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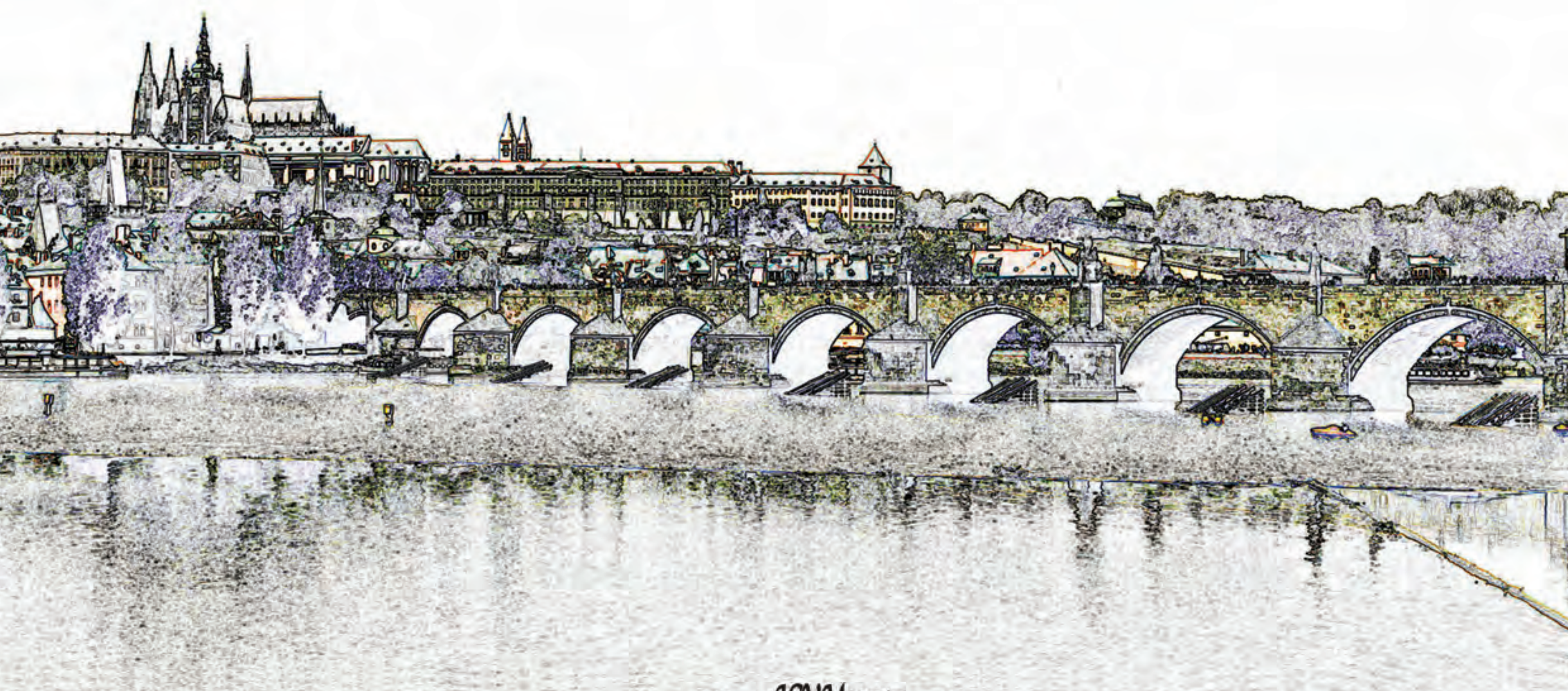

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abscission, and regeneration in cervid artiodactyls (deer). It is the only example of complete organ regeneration in mammals. The physiology behind is complex and synchronized with behavioral and environmental specifics. Previous paleohistological evidence provided important insight in stem cervid antlers and allowed for a more differentiated view; however, it suffered from limitations in methods and material. We took advantage of a sample of more than 35 specimens of early and middle Miocene stem cervids, including the earliest known (≈ 20 to 19 Ma), to gather paleohistological data. In doing so, we used x-ray micro-computed tomography and petrographic thin-sections. These early antlers share the apophyseal, branched, and deciduous condition with those of crown cervids, but differ in morphotype by being generally smaller and simpler structured, lacking the longitudinal beam construction as well as burrs, and exhibiting a variety of branching patterns (dichotomous, trichotomous, multitomous). Our findings provide empirical data of growth patterns that demonstrate a cycle of apoptosis, abscission and regeneration and no longevity in stem cervid antlers, consistent with data from modern antlers. Accordingly, we conclude that primary processes and mechanisms of the modern antler cycle were not acquired in multiple steps during evolution, but were fundamental from the earliest record of antler evolution. The previous interpretation that proximal circular protuberances, burrs, are the categorical trait for the indication of ephemerality turned out to be mistaken. GER and XW received funding from the DFG (Projects RO 1197/11-1 and RO 1197/7-1).

Morphology and Evolution of Palaeomerycid (Mammalia, Ruminantia, Giraffomorpha) Headgear

Sánchez IM[1], Cantalapiedra JL[2], Quiralte V[3], Morales J[4]; [1]Institut Català de Paleontologia Miquel Crusafont, Barcelona, Cerdanyola del Vallès, Spain, [2]Universidad de Alcalá, Alcalá de Henares, Madrid, Spain, [3]Museo Geominero (IGME), Madrid, Spain, [4]Museo Nacional de Ciencias Naturales–CSIC, Madrid, Spain (micromeryx@gmail.com)

The Palaeomerycidae were strange Miocene Eurasian three-'horned' giraffomorph ruminants. The Giraffomorpha comprise pecorans with the strangest cranial appendages, and palaeomerycids were no exception. They sported both frontal (supraorbital) ossicones and a single forked occipital epiphyseal appendage. Ossicones, as those of giraffes and palaeomerycids, are apophyseal cranial appendages that fuse to the skull roof (frontals) after birth. They are almost identical in giraffes and palaeomerycids, and are diagnosed by the presence of both a distinctive suture line at the ossicone base, and a characteristic morphology of the inner surface of the ossicone base. On the other hand, the occipital appendage of palaeomerycids derives from a deep modification of the nuchal plane, and involves a relatively vertical growth of the supraoccipital area and a lateral expansion that results in the integration of areas belonging to the occipital crest. The nuchal plane and its muscular attachments are reorganized, with some of these areas of muscular insertion extending over the basal portion of the appendage. Thus, palaeomerycid necks were highly modified, with enhanced muscular packs related to the lateral and extension movements of the head. This is an outstanding example of a cranial appendage involved in deep anatomical and functional modifications related to the head-neck system. The presence of ossicones in two giraffomorph groups, palaeomerycids and giraffids, belonging to different clades within Giraffomorpha (Giraffoidea and Palaeomerycoidea), rises the hypothesis of a basal origin of ossicones that later produced the varied appendages of giraffomorphs. To test this we need: a) a deep histological study of the frontal appendages of prolibytheriids and climacoceratids; and b) to discover if *Propalaeoryx*, the African palaeomerycoid sister group of Eurasian palaeomerycids, was a horned pecoran, and if this was the case, what type of frontal appendages sported.

The Anatomy of the Giraffe Ossicone

Solounias N[1], Cydylo MA[2], Celebi T, Danowitz M; [1]NYIT College of Osteopathic Medicine, Old Westbury, USA, [2]NYIT College of Osteopathic Medicine (nsolouni@nyit.edu)

Except for a few studies by Ganey, Spinage, and Lancaster, the ossicones of *Giraffa camelopardalis* have not been studied in detail, which warranted this in-depth analysis. Developmentally, the earliest ossicone is a dermal pouch situated on top of the frontal bones. This pouch is laterally continuous with the dermal layers of the skull. In this respect, the ossicone closely resembles an embryonic placode. The overlying dermis is present throughout life and appears to decrease in overall thickness moving from the calvaria to the apex of the ossicone. Within the very young, the ossicone contains a central ossification surrounded by dermis. Under the base of the ossicone, numerous dermal fibers penetrate into the center of the element. As the animal matures, the core becomes completely ossified. New ossifications spread into the dermis. A secondary bone growth, termed the "epikouron", eventually covers the entirety of the posterior ossicones and passes onto the calvaria. All these ossifications begin as fibrocartilage. The epikouron forms the knob of the ossicones, while the true or ossicone proper is more pointed and entirely encased in epikouron. The nasal ossicone is similar in origin. In some specimens, there is epikouron underneath the nasal ossicone but not under the posterior pair. In coronal cross-section of the skull, the frontal sinus possesses a number of septa most of which are not organized in position. Two septa appear to be in specific locations: one at the sutures between the two frontal bones, and the other between the parietal and temporal bones bilaterally. We term these suture septa. The vasculature of the ossicone consists of only one superficial artery, providing blood to the ossicone proper. In comparison, there is little vasculature in the surrounding epikouron and dermis. We hypothesize that the reduced vasculature on the surface of the ossicones is an adaptation to avoid excessive bleeding due to their fighting style.

Contributed sessions

Reassessment of the Enigmatic Pterosaur *'Ornithocheirus' wiedenrothi* from the Lower Cretaceous of Northern Germany

Abel P[1], Hornung JJ[2], Kear BP[3], Sachs S[4]; [1]Eberhard Karls University of Tübingen, Gnotzheim, Germany, [2]University of Göttingen, [3]Uppsala University, [4]Naturkundemuseum Bielefeld (pascal.abel94@web.de)

In stark contrast to the famously rich Jurassic fossil record, the documented occurrences of Cretaceous pterosaur remains from Germany are extremeley sparse. To date, only a few bones and footprint traces have been found in strata of Berriaisian–Hauterivian age. The most complete and best-preserved of these specimens is the holotype of '*Ornithocheirus*' *wiedenrothi* from the lowermost Hauterivian (Endemoceras amblygonium Zone) Stadthagen Formation of Engelbostel, near Hanover in Lower Saxony, northern Germany. This fragmentary skeleton comprises parts of the mandible, including a long symphyseal rostrum, some forelimb elements, and a section of a dorsal rib. The mandible displays several distinctive features, most notably, an anteriorly directed spur-like process at the tip of the mandibular symphysis, and an enlarged and anterodorsally inclined pair of teeth at the first tooth position in the jaw (these are also bordered by a prominent sulcus). When first described in 1990, *'O.' wiedenrothi* was assigned to *Ornithocheirus* based on similarities with *'Ornithocheirus' compressirostris*, which was then classified as the type species of the genus. However, *'O.' compressirostris* has since been referred to *Lonchodectes*, which resembles *'O.' wiedenrothi* in its lanceolate mandibular rostrum, and oval alveolar profile with raised alveolar ridges. *'Ornithocheirus' wiedenrothi* is not directly comparable with the likely monotypic *Ornithocheirus* sensu stricto as no equivalent mandibular elements have been recovered for the type species *O. simus*. Consequently, while we concur with lonchodectid affinity, we consider *'O.' wiedenrothi* to possibly represent a separate genus, and thus a novel addition to the Early Cretaceous pterosaur diversity of Europe.

The Relationship Between Eye and Upper Jaw Development in the Avian Embryo

Abramyan J.; University of Michigan, Dearborn, USA (abramyan@umich.edu)

The embryos of birds and nonavian reptiles form exceptionally large eyes at early developmental stages. In the chicken embryo, the developing eyes span the sides of the face, take up approximately a quarter of the entire head, and directly abut the embryonic lateral nasal and maxillary processes. As development progresses, the maxillary processes grow anteromedially and fuse with the centrally positioned frontonasal mass in order to form an intact upper beak and nasal cavities. Due to the size and placement of the embryonic eyes, we suspected that they might play a role in pushing the maxillary processes forward in order to facilitate fusion of the upper beak. To test our hypothesis, we performed unilateral and bilateral ablation of the eye primordium in the chicken embryo and assessed downstream craniofacial development and patterning. If the eye does indeed perform a vital function in lip fusion, we would expect to see the formation of a cleft in the beaks of treated embryos. However, the beak remained unaffected, indicating functional independence between the developing eye and craniofacial prominence fusion. That said, we did observe minor changes in size, shape and position of the craniofacial prominences, later translating to effects on the developing skull.

Long Teeth, Long Life: Understanding the Effect of External Abrasives on Hypsodont Teeth and Defining the Duration of the Dietary Signal Created by Tooth Wear

Ackermans NL[1], Clauss MC[2], Martin LF[3], Codron D[4], Kircher PR[5], Hummel J[6], Hatt J-M[7]; [1]Vetsuisse faculty, University of Zurich, Zurich, Switzerland, [2]Vetsuisse faculty, University of Zurich, [3]Vetsuisse faculty, University of Zurich, [4]Florisbad Quaternary Research Department, National Museum, [5]Vetsuisse faculty, University of Zurich, [6]Department of Animal Sciences, University of Goettingen, [7]Vetsuisse faculty, University of Zurich (nicole.ackermans@uzh.ch)

Maintaining healthy teeth is paramount to a healthy life. In herbivores, this means avoiding tooth wear. Dental wear is mainly caused by the ingestion of silica abrasives, which are either phytoliths (internal to plants), or external abrasives, such as dust and grit. High-crowned teeth are adapted to offset the effects of tooth wear, yet exactly how hypsodonty is affected by different forms of abrasives remains poorly understood. Analyzing tooth wear to reconstruct the dietary signal of the past is a common practice in paleontology, yet the rare experiments investigating how long these dietary signals take to form call the validity of these reconstructions into question. In a long-term feeding study, sheep (*Ovis aries*, n=46) were fed experimental diets containing high or low concentrations of external abrasives (silica dust) of three different sizes (7 diets in total, including a control). Tooth wear was measured using mesowear (crown shape and height) and absolute wear (crown and root volume) on *in vivo* CT-scans taken at the start, midpoint, and end of the experiment. Comparisons between diet groups showed hardly any significant differences after 18 months, irrespective of whether CT-scans, molds, or actual teeth were scored, though CT-scans produced the bluntest scores. When comparing mesowear scores between methods, CT-scans showed a higher correlation to the real teeth for crown height ($R2=0.93$ *vs* $R2=0.75$), while the molds showed a higher correlation to the teeth for cusp shape ($R2=0.64$ *vs* $R2=0.56$). When scoring crown height, CT-scans were more advantageous than dental molds. The expected wear gradient of "more wear on higher abrasive diets" appeared in visual representations of mesowear change over time, though orders of magnitude were extremely small. These results indicate dietary signal formation to be much more time-consuming than previously thought, in particular when assessing the influence of external abrasives on mesowear in ruminants.

Comparative Gonadal Ultrastructure in Cuban Frogs (Anura: Eleutherodactylidae) Revealed by Transmission Electron Microscopy

Alfonso YU[1], Rodríguez-Gómez Y[2], Sanz-Ochotorena A[3], Segura-Valdéz ML[4], Lara-Martínez L[5], Jiménez-García LF[6]; [1]Florida Museum of Natural History, University of Florida, Gainesville, USA, [2]Facultad de Biología, Universidad de La Habana, Cuba, [3]Facultad de Biología, Universidad de La Habana, Cuba, [4]Facultad de Ciencias, Universidad Nacional Autónoma de México, México, [5]Facultad de Ciencias, Universidad Nacional Autónoma de México, México, [6]Facultad de Ciencias, Universidad Nacional Autónoma de México, México (anoles1983cuba@gmail.com)