42-4 JUAREZ, BH*; MOEN, DS; ADAMS, DC; Iowa State University, Oklahoma State University; *bryanhjuarez@gmail.com*
Morphology Predicts Interspecific Jumping Performance in Frogs
Ecological and evolutionary processes depend on individual fitness. Oftentimes, organismal performance is a more accurate predictor of individual fitness than morphology. Recent work has shown that organismal performance, such as feeding performance in fishes, can sometimes be estimated from morphology. Here we test whether morphological proxies can predict jumping performance across 167 individuals from 29 species of frogs. First, we used biological and physical principles to mathematically derive three anatomical proxies for three aspects of jumping performance: jumping velocity, energy, and power. These anatomical proxies use non-invasive anatomical measurements such as the hip length, leg length, body size, and mass of frogs to estimate jumping performance. Second, we used phylogenetically generalized least squares and ordinary least squares regression to assess the precision with which these anatomical proxies allow us to predict jumping performance across the morphological, ecological, and geographical diversity represented in our interspecific dataset. Preliminary analyses indicate that we are reasonably able to estimate all three aspects of jumping performance. The ability to predict jumping performance from morphology (e.g. using museum specimens) allows the rapid sampling of many individuals. Therefore, relative to traditional laboratory methods, this new method enables us to more easily collect the large sample sizes necessary to test different macroevolutionary-level hypotheses regarding the jumping performance of anurans, and possibly other jumping animals.

5-4 JUNG, SJ*; KIM, S; WU, B; DOMBROSKIE, J; Cornell University; *sj737@cornell.edu*
Shattering raindrops on biological surfaces (insect wings, bird feathers)
Many biological surfaces (e.g. bird feathers, insect wings, and plant leaves) are super-hydrophobic with physical morphology at different scales. However, it is not well understood how a raindrop impacts natural super-hydrophobic surfaces, and its significance of biological functions. In this present study, we found that a spreading drop at a high speed can generate wrinkled pattern (including shock-like waves) on a spreading liquid in the presence of surface morphology at the micro scale. Furthermore, the spreading drop is suddenly ruptured by growing holes followed by the shock waves, which leads to a decrease in contact time more than 50%. As a result, heat and momentum transfers are reduced by raindrops, which may lower the hypothermia risk of animals or less affect the stability of insect flights. Additionally, we revealed that the drop fragmentation sheds smaller satellite droplets, which play a crucial role in promoting wet pathogenic dispersal by carrying pathogenic spores along. Therefore, our results shed light on multi-functional aspects of biological super-hydrophobic surfaces.

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Propulsion via vertical undulation in snakes
Snakes have multiple modes of locomotion including lateral undulation, concertina, rectilinear, and sidewinding. During lateral undulation, snakes generate posteriorly-propagating waves of body bending which press against irregularities in the environment and generate propulsive reaction forces. We hypothesize that snakes are capable of using the same mechanism in the vertical plane, using vertical waves of body deflection to generate propulsion from vertical substrate irregularities. We used six corn snakes (*P. guttatus*) to test this hypothesis using an array of horizontal cylinders oriented perpendicular to the direction of travel, one of which was instrumented to record forces. Surrounding this setup are motion capture cameras recording at 120 fps and a GoPro camera to track the snake's kinematics and to confirm that the snake is crossing the cylinders with minimal horizontal bending (and thus not generating propulsion via lateral undulation). Results show snakes produce both propulsion and braking across the pegs, with various trials showing pure propulsion, pure braking, or a combination of both. The magnitudes of peak propulsive force and braking are 0.0586 body weights (BW) (0.043 - 0.075 BW) and 0.0590 BW (0.039 - 0.077 BW), respectively. In contrast, when an inert rope approximately the same weight as the snakes was dragged across the force sensor, it produced only braking force. While this experimental setup was designed to elicit locomotion solely via vertical undulation in order to demonstrate the mechanism most clearly, it is likely that in complex, three-dimensional natural terrain, snakes can combine both lateral and vertical undulation for maximal locomotor efficacy.

129-3 JUSTYN, NM*; HEINE, KB; PETEYA, JA; HOOD, WR; SHAWKEY, MD; WANG, B; HILL, GE; Auburn University, John Carroll University, Ghent University; *nmj0005@tigermail.auburn.edu*
Persistence of Carotenoids in the Red Eyespots of Copepods (Tigriopus californicus) on Carotenoid-free Diets
Copepods can serve as a model for investigations into the functions of carotenoids in animals. Previous work on *Tigriopus californicus* demonstrated that copepods rely on their diet to accumulate carotenoids in their bodies and suggested that, despite their red color, eyespots contained no carotenoids. When fed a carotenoid-free diet of yeast, the orange coloration of the bodies of copepods fades away while the eyespot remains a bright red color. The eyespots of copepods play an important role in many behaviors including diel vertical migration, food acquisition, and predator detection. Elucidating the mechanism behind the source and maintenance of eyespot color in copepods is therefore crucial to understanding these behaviors. Here we used Raman spectroscopy to detect the pigments present in copepods fed both normal and carotenoid-free diets. We detected the red carotenoid, astaxanthin, in *T. californicus* eyespots of both diet groups, as well as in the eggs and the cuticles of normal red-colored individuals. Additionally, we also identified canthaxanthin for the first time in the antennae and caudal rami of normal and diet-restricted individuals, as well as in the bodies of diet-restricted individuals. We will discuss the implications of the persistence of carotenoids in the eyespot even with no access to dietary carotenoids.