anteroposterior wave-like pattern to generate suction. Sensorimotor integration helps to regulate suckling and allows an infant to respond to various sensory inputs, including milk viscosity, which is often prescribed as an intervention for infants who struggle with feeding. However, we have little insight about the neuromotor response to thickened milk. To address this, we raised three infant pigs on regular formula and three on thickened formula. At the end of infancy, we exposed each group to both regular formula and thickened formula while recording synchronous videofluoroscopic video and intraoral pressure generation. We found no significant differences in suck rate across groups and milk types. The viscous-raised pigs generated less suction and acquired less milk per suck when feeding on regular milk compared with control pigs. The suck volume of control pigs was lower when feeding on thickened milk than standard milk, but was similar to the suck volume for viscous-raised pigs when feeding on thickened milk. This was correlated with differences in tongue movement between groups and milk types. These results suggest that being raised on thickened milk reduces the ability to respond to variation in milk viscosity and feed effectively on regular milk, and inhibits the development of oromotor function.

Neurophysiological Alterations in Crayfish Using Common Inhibitory Drug

Grace Smith, Daniel Bergman

Gabapentin (GBP) is one of the most prescribed medications in the United States today. Its original use was for treating partial seizures; however, it gained popularity when it became approved for treating fibromyalgia and neuropathy. Many providers have grown to accept GBP more for its ability to treat various pain syndromes off label than for its FDA accepted uses. The drug is continuing to gain popularity with new off label uses suggesting therapeutic effects in mood disorders. Current research suggests 95% of gabapentin is prescribed off label. It is known that GBP gains its anticonvulsant properties from its ability to slow electrical conductions within the brain, however, its mechanisms for pain and mood stabilization remain unknown. Proposed is an experiment in two parts: a neurophysiological model and a behavioral model. The first will assess the contractibility of muscle fibers in the presence of gabapentin using electrophysiology to confirm neuronal inhibition. Second, an assessment of variations in aggressive interactions among crayfish. We hope to establish a model system that allows for the better understanding of GBP's mechanisms of action.

Diel thermoregulation in grasshoppers: where to be, when to feed

Julia Smith, Lauren Buckley, Monica Sheffer

Ectotherms' ability to acquire and process food and the rate at which they burn energy are highly temperature dependent. While ectotherms do not internally regulate their body temperatures, they can alter their body temperatures and subsequently performance and energetics via microhabitat selection and temporal partitioning of activities. Food processing (digestion) has a higher thermal optima than food acquisition (locomotion) for my focal grasshopper species, Melanoplus boulderensis and M. sanguinipes. I analyze field observations to test the hypothesis that grasshoppers' choices of activity and microhabitat throughout the day reflect the differing thermal optima of locomotion and digestion. I do not find a strong relationship between time of day and activity or microhabitat, but a next step is to examine how activity timing and microclimate selection vary with grasshopper body temperatures. The observations will be used to construct an energy budget and analyze shifts in estimated discretionary energy over the past 60 years. Understanding behavioral thermoregulation and how it mediates energy gain may be key to predicting the fitness effects of climate change on many ectotherms.

How does trabecular structure influence the mechanical properties of tiny mammalian vertebrae?

Stephanie Smith, Myleen Amendano, Saniya Patel, Kenneth Angielczyk, C.Tristan Stayton

The relative contributions of trabecular (spongy) and cortical (compact) bone to bone strength and stiffness, although investigated in humans, is mostly unclear. As a result, we do not understand how the skeleton of small animals, especially the axial skeleton, has evolved to deal with the particular challenges of life at tiny size. In mammals, some small species have notably reduced their vertebral trabecular bone structure, resulting in mostly hollow medullary cavities. To assess the importance of trabecular structure to the mechanical properties of small mammalian vertebrae, and incorporate the effects of both trabecular and cortical bone structure, we conducted finite element analysis on the lumbar vertebrae of 15 species of shrews (Mammalia: Soricidae). We analyzed two sets of models: vertebrae with the trabecular structure intact, and vertebrae with all trabeculae excised from the centrum. In all models, the cranial end of the centrum was immobilized, and a 5N load was applied to the caudal end of the centrum, parallel to the

craniocaudal axis. Results indicate higher peak stresses and larger displacements in models lacking trabeculae. Ongoing work will assess how bone morphofunctional characteristics change as body size increases, and to validate these analyses with empirical materials testing.

Paranasal spaces and nasal glands in bats: Too big to fit?

Tim Smith, Abigail Curtis, Thomas Eiting, Vaibhav Chhaya, Nicholas King, Sarah Downing, Veronica Rosenberger, Valerie DeLeon, Sharlene Santana

Bats are notable for their great variation in nasal anatomy, including paranasal cavities that vary from absent to large, cavernous spaces rivaling the central airway in size. In most mammals, these chambers house the lateral nasal glands (LNG) or olfactory turbinals. Here, we studied 78 bat species from 15 families using histology and iodine-enhanced CT to assess the relationship of the LNG to the paranasal spaces. We noted presence or absence of paranasal recesses and nasal respiratory glands, and made developmental inferences using several neonatal specimens. Some bats of the suborder Yangochiroptera, including all vespertiolionids, lack any paranasal recesses. In contrast, all bats of the suborder Yinpterochiroptera possess paranasal spaces, including a maxillary recess and its rostral continuation, a cul-de-sac called the anterolateral recess. Notably, the LNG is partly or completely outside the confines of the paranasal recesses in most bats of both suborders. It extends far caudally in pteropodids, a bat family that lacks the septal nasal gland. Our developmental samples suggest that bats have deficient growth or loss of parts of the nasal capsule. Notably, the lamina semicircularis is deficient rostrally, which may allow expansion of the LNG beyond paranasal spaces. Our findings indicate that bats may have fundamentally reorganized the nasal bauplan, and suggest paranasal spaces have lost function in some bats, and perhaps evolved novel functions in others.

STEM Educators as Civic Educators

Davida Smyth

Spurred by twin crises of COVID-19 and climate change, and an uncertain employment horizon, the goals for STEM education have shifted from developing a STEM capable workforce to broader and more durable undergraduate learning outcomes, such as evidence-based and informed civic engagement, life-long learning, and systems thinking. At the same time, our polarized and weakened democracy has generated new demands for greater attention to civic education. For over 20 years Science Education for New Civic Engagements and Responsibilities (SENCER) has supported curricular and institutional change to improve civic capacity and STEM learning through context and problem-based teaching. Designated a “”community of faculty transformation”” and a “”lever for change”” in literature on STEM reform, SENCER’s programs help faculty re-frame traditional course content by teaching disciplinary concepts through real-world, relevant, civic challenges. Gen Bio becomes “”Biomedical Issues of HIV-AIDS,”” or “”COVID-19”” Environmental Sci 100 becomes “”The Future of Natural Resources,”” Gen Chem becomes “”Assessing Exposure to Toxic Chemicals,”” Cellular and Molecular Biology becomes “”Cancer,”” Math 102 is “”Statistical Analysis of Community Challenges.”” Learning research confirms the effectiveness of SENCER’s problem-based, inquiry driven pedagogies, as well as the importance of social and community relevance to retention and persistence of traditionally underserved students. This talk will describe strategies employed by SENCER faculty to integrate civic issues into their courses than span the discplines and engage all students with the goal of not only increasing STEM content knowledge but also STEM engagement, understanding of STEM relevance and a love of lifelong STEM learning.

Phylogenetic Niche Models Offers Insights into Past Refugia and Niche Evolution in Plethodon spp.

Anthony Snead, Kristin Winchell

While adaptive radiations serve as model systems to quantify rates of diversification. Diversification driven by vicariance or allopatric speciation is considered to be the most frequent form of diversification. Salamanders within the Plethodon genus exhibit few morphological differences between taxa and are suggested to be a nonadaptive radiation, even though their ranges differ significantly. Hence, the woodland salamanders offer an interesting system to interrogate the rate of niche differentiation when speciation is assumed to be driven by largely neutral processes. By combining a time-calibrated phylogeny with publicly available occurrence and climatic data, we develop ecological niche models for 46 of the 54 recognized species in the genus and use the response curves as traits to understand how ecological niches changed over macroevolutionary timescales. Our results suggest that evolutionary change in response curves differ significantly depending on the environmental variable and taxon being compared. Furthermore, we find dramatic differences between groups in their ecological niche even though the radiation is suggested to be non-adaptive. Using our an-