of the avian respiratory system invade and aerate particular postcranial skeletal elements, producing pneumatic (i.e., air-filled) bones. However, the universality of these patterns was recently challenged by the discovery of highly heterodox pneumatization patterns in the Common Ostrich (Struthio camelus). Here we evaluate pneumatization patterns in six phylogenetically disparate species: Common Ostrich, Mallard, Red-tailed Hawk, Great Horned Owl, African Grey Parrot, and Zebra Finch. Each specimen was inflated, imaged via microCT/CT, and checked for decay, and then the pulmonary sources of intraosseous diverticula were tracked for each taxon ($n \geq 3$). This method was validated for each species ($n \geq 2$) by full segmentation and 3D modeling of the respiratory system. All six taxa show strongly divergent patterns. The Red-tailed Hawks pneumatize the femora via the abdominal air sacs, whereas the ostriches do so via pelvic diverticula. Contrary to nearly all published reports, most taxa pneumatize their synsacra via pelvic diverticula, not the abdominal sacs. We show that the specific pulmonary tissues pneumatizing different regions of the skeleton are far more variable than previously recognized, indicating that pulmonary reconstructions of avian lungs in dinosaurs should be much more conservative.

Risk perception and locomotor performance in wild and captive primates

Nicole Schapker, Lydia Myers, Judith Janisch, Ahmad Matar, Julie Pham, Abdelrahman Boghdady, Liza Shapiro, Jesse Young

Research on primates' aptitude for navigating fine, compliant, and oblique branches has often focused on their postcranial morphology and locomotor mechanics. Here we aim to understand how primates perceive risk and make informed judgments to move safely. We video-recorded and digitized the locomotion of four lemur species (Ranomafana National Park) and 3 cercopithecoid monkeys (Kibale National Park). We test the general hypothesis that primates should change their gaits and engage in exploratory behaviors – using touch and sight as guides – to increase stability in precarious settings. Augmenting our prior study showing that some lemurs change their locomotion when moving high in the canopy, we present new data on the behavior of wild lemurs and monkeys as they cross gaps between substrates or switch between locomotor modes. They frequently cross gaps and transition between modes without pause, meaning they can accurately gauge their locomotor capacity before moving onto a new substrate. In an investigation on four species of captive lemur (Duke Lemur Center), we examine how variations in substrate diameter, orientation, and compliance influence the paths lemurs choose to take. Preliminary results suggest that lemurs will tend to avoid the most precarious substrates in their paths, and future analysis will examine the role that light availability plays as well. Overall, this research highlights the importance of risk perception for robust locomotor performance while moving in arboreal environments.

Scratching beneath the surface: forelimb muscle properties in black-tailed prairie dogs

Luke Scheetz, Carter Burnett, Benjamin Kimble, Michael Butcher

Black-tailed prairie dogs excavate burrow systems mainly for predatory avoidance and social organization. As such, they have evolved a suite of musculoskeletal traits in their forelimb digging apparatus for scratch-digging. However, the degree to which their muscular anatomy is modified in response to the selective pressures of their semi-fossorial lifestyle is unknown. The functional capacities of the entire forelimb musculature of Cynomys ludovicianus (N=9) were discovered through quantifications limb mechanical advantage, muscle architectural properties, and myosin heavy chain (MHC) isoform content. Forelimb mass distribution was marked by a large investment in scapular and shoulder muscles that accounted for two-thirds of total forelimb muscle mass. The majority of forelimb muscles had long fascicles with high LF/ML ratios and low PCSA/MM ratios. Only the massive m. pectoralis superficialis was capable of high power by its architectural properties, although several other large muscles were modified for large joint torque or torque range, including mm. latissimus dorsi and triceps brachii long head. Mechanical advantage was correspondingly greatest at the shoulder, intermediate at the elbow, and lowest at the wrist. Muscle composition was also surprisingly faster-contracting by moderate expression of fast MHC-2B and low expression of slow MHC-1. The findings suggest that prairie dogs are less-specialized compared with subterranean burrowing rodents due to their preferences for medium soil types, cooperative social behavior, and trade-offs between terrestrial locomotor and digging functions.

Against the grain: untangling the tangled denticles of basking sharks

Mike Schindler, Aurora(Tairan) Li, Frederik Mollen, Nick Payne, Shahrouz Amini, Venkata Surapaneni, Ruien Hu, Mason Dean

In contrast to other sharks, slow swimming basking sharks (Cetorhinus maximus), high-volume suspension feeders, are covered by massive conical denticles. Shark denticles are effectively teeth embedded in the skin, with most examples diminutive (<500μm) and consisting of a wide basal plate, tapering towards an angled pointed crown, often bearing ridges. As a group, denticles are organized in streamlined series on the skin, their cusps pointing towards the tail, reducing drag. In sharp contrast to this canonical pattern, we show that basking shark denticles are densely and focally clumped to form 'paver blocks' separated by unscaled folds. In each block, denticles are radially arranged like floral whorls, their tips pointing toward and interdigitating with denticles of neighboring blocks. The wrinkling resembles the skin of elephants, with folds oriented to prescribe local anisotropic flexibility. Using high-resolution μCT scans, histology, mechanical tests and large-area laser scanning, we characterized how the significant shape and orientation of basking shark denticles differ from other species' and discuss how variations of denticles and skin alignment along the body promote extreme stretching of the head skin for oral volume enlargement during feeding. These investigations provide much-needed insights into basking shark anatomy, for understanding the evolution and ecological constraints of large marine suspension filter feeders and for the design of dynamic bio-inspired textiles.

Complex environments drive adaptive hunting strategies in mice

Aidan Schneider, Jacob Amme, Keith Hengen

An animal's predatory behavior is often uniquely evolved and adapted to its natural environment. However, predators can also persist and adapt in the face of environmental change. Laboratory studies of mice preying on insects offer controlled, mechanistic insights into their hunting dynamics. Yet, these experiments typically occur in barren, unchanging environments. This study investigates how prey capture and search strategies evolve with increasing environmental complexity.

We designed an experimental setup enriched with objects reminiscent of refuse commonly found in cluttered anthropogenic environments where mice and cockroaches may coexist (e.g., a landfill). Mice reared in barren environments were introduced to this complex setting, and their behavioral adaptations were studied. This required specialized computer vision tools to track the animals despite frequent occlusions, as well as novel machine-learning models to classify both brief individual actions and extended behavioral states integral to the hunt.

Our analyses revealed the emergence of new hunting behaviors unique to the complex environment. These include: 1. skillful maneuvering through dense clutter, 2. persistent tracking of prey over extended periods and through uncertainty, 3. discovering and revisiting potential prey hiding locations, and 4. complex, sequential hunting and search strategies. These behaviors, although observed within an enclosure, mirror strategies of wild predators in their native environments, suggesting that animals can adaptively develop novel complex behaviors in response to a changing, complex environment.

Mechanisms of a novel feeding strategy in chameleons

Nikole Schneider, Christopher Anderson

Some organisms have evolved extreme anatomical structures which increase the performance of a specific behavior. However, these structures may be coopted for alternate usages which can also benefit the animal. How these novel behaviors evolve from existing structures remains unanswered in many organisms, including the chameleon. Chameleons have a specialized feeding apparatus which allows them to ballistically project the tongue at high performance up to 250% of their body length. Though tongue projection is their typical feeding strategy, chameleons have also been reported to feed on slow or non-mobile prey items by directly capturing the prey item with their jaws. This direct capture strategy is minimally described in the literature and the basic mechanisms never examined. We compared the kinematics and muscle patterns of tongue projection and direct prey capture between two chameleon species feeding on different prey items to determine whether these strategies utilize the same movements and patterns, or if distinct behaviors can be performed despite the extreme specialization of the feeding apparatus. Preliminary results suggest that these feeding strategies are not constrained to the same kinematics and muscle patterns, and that the direct prey capture strategy is similar between chameleon species. Additionally, future comparisons with an agamid outgroup could help elucidate whether direct prey capture is a co-optation of ballistic projection or a reversion back to the ancestral mode of feeding.

Conserved anterior-posterior bilaterian features of the adult gut in a marine annelid

Stephan Schneider, Wahyu Cristine Pinem, Grace Sonia

A through-gut, a digestive organ with a mouth and anus, is one of the major features of animals with bi-