S7-2.1

HEYLAND, A., MOROZ, L.L.; aheyland@ufl.edu. The Whitney Laboratory for Marine Bioscience, Saint Augustine, University of Florida

SEARCH FOR NEURONAL TRANSCRIPTS INVOLVED IN THE METAMORPHIC TRANSITION OF THE SEA HARE APLYSIA CALIFORNICA

Metamorphosis among many marine invertebrate species involves a radical transition from a larval to a juvenile/adult body plan that can occur in a remarkably short period of time. Metamorphic competence directly precedes this radical change in morphology and can best be described as the developmental potential of a larva to undergo the radical transition in response to environmental signals. Such signals (i.e. settlement cues, substrate architecture, temperature, food etc.) are modulated via neuronal gene networks. A metamorphic pattern with competence and a fast radical transformation evolved many times independently in animals and we hypothesize that similar signaling modules have been co-opted for the regulation of a) the development to competence and b) the interpretation and modulation of environmental signals. However the actual signaling architecture underlying these processes is largely unknown for the majority of marine invertebrate species. We used representative oligo-arrays constructed from transcripts obtained from the *Aplysia californica* (sea hare, Mollusca) central nervous system to explore the following two questions: 1) What neuron specific genes are expressed during development to metamorphic competence? 2) What neuron specific genes are expressed immediately after settlement, i.e. upon exposure to specific environmental signals. We validated our expression analysis of specific neuropeptides, nuclear hormone receptors and chemoreceptor molecules using in situ hybridizations. Support Contributed By: NIH, NSF, & McKnight BR Foundation.

45.5

HIERONYMUS, T.L., WITMER, L.M.; th108702@ohiou.edu. Ohio University, Athens

FROM ARMOR TO ANCHOR: CHARACTER EVOLUTION OF THE SKIN AND HORNS OF RHINOS

Previous reconstructions of extinct rhinocerotid taxa have invoked three separate patterns of nasal horns, but without specifying an explicit and mechanistic relationship between unpreserved soft tissues and available osteological correlates. New data on the anatomy and histology of rhinoceros horn attachment allows a reevaluation of previous reconstructions and an assessment of character evolution in the dermis and epidermis that make up these unique horns. Numerous osteological specimens of extant rhinoceros and taxa with similar dermal histology were examined to test a mechanistic hypothesis of osteological correlate formation in relation to an epidermal horn. Sixteen extinct rhinocerotoid taxa were then examined for osteological correlates indicative of derived dermal architecture and keratinous horns. The resulting character scores were optimized onto a composite phylogeny of Rhinocerotoidea. Based on the co-occurrence of these osteological correlates with other morphological features commonly associated with agonistic behaviors, a phylogenetically independent pairwise comparison was conducted to determine the extent of character correlation among a diverse array of extant mammalian taxa. This study found a consistent osteological correlate of horn attachment related to mechanical epigenetic control of bone growth. This correlate is separate from the correlate of derived dermal architecture that occurs elsewhere on the skull. The latter first appears at the base of Rhinocerotidae in the Middle Eocene, while true horns do not appear until the Late Oligocene Early Miocene, and only within the crown group Rhinocerotini. Character correlations between the relevant soft tissues and other features in many extant mammalian taxa provide a basis for reconstructions of behavior and ecology in extinct rhinocerotids.

44.6

HIGHAM, T.E., DAY, S.W., WAINWRIGHT, P.C.; tehigham@ucdavis.edu. University of California, Davis, Rochester Institute of Technology

CAN PEAK BUCCAL CAVITY PRESSURE BE USED TO PREDICT PEAK FLUID SPEED DURING SUCTION FEEDING IN FISHES?

Suction-feeding fish capture prey by rapidly expanding their buccal cavity, which generates a flow of water directed towards their mouth. A sub-ambient pressure inside the buccal cavity is associated with this expansion, and the magnitude of this pressure differs considerably among species of fish and within an individual. Although peak sub-ambient pressure is thought to be proportional to fluid speed squared by Bernoullis principle, no study has measured both pressure and fluid speed simultaneously. Thus, we quantified buccal pressure and fluid speed simultaneously during feeding in four individuals of largemouth bass, Micropterus salmoides. We measured pressure by inserting a transducer through the skull of the fish so that the tip of the transducer was flush with the dorsal surface of the buccal cavity. We measured fluid speed using digital particle image velocimetry (*DPIV*). A laser sheet was positioned on the mid-sagittal plane of the fish so that the fluid speed could be measured along a transect extending from the center of the fishs mouth. We found that peak pressure was significantly correlated with the peak fluid speed (r^2=0.61; P<0.01) of the same feeding. However, the magnitudes of the pressures were much greater (up to 5 times) than those estimated from the measured fluid speeds. We found that peak pressure preceded peak gape and peak fluid speed by an average of 14 ms and 18 ms, respectively. Thus, although correlated, pressure is sub-maximal at the time of peak fluid speed. In conclusion, a substantial amount of variation in peak fluid speed cannot be explained by peak pressure, suggesting that a mechanism other than pressure is being modulated by the fish in order to alter fluid speed. Supported by NSF IOB-0444554.

52.1

HILL, R.I.; rihill@berkeley.edu. University of California, Berkeley

MORPHOLOGY AND LOCOMOTOR MIMICRY IN ITHOMIINE BUTTERFLIES (NYMPHALIDAE)

Neotropical ithomiine butterflies (Nymphalidae) exhibit rampant convergent evolution of color patterns. It is not uncommon in lowland rainforest to find up to nine color patterns at a site, with several species from 2-5 genera exhibiting each pattern. This color pattern convergence is an excellent example of Müllerian mimicry involving mutually distasteful species. Unpalatable butterflies in general have associated kinematic and morphological traits such as slow flight, low wing beat frequency and rearward displaced center of body mass. Mimicry among unpalatable butterflies is known to extend to flight morphology and kinematics in *Heliconius* butterflies, but the generality of this locomotor mimicry has not been tested. Morphological measurements of 38 species of ithomiine butterflies from an assemblage in eastern Ecuador containing eight mimetic color patterns, or mimicry rings, are used to examine whether locomotor mimicry exists in the ithomiines. Do species that share color pattern also share flight morphology? Principal components and discriminant function analyses are used to assess which morphological traits best discriminate among mimicry rings. Comparative analyses using a molecular phylogeny are also used to examine scaling relationships and morphological trait evolution.