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Sparring Stomatopods: Do Colored Patches Signal Fighting Ability?

Many animal characteristics have evolved to facilitate intraspecific communication. Deciphering what information these signals convey to a receiver is essential if we are to understand these signaling systems. Stomatopods are marine crustaceans that live in burrows, and are recognized by two punching arms capable of inflicting damaging blows. On each punching arm is a colored patch called the meral spot. During contests over ownership of burrows, stomatopods can use the meral spots to assist with opponent assessment. In *Neogonodactylus oerstedii* stomatopods, both the luminance and UV reflectance of the meral spots are used in contests; however, we do not know what information these spots convey to the receiver. Previous research has demonstrated that in *N. oerstedii* stomatopods, darker meral spots are correlated with larger meri (the segment of the punching arm where the meral spot is located). Furthermore, merus size is associated with strike force in other stomatopod species. We hypothesized that the meral spot transmits information about fighting ability, or Resource Holding Potential (RHP), to an opponent. To investigate this, we recorded strike force, and spectra of the meral spot for *N. oerstedii* individuals in the lab. We discuss whether these variables correlate, and the implication for stomatopod signaling systems and contests. This research addresses a key question in animal communication research - what are animals 'saying' to one another?

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Multiple Bacterial Cues Induce Larval Invertebrate Settlement

Larvae of the serpulid polychaete *Hydroides elegans* can be induced to metamorphose by monospecific biofilms of a number of bacterial species. Detailed investigations into the nature of the settlement cue produced by the bacterium *Pseudoalteromonas luteoviolacea* have established bacteriocin aggregates (or MACs) as the metamorphic cue by this bacterium. In our study, three additional inductive bacterial species, *Cellulophaga lytica*, *Bacillus aquimarus* and *Staphylococcus warneri*, were investigated to determine if they produce similar products. Genomic comparisons of these bacteria revealed that their metamorphic activities are not due to the presence of the same genetic machinery as *P. luteoviolacea*. Active biofilm cell densities differed between the strains and metamorphic activity was found in the 0.22 μm filtrate in direct contrast to MACs of *P. luteoviolacea*. In *C. lytica*, negatively stained TEM images confirmed the lack of MAC structures and instead revealed the presence of vesicles. Further TEM imaging confirmed that these vesicles budded from the surface of *C. lytica* in a manner consistent with outer membrane vesicles. Equivalent TEM analyses of *S. warneri*, however, did not reveal the presence of either MACs or vesicles. It is likely that the ability of *H. elegans* to respond to multiple bacterial biofilm products greatly increases its larva's ability to find and settle on appropriate surfaces with differing bacterial communities.

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Patterns of Body Size and Shape Diversification in Marine Angelfishes (Pomacanthidae)

The Pomacanthidae is an iconic reef fish family of about 88 species. They occupy a diverse range of trophic niches (e.g. spongivory, algivory, zooplanktivory) and show habitat partitioning (e.g. cryptic, pelagic species). The pomacanthids reach disparate body form, with large body sized species (e.g. 30-45 cm of Total Length - *Pomacanthus* spp) and a paraphyletic group of 34 pygmy angelfishes (e.g. 7-12 cm TL - *Centropyge* spp). To the best of our knowledge, the hypothesis that size variation in Pomacanthidae is adaptive and the potential correlation between size and overall body shape optima has never been tested in a quantitative evolutionary framework. Here, we tested these hypotheses using a novel time-calibrated phylogeny, eco-morphological data and phylogenetic comparative methods. The method SURFACE allowed the detection of three adaptive peaks in the body size space, one of them referring directly to the pygmy angelfishes ($_{pygmy}$ = 11 cm TL). Firstly, we found no evidence of evolutionary allometry across angelfishes (PGLS analysis; P-value = 0.12). Secondly, in order to detect the major driving force of overall body shape in angelfishes, we compared the fit of Brownian motion (BM) and Ornstein-Uhlenbeck (OU) models that allow for different optimal shapes according to size, diet and habitat partitioning. Counter to our simple prediction of size and ecological determinants of body shape, a single-optimum OU model produced the best fit. Overall, our results show that the drivers of size diversity may differ from the ones of body shape.

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Hagfish Houdinis: Biomechanics and Behavior of Squeezing Through Small Openings

Hagfishes are able to squeeze through small openings to gain entry to crevices, burrows, hagfish traps, and carcasses, but little is known about how they do this, or what the limits of this ability are. In order to describe this ability, and to investigate possible mechanisms by which it is accomplished, we analyzed videos of Atlantic hagfish (Myxine glutinosa) and Pacific hagfish (Eptatretus stoutii) moving through narrow apertures in the lab. We investigated the hypothesis that the passive movement of blood within a hagfish's flaccid subcutaneous sinus allows it to squeeze through narrower apertures than it would be able to if it were turgid. To test this hypothesis, we measured changes in body width as the animals moved through narrow openings, and documented the behaviors associated with this ability. We found that hagfishes are able to pass through narrow slits that are less than one third the width of their bodies. Our results are consistent with the idea that a flaccid subcutaneous sinus allows hagfish to squeeze through narrow apertures by facilitating a rapid redistribution of venous blood. In addition, we describe nine distinct behaviors associated with this ability, including a form of non-undulatory locomotion also seen in snakes and lampreys. These results have relevance for the hagfish trap fishery and they illuminate a behavior that may be a critical component of the hagfish niche, due to its likely importance in feeding and evading predators.