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***Pheromone exposure influences preoptic arginine vasotocin gene expression and inhibits social approach behavior in response to rivals, but not potential mates***

The nonapeptide arginine vasotocin (AVT) mediates a variety of social behaviors in non-mammalian vertebrates. In fish, AVT stimulates the aggressive and courtship responses typical of dominant males in several species, although it can also inhibit social interactions in some cases. Such differential effects may depend upon AVT influences within brain circuits that differ among species or between males that adopt alternative reproductive phenotypes and/or upon the differential activation of those circuits in different social contexts. However, to date, very little is known about how social stimuli that provoke alternative behavioral responses influence AVT circuits within the brain. To address this issue, we exposed adult male goldfish to androstenedione (AD), a pheromonal signal that is released by both males and females in the context of reproduction, and measured social approach responses of males towards same- and other-sex individuals before and after AD exposure. In a second experiment, we also measured AD-induced AVT gene expression using *in situ* hybridization. We found that brief exposure to AD induces social withdrawal in response to rival males, but does not affect the level of sociality exhibited in response to sexually receptive females. Exposure to AD also increases AVT gene expression in the preoptic area of male goldfish, particularly in the parvocellular population of the preoptic nucleus. Together, these data suggest that AD is part of a social signaling system that induces social withdrawal specifically during male-male interactions by activating the parvocellular AVT circuit.

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***Programmed cell death by reactive oxygen species in tail of tadpoles, *Xenopus laevis****

During metamorphosis, anuran tadpoles undergo morphological, biochemical and physiological changes in order to adapt to a different habitat. The process involves reorganization of the body plan and regression of the tail which are controlled by several pathways of apoptosis including autophagy. Autophagy induces cell death in regressing tail in response to reactive oxygen species (ROS). Several antioxidant systems regulate the presence of oxidant species such as superoxide dismutase (SOD), glutathione, ascorbic acid, catalase etc. Nitric oxide synthase(s) (NOS) leads to production of nitric oxide (NO), a free radical, important in cellular signaling. We performed a cellular, biochemical and molecular analysis of SOD, catalase, NOS, *in situ* staining for NO and mitochondria in the tail of tadpoles *Xenopus laevis*. NO also has profound effect on the mitochondrial function as mitochondria possess their own NOS enzyme. Spatiotemporal distribution of SOD and catalase showed significant co-localization (overlap coefficient of 95%) during earlier stages of metamorphosis. However, during climax (just before the tail regression begins), there was a significant decrease in activity of these enzymes as well as reduction in overlap coefficient (49%) which suggests an elevated ROS accumulation. Expression for nNOS and iNOS was found to be stage specific and both enzymes co-localized in epidermis and muscle tissue of tail, their expression being controlled by thyroxine as evidenced by RT-PCR studies. Additionally, NO and mitochondrial staining also shows co-localization suggesting that NO is derived from mitochondria. These findings are discussed in terms of putative functional importance of ROS and mitochondria derived NO in programmed cell death in tail tissue.

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***Design of a phased array acoustic tracking system for flight biomechanics tracking studies***

We are developing a phased array acoustic tracking system intended for use in several types of biological study: 1) biomechanical studies of flying animals in which the trajectory and data about wingbeat frequency and movement is needed; 2) ecological studies of acoustic communication or behavioural ecology; 3) surveys to count and locate species based on audible calls. Other uses are also possible. A phased array uses the phase or time difference of arrival of sound at multiple microphones to estimate position of a sound source, such as a wingbeat, chirp, whistle or other acoustic signal. The prototype system consists of multiple microphone and amplifier boards connected via an analog-to-digital converter to a computer that performs the phased array signal processing. The end goal is a low cost system, portable and field-deployable by a single researcher, and an open source, modular design able to be modified or scaled up or down or combined according to the needs of individual researchers and the constraints of particular projects. The current design, remaining design challenges, and preliminary performance in tracking of flying animals will be discussed.

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***Functional consequences of carapace shape diversity in boxfishes***

The carapace is a hard structure, similar to that of a turtle, which encases boxfishes and comes in a variety of shapes. Boxfish are composed of two families: the aracanids, which primarily consist of disk and tube-like shapes, and the ostraciids, which consist of prism, box, and bell-like shapes. This diversity in shape might be explained by its multiple functions, i.e. its hydrodynamic abilities and its ability to distribute stress. The carapace's many keels are implicated in creating stabilizing forces via vortices shed posteriorly. We suggest that the boxfish carapace may have initially served as a defensive structure, but recently its function was altered for hydrodynamic stability and/or maneuverability, reflected in the aracanid-ostraciid split. We hypothesized that these two functions trade-off, i.e. stabilizing well means being less able to distribute stress and vice versa. We actually found that the association between the two functions and their morphologies is more complex. We found strong correlation between lift, lift/drag and morphology, suggesting maneuverability rather than stability explains some of the variation. While we did find a trade-off in function between two major carapace shapes, we also found that some shapes minimize performance in multiple orientations, but not as strongly as in extreme cases.