specialist ichthyology course in their final, 3rd year. In these courses, the main teaching tool is the dissection of fresh material. Students are provided with whole fishes to dissect at 2nd year to answer the question: Does morphology inform us about the lifestyle and biology of fishes? At 3rd year, students are required to process and reconstruct a whole fish skull to explore the morphological basis for the diversity of feeding modes seen in coral reef fishes. In comparison to computer simulations and videos, we have found that a hands-on approach in the laboratory, followed by a week of behavioral observations on a reef, generates more enthusiasm and energy amongst students in the study of vertebrate morphology. Most importantly, it has triggered novel questions and opened up new research topics in marine ecology and paleontology. Enthused students have since undertaken morphology-based research projects at Masters and PhD levels, which have led to high-quality publications in key journals. Our experience confirms the dependability of 'old' tools in teaching vertebrate anatomy and the capacity of these hands-on experiences to inspire a new generation of morphologists.

**Intra-specific Variation in Color Patterns, Morphology and Sexual Dimorphism in the Moroccan Spiny-tailed Lizard *Uromastyx nigriventris* (Sauria: Agamidae) along a Mediterranean-Saharan-Aridity Gradient**

*Bendami S[1], Znari M[2], Loulida S[3]; [1]Cadi Ayyad University Faculty of Sciences Semlalia, Marrakech, Morocco, [2]Cadi Ayyad University Faculty of Sciences Semlalia, [3]Cadi Ayyad University Faculty of Sciences Semlalia (safaagegb@gmail.com)*

*Uromastyx nigriventris* is a large-sized herbivorous agamid lizard species distributed from northeast-southwest Morocco to western Algeria, from the Mediterranean to the northern margin of the Sahara desert. The species exhibits intra- and inter-population variation in color patterns, but there is no apparent sexual dimorphism. However, it seems that head size and shape may differ between the two sexes. The present study aimed at analyzing: i) inter-population variation in body size and shape, and color patterns along a Mediterranean-to-Saharan aridity gradient in Morocco, and ii) checking the occurrence of an actual sexual dimorphism in head size and shape. We used traditional morphometry to analyze the morphological variation of lizards from four distant populations across the latitudinal aridity gradient. Adult individuals were sexed, weighed, photographed and measured for 2 meristic (number of tail whorls and number of scales around the 5th whorl) and 14 metric characters. There is a color polymorphism, but with no apparent sexual dimorphism, both within and between populations, with variation in proportions among four observed dorsal color patterns: yellow, green, orange, and red along with their combinations. Our results suggest sexual dimorphism for only four morphological variables analyzed: snout-vent length and tail length, and head width and ear-to-nostril distance. The four studied populations differed significantly in the two tail meristic characters and 10 body dimensions excluding head dimensions, except head depth. The observed differences seem to be related to local factors, such as climatic conditions, topography and substrate. Changes in skin color patterns might be related to both genetic and plant nutritional (e.g., carotenoids) determinants. The obtained results on sexual dimorphism are discussed in relation with breeding behavior, but information on mating system for this lizard is needed for better explaining the sexual dimorphism.

**Postcranial Anatomy of a Gorgonopsian and its Implications for the Evolution of the Mammalian Sternum**

*Bendel EM[1], Kammerer CF[2], Fröbisch J[3]; [1]Museum für Naturkunde Berlin, Berlin, Germany, [2]North Carolina Museum of Natural Sciences, [3]Museum für Naturkunde Berlin (eva-maria.bendel@mfn.berlin)*

Gorgonopsians are one of the most iconic groups of non-mammalian synapsids and are common in middle–late Permian continental strata in southern Africa and Russia. Gorgonopsians are characterized by hypertrophied canine teeth and included the apex predators of the late Permian. Though gorgonopsian cranial anatomy is increasingly well-studied, comparable research on their postcranial anatomy has lagged. Here, we describe a new specimen of the namesake taxon *Gorgonops* (SAM-PK-K10591) from the Northern Cape Province of South Africa, revealing new insights into the gorgonopsian body plan and the diagnostic potential of gorgonopsian postcranial elements. Notably, this specimen provides novel information on the anatomy and evolution of a poorly understood component of the pectoral girdle of Gorgonopsia and Therapsida in general: the sternum. Plesiomorphically an undivided element, it often remains cartilaginous in 'reptilian-grade' amniotes and hence has a poor representation in the fossil record. By contrast, modern mammals usually possess an ossified, multipartite sternum consisting of the proximal manubrium and several sternebrae including the distal xiphoid process. An undivided but ossified sternum is known from several therapsid clades and is particularly well-represented in dicynodonts. The earliest documented multipartite, and therefore mammal-like, sternal complex previously reported belongs to the Middle Triassic cynodont *Diademodon tetragonus*. SAM-PK-K10591 shows an earlier occurrence of a multipartite sternum in a gorgonopsian, pulling the origins of this characteristic mammalian trait deep within theriodont therapsids in the Permian. It furthermore underlines the robust and agile design of the gorgonopsian Bauplan, well-adapted for handling large prey.

**Mandibular Shape Disparity and Convergence in Ichthyosaurs and Toothed Cetaceans**

*Bennion RF[1], Lambert O[2], Fischer V[3]; [1]University of Liege, Liège, Belgium, [2]Royal Belgian Institute of Natural Sciences, Brussels, Belgium, [3]University of Liege, Belgium (r.bennion@uliege.be)*

Ever since they first made the transition to life on land around 350 million years ago more than 30 lineages of tetrapods have reinvaded the water independently, filling important roles in aquatic ecosystems. The constraints that arose from living in water rather than air have forced the evolution of similar morphologies within these groups, making them among the most iconic examples of evolutionary convergence. In particular, modern toothed cetaceans are often compared to the ichthyosaurs, a diverse clade of extinct marine

reptiles which also evolved a 'fish-shaped' body plan with tail propelled locomotion. Both are groups of raptorial marine tetrapods with long evolutionary histories and good fossil records, yet surprisingly their ecological convergences and the macroevolutionary pathways behind them are poorly understood and lack a thorough, quantitative framework. The goal of this project is to investigate convergences of ichthyosaur and cetacean skulls on similar morphologies and ecological functions. Here, we present results of a preliminary analysis focusing on the shape of the mandible from a sample of archaeocete and odontocete cetaceans and parvipelvian ichthyosaurs. Landmarks and semi-landmarks were placed onto photographs of specimens or 3D-models made with an Artec Eva handheld scanner. The resulting coordinates were subjected to a principal components analysis in R to show mandibular shape disparity, with preserved stomach contents and tooth shape data used to correlate this morphological variation with possible ecological functions. Up-to-date phylogenies can be superimposed to show convergences and trajectories of evolutionary change in the two groups through time. Using these ordination techniques adaptive landscapes can be created to reveal which areas of morphospace ("peaks") are colonized more frequently. These results will form part of the first detailed quantitative analysis of ecomorphological convergence in ichthyosaurs and cetaceans.

**Is the Lateral Semicircular Canal a Reliable Proxy to Infer Head Posture?**

*Benoit J[1], Farke A[2], Neenan J[3], Manger PR[4]; [1]Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg, South Africa, [2]Alf Museum of Paleontology, Claremont, USA, [3]University of Oxford, UK, [4]School of Anatomical Science, University of the Witwatersrand, South Africa (julien.benoit@wits.ac.za)*

The orientation of the lateral semicircular canal of the bony labyrinth is habitually used to infer head posture of modern and extinct animals (mammals, birds, archosaurs and early "reptiles"). It is believed to be influenced by ecology, diet and behavior (browsers and semi-aquatic species would hold their head higher than grazers and head-butting species). By placing the plane of the lateral semicircular canal parallel to the horizontal, the 'spontaneous', 'neutral' position of the head would be revealed. Though widespread in the literature, this assumption has not been tested on a large sample size in mammals, while it has been challenged in archosaurs and humans. Using direct field observations of living animals and CT-scanning on almost 200 dry skulls representing some 130 modern species, the aim of this project is to investigate the orientation of the plane of the lateral semicircular canal and its reliability for the reconstruction of neutral head posture in modern mammals. Preliminary results indicate that LSC orientation might be governed by factors other than head posture alone. This would question a century of assumed linear relationship between the two metrics. A possible effect of body mass has been detected since small taxa seem to hold their head more horizontal than larger ones. A phylogenetic effect is not ruled out. This study was conducted with the financial support of the DST-NRF Center of Excellence in Palaeosciences, the Palaeontological Scientific Trust (PAST) and the Claude Leon Foundation.

**Similar Appearance but a Different Behavior – a Behavioral Study of Leaping in Four Species of Callitrichidae**

*Berles P[1], Nyakatura JA[2]; [1]Humboldt Universität zu Berlin, Berlin, Germany, [2]Humboldt Universität zu Berlin (patricia.berles@hu-berlin.de)*

The tamarins and marmosets (Callitrichidae; Primates) are a species-rich radiation within the New World primates. Apart from fur coloration, especially external appearance of tamarins is very conserved and suggests a similar behavior of all species. Nevertheless, ecological differences and differences in locomotor behavior have been previously documented in tamarins. To further explore this system, we are interested in fine-grained ecological differences between species related to locomotion. To pinpoint these, we have documented and evaluated data of four tamarin species in terms of substrate use and relevant biomechanical and morpho-functional parameters (such as leaping distance and durations of sub-phases of the leaping motion) in two behavioral studies. These were conducted in a natural habitat in Amazonian Peru and in a naturalistic setting in a zoo in France. We found significant differences in the leaping behavior of the species, based on which we can now expect to find differences in their morphology. While *Saguinus midas* mostly avoided vertical leaps, *Leontocebus nigrifrons* preferred vertical leaps. *Saguinus imperator* and *Saguinus mystax*, on the other hand, appeared to be generalists with no clearly preferred leaping behavior. Morphological differences in muscle architecture, bone shape, and bone internal structure reflecting these differences can be expected and will be traced down in ongoing analyses. This study thus aims to integrate field work with the study of morphology in order to identify potential adaptations.

**Postnatal Dental Morphogenesis of Lagomorphs Point out Potential Developmental Heterochronies as Evolutionary Processes**

*Bertonnier-Brouty L[1], Desoutter A[2], Langonnet S[3], Goudemand N[4], Chaux-Bodard AG[5], Viriot L[6], Charles C[7]; [1]Institut de Génomique Fonctionnelle de Lyon, Université Lyon 1, CNRS, Ecole Normale Supérieure de Lyon, Lyon, France, [2]Head and Neck Unit, Surgical Oncology Department, Lyon, France, [3]Department of Surgical Oncology, Inserm, Claude Bernard University, Lyon, France, [4]Institut de Génomique Fonctionnelle de Lyon, Université Lyon 1, CNRS, Ecole Normale Supérieure de Lyon, Lyon, France, [5]Head and Neck Unit, Surgical Oncology Department, Lyon, France - Department of Surgical Oncology, Inserm, Claude Bernard University, Lyon, France, [6]Institut de Génomique Fonctionnelle de Lyon, Université Lyon 1, CNRS, Ecole Normale Supérieure de Lyon, Lyon, France, [7]Institut de Génomique Fonctionnelle de Lyon, Université Lyon 1, CNRS, Ecole Normale Supérieure de Lyon, Lyon, France (ludivine.bertonnierbrouty@ens-lyon.fr)*

Cheek teeth have changed considerably during lagomorph evolution, from rooted to unrooted evergrowing teeth, with an increase in crown height and modifications of the occlusal morphology. The adult upper cheek teeth of extant lagomorphs are characterized by the presence of two lophs separated by a lingual enamel fold. We observed that juveniles and adults have different dental morphologies. In order to characterize changes in the occlusal surface morphology related to age, we studied its variability in different species of lagomorphs from birth