from the heads of the males. Male beetles use these horns to battle over females and sap feeding territories on trees. These exaggerated structures likely evolved as weapons or as a signal to other beetles of the resource holding potential of an individual. To understand how these structures are used in resolving competition, we staged a series of interactions between males. Half of the beetles were calorie restricted to manipulate condition and trials were conducted with beetles both size matched, and with pairings made by random. Winners and losers were tracked for each fight and behavioral sequences were documented and analyzed. Most interactions did not end with physical fights between the beetles, instead there were contacts and what appeared to be assessment, then one of the beetles retreated and the other claimed the territory. However, in some cases, the horns were used to throw the other beetle from the territory. Both horn size and body size, but not male condition were found to be significant factors predicting fight outcome.

Competition has greatest effect on behavioral thermoregulation in high quality thermal environments

Julie Rej, Alex Gunderson, Eric Riddell

Temperatures are rising at an alarming rate, forcing species to behaviorally thermoregulate by seeking cooler microclimates. Two factors that dictate the costs and benefits of behavioral thermoregulation are the spatial structure of available microclimates and the presence of competitors. The effects of these factors on thermoregulation have been explored extensively in isolation, but we know little about how they interact. To address this gap in our knowledge, we used an individual—based model to determine how competition for space hinders thermoregulation, and if the effects of competition depend on the spatial arrangement of the thermal environment. We found that an even distribution of shade had the greatest impact on thermoregulatory ability when a competitor was present. An even distribution of shade increases the quality of a thermal environment which leads to an improved thermoregulation ability, but our results show that the presence of a competitor can negate these effects. Additionally, there is an increased energetic cost to maintaining preferred temperatures in the presence of a competitor. Our results demonstrate the importance of considering species interactions in evaluating thermoregulatory potential and costs in current and future environments.

Growth plate specific genes found using the unusual ossification of the metatarsal and pisiform

Philip Reno, Sungdae Park, Kelsey Kjosness, Sherrie Wallace, Sarah Doelp, Maria Biancaniello, Douglas Menke

We utilize the substantial variation in the location of growth plates within the mammalian skeleton to identify genes specific to growth plate patterning. Third metatarsals (MT3) form only a single growth plate located at the distal end, and the pisiform (in non-human mammals) forms an active growth plate unlike the other carpals. Comparison between the growth plates of mouse distal MT3 and pisiform to generalized endochondral ossification in proximal MT3 and other carpals controls for the effects of age, systemic growth factors, and biomechanical environment. We identify numerous differentially expressed genes (DEGs) using RNA-seq in 4- and 9-day old mice. DEGs from the MT3 are disproportionately represented in gene ontology (GO) categories including limb development and growth and factors associated with the Fzd8-Ror2-Wnt5a pathway. The Pisiform-Carpal comparison includes GO terms associated with skeletal and cartilage development and abnormalities of the carpal bones. A limited set of DEGs shared by both the MT3 and Pisiform-Carpal datasets includes Wnt5a. Wnt5a is expressed in the perichondrium in both ends of the MT3 and the pisiform, but expression at the columnar/hypertrophic cell boundary is stronger in the distal MT3 and pisiform growth plates. The related Wnt10a gene is solely expressed in the bone collar of the distal MT3 and pisiform. This confirms previously identified roles for Wnts in regulating osteogenesis and cell polarity within the growth plate.

Thermoregulatory and Immune Responses to Ebola-like Particles in Thirteen-Lined Ground Squirrels

Matthew Repke, Lisa Powers, Luis Víquez-R, Briston Bayle, Sara Talmage, Isabel Steinberg, DeeAnn Reeder, Ken Field

Hibernation induces a significant physiological change through decreased metabolism, respiration, heart rate, and immune responses. In this study, we sought to understand how antiviral immune responses were affected by hibernation, using the thirteen-lined ground squirrel (Ictidomys tridecemlineatus) as a model organism. Ebola virus-like particles (eVLPs, which present Ebola antigens but are not infectious)