than brain volume. The neocortex remained small, relative to the rest of the brain, in Paleocene taxa and expanded independently in Eocene crown groups. The relative size of the olfactory bulbs, however, remained relatively stable over time, except for a major decrease in Euarchontoglires and some Eocene artiodactyls, while the petrosal lobules (associated with eye movement coordination) decreased in size in Laurasiatheria but increased in Euarchontoglires.
Our results indicate that an enlarged, modern-style brain was not instrumental to the survival of placental mammal ancestors at the end-Cretaceous, nor to their radiation in the Paleocene. Instead, opening of new ecological niches post-extinction promoted the diversification of larger body sizes, while brain and neocortex sizes lagged behind. The independent increase in PEQ in Eocene crown groups is related to the expansion of the neocortex, possibly a response to ecological specialization as environments changed, long after the extinction.
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Biomechanics & Functional Morphology

CAN AGNOSTIC ORNSTEIN-UHLENECK MODELING OF STYLOPOD CIRCUMFERENCES IDENTIFY LOCOMOTORY REGIME SHIFTS IN DINOSAURIA?

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It has long been recognized that several major lineages of dinosaurs evolved a quadrupedal locomotory mode from bipedal ancestors. However, pinpointing the transition from bipedality to quadrupedality in the evolutionary history of these groups has proved challenging. Recent research drawing on data from extant and extinct tetrapods has demonstrated that the stylopod midshaft circumferences of bipeds and quadrupeds show distinctive scaling patterns. The humeri of quadrupeds are recruited to bear some of the mass of the body, and hence become relatively more robust than those of bipeds. This relationship may be used to identify shifts in locomotory mode across the evolutionary history of dinosaurs and related archosaurs. To discover such shifts, we applied recently developed Bayesian reversible-jump Markov chain Monte Carlo methods to a dataset of stylopod circumference measurements for 220 dinosauromorph taxa. This approach treats the slope and intercept of the stylopod scaling relationship as traits that evolve on a phylogeny under an Ornstein-Uhlenbeck (OU) process, and does not require a priori specification of locomotory mode. Our agnostic modeling approach produced seven major scaling regimes within Dinosauria. Collapsing nested clades found not to differ statistically in slope, intercept, or both through generalized least squares phylogenetic analysis of covariance reduced the number of regimes to four. These regimes included: a group comprising early-branching dinosaurs and dinosauromorphs, unambiguous bipeds, non-ceratopsid ceratopsians, and all iguanodontians; all of Sauropodomorpha; Scutellosaurus and later-branching thyreophorans; and Ceratopsidae. Of the four, Sauropodomorpha and the thyreophoran clade are not statistically different, suggesting convergence to a common regime. Surprisingly, we did not recover a shift between assumedly bipedal, basal sauropodomorphs and unambiguously graviportal sauropods. We also did not recover a shift within Iguanadontia, members of which have been considered quadrupedal based on trackway and osteological evidence. The regime shift within Ceratopsia is consistent with a switch to obligate quadrupedality. Our results provide evidence for clade-specific differences in the scaling relationship of stylopod circumferences, but so far cannot be explained strictly by inferred locomotory mode, indicating complexity in the effects of locomotion on the scaling relationships of limb shaft robustness in dinosaurs.

Anatomical & Developmental Explorations of the Mammalian Skull

MAMMALIAN CHEWING DEPENDS ON ROLLING OF THE JAW AND DEEP CONSERVATION OF TOOTH FORM AND FUNCTION

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