sis of the well-preserved postcranial bones of *Neoreomys australis*, one of the most abundant Miocene dasyproctids from Patagonia, provides evidence to infer its locomotor behavior. Osteological and myologycal features of the extant species were used as a model to interpret the functional significance of the postcranium of *N. australis*. Several postcranial features of this species are functionally compatible with cursorial habits: the humeral tuberosities, specially the greater tuberosity, are higher with respect to the humeral head, restricting the mobility of the gleno-humeral joint; the humero-ulnar and humero-radial joints limit pronation/supination movements at the elbow joint and increase the stability during flexion/extension (e.g., the capitular tail and capitular eminence are well developed, in congruence with the enlargement of the subrectangular radial head, which is anterior with respect to the ulna). The shape of the hip, knee, and cruro-astragalar, calcaneo-astragalar, and astragalo-navicular joints would have limited the rotational movements, improving the flexion/extension (e.g., the greater trochanter is proximally projected, increasing the mechanical advantage of the glutei; the tibial tuberosity is anteriorly projected, improving the mechanical advantage of quadriceps femoris; the intercondylar tubercles enhance the stability; the internally concave posterior process offers a stop at the upper ankle joint; the anterior distal tibial spine acts as a stop to lateral movements; the distal portion of the calcaneus is elongated).

The Evolution of Weapons in Hartebeest

Isabella Capellini; Dept. of Anthropology, Durham University; 43 Old Elvet, Durham; DH1 3HN, UK (Isabella.Capellini@dur.ac.uk)

The horns of bovids are used in male intrasexual competition and evolved under sexual selection; however, recent studies of developmental variation within populations showed that reduced nutrient availability limits the investment in horns by males. This suggests that selection for larger horns may be opposed by food constraints but, to date, no study has tested how sexual and natural selection interact in the evolution of fighting structures in ungulates. I used variation within the hartebeest clade (Alcelaphus) to test the hypothesis that dimorphism in horns, the pedicel (a bony structure that bears the horns) and skull weight increase when the potential reproductive benefits for males are greater, and in more productive and less seasonal habitats. Dimorphism in horn circumference and length, pedicel height and skull weight, was quantified using 382 museum specimens for eight hartebeest sub-species and regressed against independent variables while controlling for phylogenetic similarity. The length of the breeding season, a surrogate measure of the potential for polygyny in time, predicted dimorphism in pedicel height and skull weight, while habitat productivity predicted horn length dimorphism. The length of the breeding season was also the best, albeit non significant, predictor for horn circumference dimorphism. These results suggest that taller pedicels and heavier skulls are under sexual selection, and that natural selection affects the evolution of fighting structures by limiting investment in longer horns. I argue that the pedicel, by increasing the defence to the head during clashes, might reduce the selective pressures on horns as protective structures.

The Evolution of the Reproductive Anatomy of Talpid Moles (Mammalia)

F. David Carmona,[1] Masaharu Motokawa,[2] Masayoshi Tokita,[3] Kimiyuki Tsuchiya,[4] Rafael Jimenez,[2] and Marcelo R. Sánchez-Villagra[5]; [1]Departamento de Genética, Universidad de Granada, 18071 Granada, Spain, [2]Kyoto University Museum, Kyoto 606-8501, Japan, [3]University of California at San Francisco, Department of Orthopaedic Surgery, San Francisco, USA, [4]Lab. of Bioresouces, Applied Biology Co., 4-12-3, Minami-Aoyama, Minato-ku, Tokyo 107-0062, Japan; [5]Paläontologisches Institut und Museum, Universität Zürich, Karl Schmid-Strasse 4, CH-8006 Zürich, Switzerland (m.sanchez@pim.uzh.ch)

In previous studies of the reproductive biology and genetics of European moles (*Talpa* spp.), some of us showed that all female moles have ovotestes (gonads with testicular and ovarian tissue) instead of normal ovaries, a unique case among mammals. Females are fertile as their ovarian tissue is fully functional. Testicular tissue is abnormal and sterile, but produces testosterone. This phenomenon was later reported in a few other talpid species from Europe and North America. To examine the evolution of reproductive features in talpids, a group comprising 17 living genera with diverse life history features, we examined histologically the gonads of several female specimens belonging to the Asian genera *Mogera* and *Urotrichus* from Japan. Whereas *Mogera wogura* has ovotestes, *Urotrichus talpoides* is characterized by normal ovaries. As not all American mole species have ovotestes, the results fit parsimoniously with recent morphological and molecular studies of talpid phylogeny. A clade of strictly fossorial moles shows conservation of the generalized XX true hermaphroditism. Shrew moles (e.g., *Urotrichus*) lack ovotestis and are more basal than desmans, which have them. Mapping of this singular reproductive trait provides clues about the evolution of territoriality among talpids.

Fossil Evidence (Pisces; Placodermi) for the Paired Origin of Basibranchials and Their Derivation from Neural Crest

Robert K. Carr,[1] Zerina Johanson,[2] and Alex Ritchie[3]; [1]Department of Biological Sciences, Irvine Hall, Ohio University, Athens, OH 45701 (carrr1@ohio.edu), [2]Department of Palaeontology, Natural History Museum, Crowell Road, London, UK, SW7 5BD, [3]Australian Museum, 6 College Street, Sydney, NSW, 2010

Goodrich proposed a paired origin and derivation from neural crest (NC) for basibranchials in gnathostomes based on their assumed origin from paired streams of NC and on documentation of a NC origin for dorsal elements in the branchial arch. However, later studies of branchial arch development usually did not extend ventrally to establish the definitive origin of basibranchials. Discovery that the median basihyoid and basibranchial in *Bombina* (flame toad) are not derived from primary NC calls Goodrich's hypothesis into question. A strict specificity was demonstrated between the hypobranchial and branchial muscles and their connective tissues and entheses (attachment sites)—the latter two are NC in origin, independent of the attachment site. Thus, indirect evidence for a NC origin would include documentation of a dual or paired origin and attachment of hypobranchial or branchial musculature. Some chondrichthyans demonstrate the first criterion as transitory paired mesenchymal condensations in ontogeny. However, the common pattern of muscle attachment is for the hypobranchial muscles to be connected laterally to the hypobranchial elements or ceratobranchials, rather than these paired (later fusing) condensations representing the basibranchials. In the extinct placoderms, paired median elements are preserved in several taxa. New evidence from *Cowralepis mclachlani* (based on a well preserved ontogenetic sequence) clearly demonstrates both the presence of paired medial elements in the adult and entheses for hypobranchial muscles. Thus, placoderms meet both criteria for a NC interpretation. The presence of unpaired elements in extant gnathostomes represents a peramorphic shift from a paired primitive state to a fused medial element.

Morphology and Function of the Feeding Apparatus in Suction-feeding Pipid Frogs

Carrie A. Carreño; Duke University, Department of Biology, Box 90338, Durham NC 27708, USA (carrie.carreno@duke.edu)

The morphology of the feeding apparatus was examined in five species of frogs representing each genus in the family Pipidae (*Xenopus laevis, Pipa pipa, Silurana tropicalis, Pseudhymenochirus merlini, Hymenochirus curtipes*). Pipid frogs are fully aquatic and use suction during prey capture, a method unusual for anurans but common to other aquatic vertebrates. Using silicone molds of the buccal cavity, the buccal volume was found to be up to 8 times greater in pipids than in other anurans. A large buccal cavity is commonly seen in other suction feeding vertebrates. The hyoid is thought to be primarily responsible for movement and support of the buccal cavity in pipid frogs. Using measurements of cleared and stained specimens, the hyoid was found to have a large surface area in all pipids examined and is highly ossified in a few species. The hyoid is positioned farther posteriorly in pipids than is typical for anurans, but maintains the same spatial relationship with the posterior buccal extension. The insertions of the muscles associated with expansion of the buccal cavity were found to have shifted posteriorly, both relative to the body as well as the hyoid itself. Some derivatives of the m. rectus abdominis have insertions that appear to be unique to pipid frogs. A model of buccal expansion for suction feeding in pipids illustrates that expansion occurs primarily through retraction and depression of the hyoid, but is also affected by flexion of the pectoral girdle.

Maximum Running Speed in Mammals is Inversely Correlated with a Proxy for Male-male Competition

David Carrier; Department of Biology, University of Utah, Salt Lake City, Utah 84112, USA (carrier@biology.utah.edu)

The physical demands of rapid and economical locomotion differ from the demands of aggressive behavior in ways that may prevent simultane-