***68.4*** GIDMARK, NJ*; STAAB, KL; HERNANDEZ, JP; BRAINERD, EL; Brown University, George Washington University; *nicholas_gidmark@brown.edu*
***XROMM analysis of 3D skeletal movement during premaxillary protrusion in common carp***
Multiple mechanisms have evolved in fishes for premaxillary protrusion, each resulting in suction, gape, and/or speed benefits during feeding. A novel, midline sesamoid bone, the kinethmoid, is present in cypriniform fishes and is highly mobile during jaw protrusion. The kinethmoid is suspended in a ligamentous sling between the neurocranium and the premaxilla, and is also ligamentously attached to the maxillae and palatines. Historically, jaw movements have been characterized by either speculations from dead specimens or by using external landmarks of live specimens. We used X-ray Reconstruction of Moving Morphology (XROMM) to visualize and measure 3D bone kinematics during oral jaw protrusion in common carp, *Cyprinus carpio*. Using biplanar x-ray video and laser-scanned bone data in a digital animation framework, XROMM produces accurate (0.1 mm) 3D animations of bone models, and can be used to explore movements and extract quantitative kinematic data. XROMM analysis of common carp collecting food from the bottom of an aquarium shows that the kinethmoid rotates in the sagittal plane, with the dorsal end rotating anteriorly, effecting premaxillary protrusion. Kinethmoid rotation is driven by the maxillae rotating slightly about their long axes, translating ventrally, and rotating in a parasagittal plane. The movements of the maxillae are caused in part by lower jaw rotation, and are consistent with previously hypothesized action of the A1 beta muscle. Lower jaw and maxillary rotation occurs prior to ventral translation of the maxilla and rotation of the kinethmoid. Protrusion of the premaxilla occurs over the entire duration, and is followed by lateral buccal expansion. This is the first description of cypriniform jaw bone kinematics in 3D space.

***67.1*** GIGNAC, P. M.*; ERICKSON, G. M.; Florida State University; *pgignac@bio.fsu.edu*
***Biomechanical modeling of bite-force generation in the America alligator (Alligator mississippiensis) throughout ontogeny***
The American alligator, *Alligator mississippiensis*, shows up to 5000-fold increases in mass during development. A substantial resource shift to increasingly larger and more durable prey items accompanies this change. To capture and subjugate these food resources this taxon utilizes absolutely high bite forces that have recently been shown to increase with positive allometry during development. Allometry of the cranial skeleton and jaw adductor musculature has been posited as the cause of such patterning. Nevertheless, the links between anatomical form and force generation have not been empirically tested. To address the cause of positively allometric bite forces in this taxon, we dissected a growth series of wild-caught *A. mississippiensis* and developed a mathematical model of bite-force generation based on ontogenetic changes to its feeding functional morphology. Muscle length, mass, pennation angle, and origin-insertion points for all six jaw adductors were considered. The model was tested against experimentally measured bite forces for an additional growth series of wild *A. mississippiensis*. The results show that bite force can be accurately predicted across the full size range of *A. mississippiensis* and that both mass increases and average attachment distance from the jaw joint of several of the jaw adductor muscles together contribute to the positive allometry of bite force in this taxon.

***1.9*** GILLAM, EH*; MCCRACKEN, GF; WESTBROOK, JK; JENSEN, ML; BALSLEY, BB; University of Regina, SK Canada, University of Tennessee, Knoxville, USDA, Agricultural Research Service, College Station, TX, CIRES, University of Colorado, Boulder; *gillam2e@uregina.ca*
***Bats Aloft: Variation in Echolocation Call structure at High Altitudes***
Bats alter their echolocation calls in response to changes in ecological and behavioral conditions, but little is known about how they adjust their call structure in response to changes in altitude. This study examines altitudinal variation in the echolocation calls of Brazilian free-tailed bats, *Tadarida brasiliensis*, a species known to fly at altitudes above 1000 m. From 50.2 hrs of recordings, we analyzed 113 high-quality echolocation call sequences (1,049 calls) recorded from 0 to 862 m above ground level. Bats flying near the ground (0-30 m) used shorter, higher frequency calls compared to bats recorded at higher altitudes, an effect likely due to the greater levels of echo-producing clutter (i.e. vegetation, buildings) found near the ground. When ground-level recordings are excluded, bats continue to shift towards the use of longer duration, lower frequency calls with increasing altitude. We propose that the observed high-altitude changes in call structure are a response to increasing acoustic attenuation rates, and/or decreasing insect densities at higher altitudes.

***100.8*** GINTOF, C.M.*; KONOW, N.Z.; ROSS, C.F.; SANFORD, C.P.; Hofstra University; *cginto1@gmail.com*
***Variability of prey processing in teleost fishes with a comparison to amniotes***
Sensorimotor control mechanisms governing prey-processing muscle activity in teleosts is understudied. Examining variability in underlying motor-patterns across a broad phylogenetic sample may improve our understanding of the evolution and complexity of vertebrate sensorimotor control. We examined two questions: is muscle-activity during prey-processing in fishes 1) behaviorally stereotypic or cyclic and 2) exhibiting a conserved level of variation? We recorded EMG from the adductor mandibulae (AM) in *Amia, Esox,* three osteoglossomorphs and four salmonids to quantify chewing duration and variation, which also was examined in raking, a novel behavior in the two latter groups. Distinct chewing occurred in behavioral trains among all taxa, a pattern that at least superficially resembles cyclic chewing in amniotes. Moreover, fish chewing cyclicity (variability in AM onset-onset duration) fell within the range seen in amniotes. Raking occurred more infrequently than chewing and rarely in trains. Stereotypy (variability in AM onset-offset duration) of chewing and raking was compared among basal and derived taxa and between basal (*Amia* and osteoglossomorphs) and derived lineages (*Esox* and salmonids). While chewing and raking stereotypy and chewing cyclicity were conserved among salmonids, variability existed in osteoglossomorphs. Our results support other evidence that prey-processing in basal teleosts may be neurally pre-programmed and rigorously controlled by central pattern generators. Work funded by NSF IOB#0444891, DBI#0420440.