The Society for Integrative and Comparative Biology

with the

Animal Behavior Society

American Microscopical Society

The Crustacean Society

Registration Brochure

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P1.266 WEGER, M*; KLEIN, A; WAGNER, H; RWTH Aachen, University of Bonn; *weger@bio2.rwth-aachen.de*

Particle Image Velocimetry measurements on model of barn owl serrations in laminar and unsteady flow

Owls are an order of birds where many species have developed a silent flight. The silent flight is achieved by several wing and feather adaptations, including serrations at the leading edge of the primary feathers which are exposed to the incoming airflow. Serrations are supposed to interact with the airflow and reduce flow separation. Many studies on serrations have been done with artificial serrated leading edges, yet these leading edges do not represent the three-dimensional shape of natural serrations. In this study we constructed a three dimensional model of an array of serrations on a barn owl (*Tyto furcata pratincola*) feather. Enlarged acrylic plastic models were fabricated from this template by 3D-printing and investigated in a water flow channel at Reynolds numbers equivalent to an owl flight velocity of 7.5 m/s. We investigated the model in laminar flow as well as in a vortex street that was created by a half-cylinder placed in front of the model by using Particle Image Velocimetry (PIV) to describe the effects of the serrations on the flow. Our results support previous studies on serrated leading edges that the serrations of owls help stabilizing the incoming flow by creating small-scale turbulences behind the leading edge that dissipate downstream. Unsteady flow is attenuated after impinging the serrations which is demonstrated by a lower RMS-value of the flow velocity parallel and normal to the bulk flow direction downstream of the serrations. We did not find such effects in free stream flow conditions or at a leading edge model with missing serrations that was used for comparison. We conclude that the serrations that can be found in owls help stabilize the incoming air flow in steady and unsteady flow conditions, which can provide flow control, especially during critical flight maneuvers like changing angles of attack and sweep angles of a moving wing.

59.2 WEHRLE, BA*; TADIC, Z; KRAJNOVIC, M; CHERNOFF, K; HERREL, A; GERMAN, DP; WEHRLE, Beck; Univ. of California, Irvine, Univ. of Zagreb, NOAA, C.N.R.S/M.N.H.N; *bwehrle@uci.edu*

Comparative nutrient digestibility between insectivorous and rapid-evolving herbivorous Italian Wall Lizards

A population of Italian Wall Lizards (*Podarcis sicula*) in Croatia has become primarily herbivorous and morphologically distinct from its source population in ~30 generations, making it a compelling example of rapid evolution. However, we know little about what these lizards are capable of digesting from plant material, and whether their physiology is optimized for a plant diet. During lab feeding trials, lizards from the newly herbivorous population digested the organic matter of plant diets more efficiently than did the naturally insectivorous lizards from the source population. However, the two populations did not show differences in digestive efficiency of an insect diet. What mechanism explains the newly herbivorous population's increased digestive performance of plants compared to their source population counterparts? By investigating what nutrients each population is assimilating from their diets, we can better understand the interplay of gut function and digestive performance. We measured both lizard populations' digestive efficiency of protein, carbohydrates, and lipids. If nutrient digestibility is matched to gut function, we should be able to predict what nutrients are assimilated based on digestive enzyme activities in wild lizards. We expect the newly herbivorous population digests carbohydrates more efficiently, as their free living counterparts have higher activities of carbohydrases in some gut regions. We also expect the newly herbivorous population is slightly more efficient at protein digestion, as trypsin activity is higher in their hindguts. Analyses of macronutrient digestion are underway. As this is a study of lizards that have diverged recently, our results may shed light on what functional and performance steps can initially lead to herbivory in lizards.

11.7 WEINBERG, R.B.*; CLANCY, D.; COHEN, C.S.; San Francisco State University; *rachel.b.weinberg@gmail.com*

Genetic Changes Following Fusion in the Invasive Colonial Tunicate Didemnum vexillum

This project examines the fusion outcomes in the invasive colonial tunicate *Didemnum vexillum* to determine how genotypes may be shared between fusion partners in a chimeric colony. *D. vexillum* has extensively colonized hard substrate habitats and poses an ecological threat to native fouling communities in numerous locations including New Zealand, Europe, and both coasts of North America. Like many other colonial tunicate species, histocompatible *D. vexillum* colonies may undergo fusion following physical contact of the tunic. The outcome of allogenic fusion and the level of integration that occurs between zooids and tissues of different genotypes in *D. vexillum* is currently unknown. While the zooids of stolidobranch tunicate species such as *Botryllus schlosseri* are connected through a shared blood vascular system which enables free movement of cells throughout fused colonies, zooids in aplousobranch tunicates such as *D. vexillum* are connected only through the extrazooidal tunic. However, moderate levels of discrimination in the fusion interactions of *D. vexillum* colonies may indicate that there is some integration of cells beyond the fusion line in a chimeric colony. We tracked the movement of microsatellite alleles between fused *D. vexillum* colonies to determine the extent of genetic integration resulting from fusion. Alleles from one colony were found to be present in both colonies two weeks after fusion had occurred, and some fused colonies were found to have lost alleles that were present prior to fusion in one colony. In some instances, allelic movement was unidirectional while in other alleles were found to be exchanged reciprocally between colonies. These results indicate that cells are exchanged following allogenic fusion between *D. vexillum* colonies and that genotypes may be fluid in chimeric colonies.

S11.6 WEIR, P.T.*; DICKINSON, M.H.; Caltech; *peter.weir@gmail.com*

Functional imaging reveals a peripheral map of skylight polarization in Drosophila

The linear polarization of natural sky light is inherently and locally directional, making it useful as a compass cue to a wide variety of insects for directing locomotion. Photoreceptors in the dorsal rim area (DRA) of the compound eye are specialized for detecting the angle of linearly polarized light. In the fruit fly, *Drosophila melanogaster*, central photoreceptors in the DRA are arranged in stacked pairs with identical fields of view and color sensitivities. In larger species of flies the photoreceptors in the DRA form an orderly array of paired polarization detectors, with preferred e-vector angles progressing systematically along the length of the array. We found that this anatomical organization is conserved in *Drosophila*. Using genetically encoded calcium indicators, we directly observed photoreceptor responses to changes in polarization, and found that the pairs of central photoreceptors exhibited orthogonal polarization preferences that varied systematically across the length of the DRA. These functional responses confirm the anatomical findings and provide a map of polarization sensitivity at the input layer of the polarization vision system. In addition, we found that some photoreceptors are inhibited by flashes of light polarized orthogonally to their preferred polarization angle, indicating reciprocal inhibition between photoreceptors in the same column. This inhibition may serve to heighten the polarization contrast of the photoreceptor output. Together, these results indicate that the polarization-vision system relies on a spatial map of preferred polarization angles at the earliest stage of sensory processing. Downstream neurons must decode the spatial structure into angular information for orientation.

Society for Integrative and Comparative Biology

2017 Annual Meeting

Meeting Abstract

59-2 Friday, Jan. 6 13:45 - 14:00 **Comparative nutrient digestibility between insectivorous and rapid-evolving herbivorous Italian Wall Lizards** *WEHRLE, BA*; TADIC, Z; KRAJNOVIC, M; CHERNOFF, K; HERREL, A; GERMAN, DP; WEHRLE, Beck; Univ. of California, Irvine; Univ. of Zagreb; Univ. of Zagreb; NOAA; C.N.R.S/M.N.H.N; Univ. of California, Irvine* bwehrle@uci.edu http://www.beckwehrle.weebly.com

A population of Italian Wall Lizards (*Podarcis sicula*) in Croatia has become primarily herbivorous and morphologically distinct from its source population in ~30 generations, making it a compelling example of rapid evolution. However, we know little about what these lizards are capable of digesting from plant material, and whether their physiology is optimized for a plant diet. During lab feeding trials, lizards from the newly herbivorous population digested the organic matter of plant diets more efficiently than did the naturally insectivorous lizards from the source population. However, the two populations did not show differences in digestive efficiency of an insect diet. What mechanism explains the newly herbivorous population's increased digestive performance of plants compared to their source population counterparts? By investigating what nutrients each population is assimilating from their diets, we can better understand the interplay of gut function and digestive performance. We measured both lizard populations' digestive efficiency of protein, carbohydrates, and lipids. If nutrient digestibility is matched to gut function, we should be able to predict what nutrients are assimilated based on digestive enzyme activities in wild lizards. We expect the newly herbivorous population digests carbohydrates more efficiently, as their free living counterparts have higher activities of carbohydrases in some gut regions. We also expect the newly herbivorous population is slightly more efficient at protein digestion, as trypsin activity is higher in their hindguts. Analyses of macronutrient digestion are underway. As this is a study of lizards that have diverged recently, our results may shed light on what functional and performance steps can initially lead to herbivory in lizards.