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Arginine vasotocin alters male-male interactions in *Xenopus laevis*

The African clawed frog, *Xenopus laevis*, has a rich vocal repertoire that it uses for social and reproductive signalling. Male frogs produce at least five different types of calls, two in the presence of males or females, and three that are exclusively heard in the presence of other males. However, little is known about male-male social interactions. Arginine vasotocin (AVT) is a neuropeptide which has been shown to alter both calling and physical behaviors in many anurans, often promoting reproductive behaviors and reducing aggression. For this study, male frogs were injected with AVT, and video and audio were recorded. Changes in calling behavior in response to AVT were examined in different social contexts. Physical interactions between males were also analyzed, including clasping behaviors. AVT did not alter calling behavior in isolated males or those paired with females. However, when paired males were treated with AVT calling increased significantly. Of the five call types, all but one significantly increased. Examination of physical behaviors is ongoing and will be presented. In this species, AVT seems to influence male-male social interactions rather than male-female reproductive behaviors, and unlike other anuran species, AVT may be promoting competitive or aggressive behaviors.

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Testosterone, plumage coloration and extra-pair paternity in North American barn swallows

In most monogamous bird species in which males care for young, circulating testosterone concentration in males peaks during territory establishment and around the social female's fertile period. The variation in the height of peak testosterone concentration between males may have a considerable impact on individual fitness. For example, exogenous testosterone has been shown to enhance behaviors important for social and extra-pair mate choice. However, little is known about the relationship between natural male testosterone concentrations, sexual signals, and individual reproductive success. To investigate these relationships we measured sexual signals and male testosterone concentration, and determined within and extra-pair fertilization success in North American barn swallows (*Hirundo rustica erythrogaster*). Dark rusty colored males had higher testosterone concentrations than drab males. Extra-pair paternity was common (42% of young), but neither within- nor extra-pair fertilization success was related to male testosterone concentration. Within-pair fertilization success was positively related to male ventral plumage color, with dark rusty colored males being less often cuckolded than drab males. Dark males did not, however, have higher extra-pair fertilization success than drab males. Our study is the first to relate natural male testosterone concentration to within and extra-pair fertilization success. Our findings suggest that in North American barn swallows, male testosterone concentration does not play a significant direct role in female mate choice and sexual selection. We provide a potential explanation for the relationships among male testosterone concentration, ventral plumage coloration, and within- and extra-pair fertilization success.

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Role of the Frenula in Cubomedusan Directional Swimming

Box Jellyfish (Class: Cubozoa) are strong, active swimmers capable of evading hazardous obstacles and orienting to photic stimuli. However, the underlying neuromuscular physiology responsible for complex swimming behaviors requires further investigation. Currently, turning is accompanied by asymmetrical deformations of the velarium, a striated muscle sheet encircling the bell opening. Radial, buttress-like muscles, termed frenula, are presently thought to serve only a stabilizing structural role during swimming. We hypothesize they may serve a greater function in cubomedusan turning behavior than previously thought. Investigations using confocal-light and electron microscopy as well as dissected and whole-animal swimming experiments were used to assess the control of turning in cubomedusae. During a turning event, frenular contractions in the radial axis result in shortening of the bell height as the velarium is retracted upward towards the bell apex. This retraction enables directional fluid ejection from the bell opening and hence culminates in a turn by the swimming medusa. Free-swimming cubomedusae lost functional turning ability after "disconnecting" neurons of the frenula from the rest of the motor nerve net. The frenulum is the most densely-innervated swim muscle in representative medusae from two cubozoan families (Carybdeidae; Tripedaliidae), followed by the velarium and subumbrella. The frenular nerve net has a distinct radial orientation in parallel with muscle cell orientation, whereas neurons in the other two regions of circularly-oriented swim muscle are distributed more randomly in non-directional networks. Our data suggest the frenula are important components in producing asymmetric velarial contractions to produce turning in cubomedusae.

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Ectoparasites, immune function, and development in European starlings

We carried out an experimental study of the effects of nestling ectoparasite load on growth, immunity, circulating corticosterone levels, begging and parental provisioning in European starlings. We tested adaptive immunity by randomly priming half of the nestlings in the study with PHA or saline on day 5 followed by a wing web injection of PHA on day 16. We measured the elicited primary or secondary swelling response on day 17 to assess cutaneous immunity and immune memory formation characteristic of such adaptive immunity. We tested innate immunity by performing bactericidal assays on days 5, 10 and 15 of development. Parental provisioning and nestling begging were digitally recorded on days 11 and 14. Despite treatment to reduce ectoparasites in experimental nests, control and treated nests did not differ in nestling ectoparasite burdens. We found no significant variation between day 17 primary and secondary swelling responses to PHA yet found significant increases in bacterial killing capacity with nestling age as well as significant within- and between-nest variation at all three ages. In order to explain variation both within and between nests, we analyzed the relationship between bactericidal ability and nestling mass, blood glucose, hematocrit, and parental provisioning. None of these variables showed significant correlation with bactericidal activity. Continuing analyses will measure fecal and plasma corticosteroids, nestling begging behavior and ectoparasite loads in effort to further explain the observed variation.