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Population differences in reproductive biology of free-living Cassin's Sparrows, *Aimophila cassinii*.

Seasonally breeding birds use various proximate cues to regulate their reproductive cycle. In relatively stable seasonal environments, the primary cue used often is day length. In less predictable environments such as Southwest USA deserts, supplementary factors associated with weather (e.g., monsoon precipitation) may also play an important role. Little is known regarding the specific role and mechanisms by which effects of these factors are integrated to regulate the activity of the reproductive system. To begin addressing this question, we compared seasonal changes in reproductive morphology (testis size and cloacal protuberance: CP) and molt in Cassin's Sparrows, *Aimophila cassinii*, belonging to two geographically separate populations (Arizona and Colorado) that employ temporally different breeding strategies: Colorado birds breed in spring whereas Arizona birds initiate breeding in response to summer monsoon-associated environmental changes. These populations were found to exhibit quantitatively similar time courses of seasonal changes in testis and CP sizes as well as prebasic (post-breeding) molt, but exhibited a temporal shift in breeding activity so dramatic that Colorado birds were in the first stages of prebasic molt when Arizona birds were just becoming reproductively active. We are currently conducting additional experiments aimed at determining the neuroendocrine basis of these intraspecific population shifts in seasonal reproductive timing.

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Bone mineralization in European eel (*Anguilla anguilla*) during maturation from the yellow eel stage to the silver eel stage

The lifecycle of European eel (*Anguilla anguilla*) has long been a mystery, until Schmidt came along. He suggested that the Sargasso Sea was the spawning location for *Anguilla* species (Van Ginneken et al, 2005). With his research the central mystery of the life cycle was elucidated, but there still remains a lack of knowledge on many aspects of the life cycle of the European eel, *Anguilla anguilla*. One of those aspects is a good knowledge on the phenotypic transformations that are linked to this shift from the yellow eel stage to the migrating silver eel stage. Drastic changes are known to occur, but a quantitative and qualitative characterization is still lacking. Additionally, it has already been shown that broad- and narrow headed phenotypes exist during the yellow eel stage. The different head shapes have been related to different diets, where broad-headed eels would feed on bigger and harder preys (Proman & Reynolds, 2000). Although some research has been focusing on this dimorphism, still very little is known about this dimorphism. For example, does this dimorphism still persist during the silvering phase, when extensive cranial transformations are known to occur (demineralization of bone, loss of teeth, increase of eye size, etc)? To test the hypothesis of differential remodeling of bone tissue during this maturation in broad- and narrow-headed eels, we calculated a "collagen stretching index" based on histological sections that were stained with Masson's trichrome. This index was evaluated as a potential indicator of bone mineralization to test both for changes during maturation as for differences between phenotypes.

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Do the exaggerated eye stalks of stalk-eyed flies have a predation cost?

When opponents compete for access to an indivisible resource, signals can reduce costs associated with competition for that resource. Theory predicts that for signals to remain reliable in such situations there should be costs associated with the signal. These costs may be imposed when the signal is being developed, while it is being displayed to a receiver, or simply by bearing it when not using it. Stalk-eyed flies (*Teleopsis dalmanni*) have their eyes on the ends of large peduncles, with males having significantly greater eyespans than females. Males use the span of their eye stalks to reliably assess body size and fighting ability during agonistic interactions. To test whether there is a predation cost to the exaggerated eye stalks of stalk-eyed flies we conducted predation trials with flies and a generalist predator, a jumping spider (*Phidippus audax*). We determined whether male stalk-eyed flies suffered higher predation than females. We also examined, within each sex, whether individuals with greater eyespans suffered higher predation than those with smaller eyespans. We conducted experiments in a small enclosure with a single fly facing a predator, as well as in larger mesocosms that contained 20 flies and a predator. We found no support for the hypothesis that there is a predation cost to exaggerated eye stalks. Males did not have lower survival than females, and individuals with larger eyespans did not have lower survival in either sex. No other morphological variable differed between survivors and non-survivors within a sex. In the single-fly trials, anti-predator behavior was the best predictor of survival. Thus, we found no evidence for selection against greater eyespans in stalk-eyed flies. Our results suggest that the exaggerated eye stalks of stalk-eyed flies are a condition-dependent signal of individual quality or that other costs maintain reliability of the signal.

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The Use of Mock NSF-type Grant Proposals as the Capstone Assignment in Upper-Level Biology Courses.

For over a decade, I have been using mock NSF-type grant proposals as the capstone assignment in my 300-level cell biology and neurobiology courses. For the students, the process is broken down into discrete steps of: finding a topic of interest; doing the background reading; and writing a short review of the literature read. This is followed by asking and writing about the appropriate next questions based on their understanding of the reading, followed by the design of appropriate experiments to test those questions. These mock grant proposals are then peer-reviewed, and the comments are then incorporated into a final draft which is then graded. The advantages of this type of assignment in enhancing scientific skills include: the need by the students to gather new information from the primary and secondary literature and to distill it; the need for synthetic thought by the students in figuring out the next interesting questions; and the need by the students to understand the appropriate scientific techniques needed in order to test those questions. The outcomes have been good, with most students being challenged to extend their skills; the students also report a great sense of accomplishment in the process. In addition, the students who have gone on the graduate school also report that they have an easier time in the process due to this type of assignment.