# POSTER PRESENTATION ABSTRACTS

## 2025 ANIMAL BEHAVIOR CONFERENCE

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Alphabetical by presenter's last name (**bold**). **ODD** numbered posters will be presented from 6-7PM, **EVEN** numbered posters from 7-8PM

1 CULTURE-DEPENDENT ANALYSIS OF MICROBIAL DIVERSITY IN THE RHIZOSPHERE OF HEALTHY AND DISEASED *SOLANUM LYCOPERSICUM*

**Adedayo** AA

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Tomato is an important fruit that contains essential vitamins, antioxidants, lycopene, and minerals. Both humans and animals consumed tomatoes contributing to their well-being. The microbes inhabiting the rhizosphere soil of plants perform specific functions including plant growth improvement, improving nutrient availability, as well as the health status of the plants. Employing a culture-dependent method, this study presents the interaction of plants and microbes in the soil samples of healthy and diseased tomato plants. It divulges various bacteria and fungi species dwelling in the rhizosphere of the plant. For identification of the isolates, the morphology and biochemical characterization of the microbes were observed which revealed their features while growing on the media plates for fungi species (macroscopic) and observation under the microscope for bacteria species (microscopic). From the isolated microbes, DNA samples were extracted and a Polymerase Chain Reaction (PCR) of the DNA sample was carried out after which Sanger sequencing (16s rRNA gene and ITS) was conducted on the amplicon product of PCR. Our result presented various microbial species including bacteria (*Bacillus* and *Streptomyces*) and fungi (*Trichoderma*, *Purpureocillium*, *Mortierella*, *Chaetomidium*, and *Mortierella*). There are abundant microbes in the healthy rhizosphere compared to the diseased rhizosphere of tomato plants. This research unveils how the microbes affect the health status of tomato plants by improving plant growth, disease-resistant ability, and prevention from abiotic stresses. Further study should be conducted on the potential of these microbes on agricultural fields, hypothesizing that they contribute to the abundant production of tomatoes for sustainable agriculture.

2 THE EFFECTS OF URBAN NOISE POLLUTION ON THE FORAGING BEHAVIOR OF HOUSE SPARROWS *PASSER DOMESTICUS*

**Alcaraz** M, **Fox** B, Harries O, Ronald K

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Urbanization is expanding with over half of the world's population living in urban areas. Anthropogenic noise pollution has been shown to negatively impact wildlife by decreasing population sizes, reducing species diversity, and inhibiting communication. Vocalization is a common form of communication among avian species that aid in key behaviors such as mating, territorial signaling, and foraging for natural resources. Evidence has shown that house sparrows express vocal communication towards conspecifics before foraging. Anthropogenic noise can interfere with the receival of incoming signals; however, research addressing the effects of urban noise has been focused on how long-term noise exposure affects the net fitness of birds. Our research aims to draw attention to the direct impact of noise exposure on the efficiency of avian communication and the resulting foraging behavior. The objective of this research was to measure the effects of types of noises on the foraging behavior of house sparrows *Passer domesticus*.

House sparrows are an ideal model organism selected for this research because they live in rural and urban areas and are known to rely on acoustic communication to initiate flocking behavior while foraging. House sparrows were exposed to a playback of traffic noise, birds chirping, and a mixed audio of both to simulate anthropocene noise interference. To evaluate changes in foraging behavior, we measured latency response times after the playback of selected noises and the number of seeds consumed. We predicted that latency and the number of seeds eaten during the traffic and mixed tests will be lower than during the chirping test. Understanding the connection between urban stimuli and its effects on the foraging behavior of birds can lead to insights on how to reduce the impact of anthropogenic change on avian populations.

## 3 THE IMPACT OF ECOLOGICALLY RELEVANT AND IRRELEVANT STIMULI ON GROUPS OF EARTHWORMS IN AN OPEN FIELD ENVIRONMENT

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This study identifies fear behaviors in response to natural and artificial, ecologically relevant, predatory sound stimuli in groups of earthworms *Eisenia fetida*. We compared our results to those of Worthen et al. (2024), who observed similar behaviors in individual worms. Our goal was to determine whether the presence of other worms decreased the frequency of fear behaviors, specifically freezing. We also observed social behaviors to explore how earthworms interact in an open-field setting. Earthworms were placed in groups of 3 or 5 in an open field environment and given 4 minutes to acclimate. Following this acclimation period, grunting and mole sounds (obtained from supplemental resources within Catania et al., 2008) were played for 23 seconds each, with a 1-minute inter-trial interval (ITI) in between. In response to the sounds, individual behaviors, such as freezing, rearing, retraction, etc., and social behaviors, such as collective movement, self-assembly, or crawling over each other were noted. Freezing was the predominant response to grunting, but no clear predominant behavior was observed for the mole sound. No clear social behaviors were exhibited in response to the sound stimuli. Preliminary results suggest that worms in groups displayed less freezing in response to the grunting sound than the individuals, thus suggesting that the presence of other worms may minimize fear responses of *E. fetida*. Further research in this area may yield an effective stimulus for establishing a simple fear conditioning paradigm in an animal model that can be utilized in a classroom setting. In subsequent research, we have begun observing factors involved in the behavior “self-assemblage” - a social response to aversive environmental conditions. Other potential suggestions for future research include exploring further fear behaviors in response to natural and unnatural avian predator calls and doing a species comparison between *E. fetida* and *L. terrestris*.

## 4 AGGRESSIVE AND AFFILIATIVE BEHAVIOR DURING EATING IN INTACT VS NEUTERED FERAL CAT *FELIS CATUS* COLONIES

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Feral cats can be described best by their lack of socialization and varying degrees of aggression and social interactions with other cats. Trap, Neuter and Return (TNR) programs are designed to help control and maintain a feral cat population, allowing the feral cats to continue living without increasing the population. TNR programs have several benefits like population stabilization and increasing the number of cats vaccinated from diseases such as rabies. Sterilized cats are less likely to make noise, such as calls to warn off or attract other cats that disturb the community surrounding them. They are generally healthier because they are not expending energy on caring for offspring nor engage in frequent fights. This study explored the impact sterilization has on

aggressive and affiliative behaviors of feral female cats. Two cats' colonies were observed, one consisting of released neutered animals and the other comprising unaltered ones. Observations were conducted during morning and evening feeding times. Analysis of the frequency of aggressive and affiliative behavior showed a significant increase just before feeding time in both colonies, however, differences in aggressive behavior were only significant during evening feeding times. These behavioral differences were not related to the time of day but to unaltered/neutered condition of cats. This could suggest that sterilization may increase the likelihood of social interactions and potential to engage in affiliative behavior in the absence of food. Food prioritization can be directly impacted by reproductive pressures such as pregnancy and providing for offspring and sterilized cats are released from these demands, decreasing instances of aggressive behavior around food. This result further supports the idea that TNR programs promote healthier lives and support affiliative social interactions between feral cat populations.

## 5 SEX-BASED RESPONSES OF EASTERN NEWTS TO ALARM CUES FROM CONSPECIFICS AND A SIMULATED PREDATION EVENT

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Chemical communication involves chemicals produced by an animal to transfer signals between conspecifics or other species. One such chemical involved in communication is alarm cues. Alarm cues are released when an animal's skin is damaged in a predation event. These chemicals are received by conspecifics which are then alerted to potential danger in the vicinity. Adult *Notophthalmus viridescens*, or Eastern newts, use chemical communication, both from conspecifics and from potential predators. For this experiment, we collected adult male and female newts and exposed them to alarm cues from macerated conspecifics, coupled with a prod to simulate a predation event. Male newts moved more than female newts during the initial movement after the simulated predation event. When exposed to an alarm cue, newts spent more times in the corner of the test arena compared to when exposed to the control, irrespective of sex. These results align with previous studies that show that newts exposed to alarm cues tend to reduce activity, and that female members of a species, in general, tend to reduce mobility when exposed to a threat. It is hypothesized that these sex differences in reaction could be explained by energy demands for reproduction.

## 6 NAPE-PLD DELETION ALTERS ORAL OXYCODONE CONSUMPTION AND ΔFOSB EXPRESSION IN A TWO-BOTTLE CHOICE PARADIGM IN A SEXUALLY DIMORPHIC MANNER

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The endocannabinoid (eCB) system (including ecB ligand, anandamide), along with the endogenous opioid system, plays a pivotal role in positive and negative reinforcement of drug rewards. Previous studies have found the enzyme N-acylphosphatidlyethanolamine phospholipase-D (NAPE-PLD) reduces anandamide levels in the brain (Leishman, 2016). However, the effects of NAPE-PLD deletion on the responses to opioids are largely unknown. To effectively characterize oxycodone consumption in male and female NAPE-PLD wildtype (WT) and knockout (KO) mice, we used a two-bottle choice (TBC) model and immunohistochemistry for transcription factor ΔFosB in different regions of the brain implicated in reward processing and habit formation: nucleus accumbens (NAc) core and shell and dorsolateral (dl) and dorsomedial

(dm) striatum. We observed an increase in oxycodone consumption in female NAPE-PLD KO mice compared to WT. We also saw an increase in oxycodone seeking behavior in both WT and NAPE-PLD KO male mice. Finally, we saw an increase in ΔFosB expression in the dorsolateral and dorsomedial striatum of oxycodone-drinking female WT mice. These findings suggest NAPE-PLD deletion potentially alters both behavioral and neurobiological responses to opioids in a sexually dimorphic manner.

## 7 EVALUATING THE USE OF HIGH-FREQUENCY VOCALIZATIONS IN HUMMINGBIRD TERRITORIAL INTERACTIONS

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Birdsong serves to defend territories and/or attract mates. Some hummingbird species sing and display to both conspecific and heterospecific competitors. Such agonism often determines access to food. Some such species produce high-frequency (HF) vocalizations (above 8 kHz), well beyond what birds are known to usually perceive (1-5 kHz). However, it is not known if HF vocalizations are directed only at conspecifics or at other species as well, when defending resources. *Boissoneaua flavescens* and *Adelomyia melanogenys* are two species of Andean cloud forest hummingbirds that produce HF vocalizations. Through our pilot studies, we have identified that these HF users engage in agonistic interactions with several other species, including HF users as well as non-users. These HF users use both HF and non-HF vocalizations at feeders when other species are present. However, it is not known if these vocalizations are directed differentially to conspecifics or heterospecifics, based on the capability of HF perception. Thus, the influence of HF vocalizations on maintaining hummingbird social hierarchies remains undetermined. Here, we aim to use video and audio recordings to document agonism between and within species and feeding success. This approach will help us understand the context, directionality, and ecological influences of HF vs non-HF vocalizations. Next, through playback experiments in captivity, we will determine if HF non-users respond to HF vocalizations, even when no other bird is present. We hypothesize that HF vocalizations are more frequently directed at and elicit more intense aggressive responses from HF users than non-users because the latter cannot perceive HF sounds. Altogether, our project seeks to uncover whether social dynamics and resource competition in hummingbird communities are influenced by the evolution of HF vocal production in some hummingbird species.

## 8 EYE COLOR IN RED-EYED TREE FROGS *AGALYCHNIS CALLIDRYAS* IS UNLIKELY TO SERVE AS A STARTLE MECHANISM

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Predator avoidance and antipredator mechanisms are ubiquitous in all organisms affected by predation. One such mechanism, startle behavior, uses bright colors or contrasting patterns to intimidate a potential predator in such a way as to provide the prey with a slight escape advantage prior to the subjugation phase of a predation sequence. The extravagant coloration of red-eyed treefrogs *Agalychnis callidryas* is commonly explained as functioning in such a startle capacity, yet to our knowledge, this hypothesis remains untested. We assessed the reaction of live red-eyed treefrogs to simulated predation events from forceps and a model bird. To determine the role of eye color on the propensity for predator attack, naïve chickens *Gallus gallus* were exposed to clay frogs with their eyes painted red or green. In a second experiment, naïve chickens were exposed to clay frogs in which the eyes were replaced with red light emitting diodes (LED) that could be turned on, thus stimulating the "flash" of color that a potential predator would experience when

disrupting a sleeping frog. Results from the simulated predation event suggest that while eye color could conceivably function as a startle mechanism, the orange hands and blue and yellow flanks of red-eyed treefrogs are unlikely to function in this capacity. Experiments with model frogs found that the red eye color increases attack frequency and intensity. Finally, results with model frogs with LED eyes failed to induce a delayed reaction in naïve chickens when turned on. These results suggest that the bright coloration of red-eyed treefrogs is unlikely to function as a startle mechanism, at least in response to avian predators. Hypotheses for the evolution of the red-eyed treefrogs coloration are reviewed and discussed.

9 THE COST OF SOCIAL DOMINANCE USING TERRITORY MANIPULATIONS IN MALES OF THE CICHLID FISH *ASTATOTILAPIA BURTONI*

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Rank or position within a dominance hierarchy determines access to valuable resources and reproductive opportunities. In many social species, individuals compete aggressively for territories, especially if territory ownership is a prerequisite to reproductive success. Although high rank and territory ownership come with many benefits, territory defense is metabolically costly, and how animals manage these costs is unclear, in part because few studies manipulate territoriality under controlled conditions. To address this knowledge gap, we altered structure availability to assess how markers of territoriality (relative gonad size and behavior) influence oxidative stress in males of the highly social cichlid fish *Astatotilapia burtoni*. In this species, territory ownership is linked to an upregulated reproductive system (as indicated by large gonad size) and intense aggression. We housed males individually with an artificial cave or not, and these focal males had visual access to a neighbor, which were also given a cave or not. All males expressed an upregulated reproductive system as evidenced by vibrant coloration and large gonads. However, to our surprise cave ownership did not significantly increase relative gonad size. We did not find any indication that cave presence affected our measures of oxidative damage (lipid peroxidation) or oxidative stress (ratio between free and oxidized glutathione). However, we found that oxidative stress was positively linked to relative gonad size, providing some experimental evidence that territoriality carries an oxidative cost. Future work will assess the impact of cave presence on behavior and oxidative stress.

10 ALTERATION OF *PASSER DOMESTICUS* PERCEPTION OF PREDATORY SOUNDS WHEN MASKED WITH URBAN NOISE POLLUTION

**Bice** KE, **Cummings** A, Carter K, Ronald K

*Department of Biology, Hope College*

Humans have altered the habitats of avian species with increasing urbanization. While some species adapt, noise pollution could be impacting avian sensory systems and their interpretation of information. In addition to acute vision, birds use hearing to detect predators, which could be impacted by noise pollution. The ability to detect predators is imperative to the survival of avian populations. Many studies have focused on the effects of anthropogenic noise on conspecific communication, but only a few have explored the impact on predator detection. We aim to understand how predatory sounds are perceived by house sparrows, *Passer domesticus*, when predatory sounds are in combination with urban noise pollution. Sparrows are a great model because they are found in urban locations. We exposed three groups of birds to different sounds: (1) potential predator sounds (e.g., dog approaching), (2) predator sounds combined with urban sounds, and (3) predator sounds combined with white noise. We chose these experimental

variables because urban noise tends to be chaotic and unpredictable, whereas white noise is continuous and uniform. We measured the latency before each bird took flight to cover. We hypothesized that the birds will fly away quicker when exposed to the sounds of a potential predator compared to when the predator sound is combined with urban sounds. Similarly, we predicted that birds will be less likely to respond to the predator sounds in urban noise compared to white noise. Studying these behaviors will give insight as to how anthropogenic noise pollution can influence animals' predator detection. This information can be used by conservationists to help preserve the diversity of avian species in these communities.

## 11 THE EFFECT OF AGE ON PIGEON (*COLUMBIA LIVIA*) DECISION-MAKING IN A VARIABLE REWARD, SPATIAL MEMORY TASK

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The process of aging leaves a notable impact on the nervous system. Recent studies on the avian hippocampus, a key brain area for spatial memory, suggest that older pigeons do experience changes in hippocampal function and cognitive decline. The present research compared the behavior of young and old homing pigeons in a spatial memory task. Twelve unsexed homing pigeons (*Columbia livia*) were divided into two experimental groups consisting of young (<7 years) and old (>11 years) individuals. Subjects were trained to locate baited food bowls in an open floor arena with scattered landmark cues. Baited food bowls contained either a small, constant reward or a large, intermittent reward. The intermittence of the large reward altered between trial types (25% or 75%). The locations for each bowl altered with trial type as well. First order results suggest that the older pigeons do not suffer from spatial memory decline: there was no significant difference between the two experimental groups with respect to error rates (choosing an empty food-bowl location). Further analysis revealed that older pigeons preferred the small, constant reward location in both the low and high variable conditions, whereas young pigeons preferred the small, constant reward location in the low variable condition only. In the high (75%) variable condition, younger, but not older, pigeons preferred the large, variable reward location. We propose that the avian hippocampus undergoes functional changes because of aging. Older pigeons may not struggle to remember food locations, but their choice preferences indicate a deviation from rational decision-making (long term, the high (75%) but riskier variable bowl would have yielded a more rapid food yield). Further research will be necessary to probe how the avian hippocampus and related structures evaluate risk and reward, and how that evaluation may change as a function of age.

## 12 CONSEQUENCES OF ARTIFICIAL LIGHT AT NIGHT ON BIOLOGICAL RHYTHMS AND FITNESS OF *RHAGOLETIS JUGLANDIS* FLIES

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Life has evolved under a predictable pattern of bright day (up to 100,000+lx) and dark night (approximately 0lx). The introduction of Artificial Light at Night (ALAN) (up to 100+lx) by humans has led to disrupted biological rhythms in a variety of organisms, which has yielded many physiological and behavioral effects. The walnut husk fly (*Rhagoletis juglandis*) utilizes temperature (primary cue) and light (secondary cue) to regulate its biological rhythms. Temperature effects are well-studied in this species, but light effects are not. We placed pupal flies into one of two environmental chambers, which had standard 14:10 light:dark hours but differed in the level of light they received at nighttime: no ALAN (0lx) or ALAN (~80lx). As the flies

eclosed as adults, they either stayed in their original treatment or were switched to the other treatment, yielding four total treatment groups: dark night pupa—dark night adult, ALAN pupa—ALAN adult, dark night pupa—ALAN adult, and ALAN pupa—dark night adult. Testing across these four groups allowed us to distinguish between effects that occurred due to ALAN exposure at the pupal stage only, at the adult stage only, or across both life stages. To test ALAN's effect on biological rhythms, we measured circannual rhythms (eclosion timing) and circadian rhythms (daily activity and sleep). Then, to test how changes in these rhythms affect fitness, we measured egg load and survival. We predicted that exposure to ALAN at any point would lead to altered eclosion timing, increased daily activity, decreased daily sleep, decreased egg load, and decreased survival rates. Here, I will discuss impacts of ALAN on circadian rhythm and egg load. I will also discuss the direction of this work towards contributing to the newly developing knowledge base of how ALAN-caused alteration of biological rhythms yields changes in organisms.

## 13 INVESTIGATING COMMUNAL ROOSTING BEHAVIORS OF BROWN-HEADED COWBIRDS (*MOLOTHRUS ATER*)

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Despite their obligate brood parasitic reproductive strategy, brown-headed cowbirds appear highly social in the context of mating displays and foraging, even in the breeding season. In contrast, they are most often reported as roosting singly or in small conspecific groups during spring and summer, but rare reports also observed large, heterospecific overnight aggregations. We used radio telemetry tags and automated receiver data to understand roost occupancy and nighttime activity patterns of cowbirds at a breeding site. Over the course of three consecutive summers at Kennekuk County Park in Danville, IL, we used baited ladder traps in the mornings and evenings to capture Cowbirds and deploy radio telemetry tags on them to better understand their roosting behavior. Nearly all radio-tagged cowbirds regardless of age or sex, consistently gathered in a single communal patch of flooded *Phragmites* (Common reed) during the summer months. We report variations in the patterns of roost occupancy between different individuals as well as substantial nighttime and early morning roost departures. We relate roosting patterns to adult's age and sex, looking at both gap length and gap frequency in roost occupancy. Our findings hold potential implications for future conservation and management of the species.

## 14 BEHAVIORAL AND PHYSIOLOGICAL TOLERANCE TO REPEATED ROUNDS OF HYPOXIA IN THE CICHLID FISH *ASTATOTILAPIA BURTONI*

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Many aquatic species are exposed to periods of reduced oxygen availability on a seasonal basis and have adapted to such conditions. As aquatic environments are changing and periods of hypoxia become more frequent in the face of climate change, there is increased interest in understanding how organisms cope with hypoxia and the adaptations that allow individuals to survive. Here we exposed males of the cichlid fish *Astatotilapia burtoni* to repeated hypoxia trials and assessed behavioral and physiological responses. We found that the time elapsed from the start of each trial to the endpoint (subject motionless on bottom of flask with the exception of opercular movements) increased between the first and final hypoxia trial. We also found that males subjected to the hypoxia treatment did not significantly differ from control fish in regard to

our selected markers of brain oxidative stress. These results set the stage for future work to disentangle the adaptations exhibited by aquatic species that allow them to survive harsh aquatic environments. Future work will examine oxidative stress in other tissues and changes in mitochondrial function.

15 WHY PATH INTEGRATING FIDDLER CRABS ALIGN THEIR BODIES WITH HOME

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Many animals navigate via path integration, wherein animals sum distances and directions of their movements to create a single home vector in memory. Atlantic Sand Fiddler Crabs are central place foragers that use path integration to navigate while they forage, court, etc. During foraging excursions, the fiddler crab's body alignment does not deviate from the home direction by more than ~35° and rarely more than ~20°. It is unknown why the crabs take the trouble to align this way, and why they are apparently not free to take up larger angles relative to home. The reason might be limitations on how the home vector is stored. That is, it may be that the path integration/home vector system can correctly operate only under certain spatial constraints and executing large body rotations would exceed its limits. Their body rotations are normally compensated for by eye counter-rotations that not only stabilize the eyes but also cause them to maintain a relationship with the burrow. Perhaps, executing large body turns exceeds the eyes' ability to compensate, and as the eyes lose their normal relationship to home, they pull the home vector out of its correct direction. To test this idea, foraging crabs were forced to negotiate a sharp turn through an acrylic corridor and during the excursion, the animal's eye and body orientations were tracked, and its homing direction was determined. Results indicate that their homing direction depends on the eye orientation, which implies the eye stability system is the arbiter of the home vector direction.

16 THIRD WHEELING IN MOUSE COMMUNICATION: HUMAN HANDLING EFFECTS ON FEMALE COURTSHIP AND SOCIABILITY

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Human handling is known to induce stress in mice, which may influence communication behaviors including courtship and sociability. However, human handling practices are not standardized across laboratories and are often an overlooked factor when conducting experiments with laboratory mice. Additionally, female mice are underrepresented in literature despite the frequent use of female stimulus mice in male-centered courtship studies. This pilot study investigates whether daily handling for two weeks affects social behaviors of female house mice (*Mus musculus*) by assigning females to two groups: a handled group (n=9) that received three minutes of handling per day for two weeks prior to behavioral assays, and a control group (n=9) that received no additional handling outside of standard husbandry care. Two behavioral assays were conducted: a three-chamber sociability trial, and a 15-minute direct interaction trial with stimulus males. During these trials, we recorded ultrasonic vocalizations (USVs), broadband vocalizations (BBVs, or squeaks), and nonvocal behaviors, including female rejection, anogenital investigation, face-to-face investigation, and mounting. While this pilot study had small sample sizes, our initial data showed a trend toward a longer latency to the first recorded USV for interactions with handled females during direct interaction, potentially indicating that handling a stimulus female may change the progression of courtship behavior. Additionally, we observed no significant differences between the two groups during the sociability assay, suggesting that handling alone did not strongly influence female preference. Further studies would be worth conducting to better

understand the effects of handling on female social interactions to reduce confounds and ensure that future behavioral studies are not affected by differences in female handling practices.

17 TOASTY TADPOLES: HOW TEMPERATURE AFFECTS SIZE AND SWIM IN A DESERT-ADAPTED FROG

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Global temperature fluctuations are a quickly emerging danger and are a threat to biodiversity. One group who will pressingly feel these effects are amphibians, frogs in particular. Frogs are ectothermic organisms, reliant on their external environment for their internal body temperature regulation. Thus water and air temperatures are influential to frog development and resilience across life stages. Therefore an imperative question to ask is: how will temperature variation affect early-life frog (i.e. tadpole) phenotypes? In order to address this question, we raised spadefoot (Family Scaphiopodidae) tadpoles under ecologically relevant thermal environments to examine the effects of temperature variation on morphological and behavioral tadpole phenotypes. In order to assess early-life behavioral phenotypes, we measured tadpole performance via swimming speed, acceleration, and exploratory behavior. Additionally, we took a series of morphological measurements to examine how tadpole shape and size may influence their behavior. We hypothesized that heat-treated tadpoles will develop faster, have longer tails, and therefore will swim at greater speeds. Furthermore we hypothesized that faster developing heat-treated tadpoles will be smaller and less exploratory than their ambient counterparts. The findings from this study will give insight into how early-life frog phenotypes may provide a buffer to an unpredictable climate. Future directions will examine how phenotypic differences in early-life tadpole phenotypes are shaped by adult frog parental condition in a changing climate.

18 WHAT CAN ANIMALS TELL US ABOUT ANALGESIC EFFICACY?

de Assis Ferreira L[1,2], Hohmann AG[1,2]
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The study of pain and analgesia relies on rodent models due to the strong conservation of nociceptive pathways across species. Nociceptive signals originate in peripheral sensory neurons (nociceptors), which detect harmful stimuli and transmit signals via the spinal cord to higher brain regions responsible for pain perception and modulation (Larson et al., 2019). This shared neurobiology makes rodents essential for identifying novel pain treatments, offering control and mechanistic insight that clinical trials often lack. While clinical trials determine efficacy and safety in humans, they frequently fail due to variability, placebo effects, poor target engagement, or unforeseen side effects (Fogel, 2018). Rodent studies allow precise manipulation of pain mechanisms and controlled analgesic testing, free from subjective biases or heterogeneous patient responses (Modi et al., 2023). Since pain does not require verbal communication, rodents' defensive and adaptive responses—paw withdrawal, guarding, licking, reduced locomotion, and avoidance—serve as critical readouts of nociception and analgesic efficacy. Nociception refers to the neural detection of harmful stimuli, while pain is the conscious experience that follows. By targeting conserved pain-modulating systems (opioid, cannabinoid, GABAergic, etc.), rodent models bridge fundamental pain mechanisms and clinical application. Our lab employs diverse pain models in mice and rats, using behavioral assays to assess pain-like responses and analgesic effects: (Electronic Von Frey: Measures mechanical sensitivity, Hargreaves Test & Hot Plate Test: Assess thermal pain sensitivity, Acetone & Cold Plate Tests: Evaluate cold sensitivity, Open Field Test: Records locomotion and anxiety, Conditioned Place Preference (CPP): Assesses pain relief or

drug reward, Tail Flick Test: Measures heat pain sensitivity, and Forced Swim Test: Evaluates depressive-like behavior)

19 THE EFFECT OF SOCIAL CONTEXT ON AGGRESSION BIASES IN TWO CICHLID FISH SPECIES

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Aggressive competition can play important roles in the origin and maintenance of phenotypic polymorphism and speciation. If territory-owners bias aggression towards their own phenotype, rare male phenotypes will be involved in fewer costly fights, facilitating the evolution of diversity, and stabilizing the coexistence of distinct phenotypes or species. However, the mechanisms that regulate aggression biases have received little attention. I present data from a field study of two cichlid species in Lake Victoria and illustrate how the social environment could modulate aggression biases of territorial males towards specific intruder phenotypes. Specifically, in *Pundamilia nyererei* (males are red) and *P. 'pink anal'* (males are blue), blue males showed a tendency to increase aggression towards red males in the presence of more red neighbors while red males exhibited the opposite pattern. I discuss how studying the social regulation of aggression biases may advance our understanding of how mate competition shapes evolutionary patterns of phenotypic diversification.

20 FEMALE DOMINANCE IN A CAPTIVE COLONY OF COMMON VAMPIRE BATS

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In animal groups with long-term associations, individuals typically form a dominance hierarchy. Common vampire bats (*Desmodus rotundus*) are obligate blood feeders, and the frequency of food sharing and social grooming among females makes them a good system for studying cooperative relationships. However, dominance relationships among females are still not well understood, with only a single study rigorously measuring social dominance in a wild caught colony. To assess the generalizability of past findings and to investigate female dominance relationships among vampire bats in another context, we recorded 936 dominance interactions across a period of 24 days (551 hours) in a long-term captive colony of 22 adult common vampire bats (21 females, 1 male). Corroborating past findings, we found a weakly linear and shallow dominance hierarchy. Our findings provide further evidence that female common vampire bats have more egalitarian dominance hierarchies than most group-living mammals studied to date.

21 NEST-SITE SELECTION AS A STRATEGY FOR MANAGING HEAT IN TREE SWALLOWS *TACHYCINETA BICOLOR*

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Global temperatures have risen dramatically over the past 50 years, driving animals to adjust their behaviors to cope with increasing heat. Nest-site selection plays a critical role in shaping the thermal environment experienced by developing chicks, yet most research has focused on how birds select sites in cooler climates. As a result, little is known about how nest-site selection functions as a strategy to mitigate heat exposure. In this study, we use GIS technology to identify and quantify the thermal properties of tree swallow *Tachycineta bicolor* nest sites. By analyzing nest-site temperature characteristics, we aim to determine whether adults select locations that provide thermal advantages for their offspring. Understanding how birds modify nest-site

selection in response to heat is essential for assessing population resilience to rising temperatures and informing conservation strategies. In future work, we will investigate how these choices influence reproductive success and chick survival under increasing heat stress.

## 22 THE EFFECT OF STRESS ON FEMALE PREFERENCE AND PERCEPTION OF A SOCIALLY RELEVANT STIMULUS

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Animals must respond adaptively to social cues for survival. Stress, often triggered by environmental factors, can alter how animals perceive and respond to social stimuli. A stress hormone, corticosterone (CORT), prepares the body to respond to a stressor and is used as a measure of stress levels. Different stress levels, such as acute and chronic, can cause shifts in the expression of social neuropeptides in the brain and changes in behavior. By assessing female preference for a socially relevant stimulus under different stress conditions, we can understand how stress impacts social behavior and the perception of social signals. In our study, female zebra finches (*Taeniopygia guttata*) will undergo different stress conditions (control, acute - AS, and chronic - CS). Using a three-chamber setup, females will be presented with a choice between a social stimulus consisting of a picture of a female zebra finch and contact calls or a control stimulus consisting of a zebra finch image with the colors scrambled and pink noise. Females will also have the option to remain in the neutral zone (no stimulus). We will assess social preference by comparing how long they spend in the control cage to the social cage. We predict that there will be a negative correlation between preference and CORT levels. We expect the control birds to have the lowest CORT levels and strongest preference, while the acute birds will have the highest CORT levels and weakest preference. This is consistent with research showing that chronic stress causes a dampened stress response and acute stress causes higher CORT levels due to the novelty of the stress. In the future, we will assess changes in the gene expression of social neuropeptides in sensory regions of the brain due to stress conditions. This work will provide insights into how stress might change decision-making and perception in zebra finches and, in turn, can help us predict how stress may affect processing capabilities in humans.

## 23 SEASONAL MODULATION OF WINNER EFFECTS AND ADRENAL ANDROGENS IN FEMALE SIBERIAN HAMSTERS

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Seasonally reproductive animals exhibit pronounced physical and behavioral changes in response to the time of year, including shifts in aggression. While breeding-season aggression is often associated with gonadal steroids, less is known regarding the mechanisms underlying nonbreeding aggression. Previously, our lab has demonstrated that, in Siberian hamsters, nonbreeding aggression is regulated by the influence of the pineal hormone melatonin on adrenal steroids, particularly the androgen dehydroepiandrosterone (DHEA). Here, we investigate whether "winner effects" – the increased likelihood of winning an aggressive encounter based on previous victories – persists in the nonbreeding season, and whether DHEA is associated with experience-mediated changes in aggression. Female hamsters underwent 10 weeks of photoperiod, or daily melatonin treatments 2 hours prior to light off, before accumulating fighting experience on repeated resident-intruder tests (RI). Winner effects were then assayed by pairing these focal females with naïve, same sex/same photoperiod opponents in neutral cage tests. Serum DHEA-S, the sulfated form of DHEA, was measured at baseline, post-repeated RI, and post-neutral arena. We found that fight-experienced females were more aggressive than their naïve counterparts in the neutral

arena, and that this effect was photoperiod-specific, suggesting that winner effects persist in the nonbreeding season independent of gonadal steroids. Interestingly, DHEA-S was not only photoperiod-dependent, but also context dependent, increasing only after neutral cage encounters but not after RI tests. Together, these findings suggest that winner effects are maintained in the nonbreeding season, and that the mechanisms underlying territory defense (RI) differ from those underlying territory establishment (neutral arena).

## 24 CHARACTERIZING OVARIAN GENE EXPRESSION ALONG STEROIDOGENIC PATHWAYS IN A WILD TERRITORIAL SONGBIRD

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It is common to measure hormone concentrations in blood or other tissues and ask how hormonal variation relates to behavioral variation, as a window into the proximate mechanisms of behavior. It is less common, however, to measure all of the steps along the pathway of hormone production. Sex steroid synthesis, for example, occurs in reproductive tissues and involves interconversion of multiple hormones from an initial cholesterol molecule. Here, we used transcriptomic assays (qPCR) to measure production of steroidogenic enzymes in ovarian tissue, and we asked how these physiological parameters relate to behavior. Specifically, we measured female-female aggression in tree swallows (*Tachycineta bicolor*) during the early spring when they have just established their territories. We then collected ovaries from a subset of females with consistently high or consistently low aggressiveness. In the lab, we measured the abundance of mRNA transcripts for six steroidogenic enzymes. Preliminary results indicate females with similar aggression scores exhibit substantial variation in ovarian gene expression; this variation is particularly noticeable among highly aggressive females. Forthcoming results will illuminate how variation in gene co-expression may contribute to stable differences in complex social behavior.

## 25 EVIDENCE FOR PARASITE-MEDIATED SEXUAL SELECTION: FEMALE PREFERENCE FOR PARASITE-FREE MALES IN *DROSOPHILA ALBOMICANS*

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Parasites often impose selective pressures that can favor the evolution of female preferences for uninfected and/or resistant mates. Such preferences, which may confer both direct and indirect fitness benefits to females, are expected to be strong drivers of differential male mating success, and hence sexual selection, in host populations. In this study, we examined whether ectoparasitic mites, *Gamasodes pachysetis*, can generate parasite-mediated sexual selection in their natural host, *Drosophila albomicans*. Under laboratory conditions, we found that parasitized male flies achieved significantly fewer copulations than unparasitized males. To investigate the role of female choice in this effect, we found that during courtship, parasitized males elicited rejection behaviors from females more frequently than unparasitized males. Furthermore, when females performed rejection behaviors, the likelihood of copulation was significantly reduced, confirming the functional link between expression of female rejection behavior and male copulation success. Our results support the existence of a female preference for parasite-free males in *D. albomicans* and suggest that *G. pachysetis* mites generate sexual selection in wild populations of this host species through eliciting female choice. Future research will focus on testing for direct and indirect fitness benefits to females that may underpin this preference.

## 26 THE IMPACTS OF HUNTING ENRICHMENT ON LARVAL ZEBRAFISH (*DANIO RERIO*) EXPLORATION AND STRESS RESPONSES

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Environmental enrichment has been shown to impact the behavior of zebrafish (*Danio rerio*) and increase stress resilience, but it is unclear whether hunting has the same effect as a form of enrichment. This study examines the impact of enrichment from live brine shrimp (*Artemia nauplii*) on the behavioral and physiological stress responses in larval zebrafish at 21 days post fertilization (dpf). By determining the effect that this feed has on larval stress resilience, discrepancies between replicated data can be accounted for and a standard reference diet for this model organism can be one step closer to development. In this work, larval zebrafish (5-21 dpf) were fed a live diet of brine shrimp or a commercial diet. At 21 dpf, the larva were subjected to a novel object test using a black Lego as the novel object. During the novel object test, the number of approaches within 12 mm of the object (roughly two larval body lengths) and the time spent in the novel object sector were recorded. The larva were euthanized immediately after the novel object test to be used in future cortisol testing. It is expected that the sample fed live brine shrimp will show a decreased stress response to the novel object test and have lower cortisol levels when compared to the sample fed a commercial diet. These findings might suggest that live prey acts as enrichment for larva in a similar manner to environmental enrichment and therefore creates stress resilience in larva. Future studies should further examine the stress responses larval zebrafish undergo during hunting and the nutritional impacts of live food.

## 27 GEOGRAPHIC VARIATION IN THE TIMING OF SONG IN THE GENUS *MICROCERCULUS*

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The evolution of song produces acoustic geographic variation across species. While geographic variation in song has been widely studied in songbirds, little is known about timing-based variations. We investigated variations in song timing across the genus *Microcerculus*. Using a crowd-sourced database, we obtained recordings across the entire geographic range of multiple *Microcerculus* species. By measuring inter-note interval durations, we classified songs into known timing variants or identified novel variants where necessary. We then tested whether these variants are separated across geographically distinct populations. This project will shed light on the evolution of timing in birdsong by studying a group of birds with wide variation in the timing of their songs.

## 28 WHO'S CALLING? SPECIES-LEVEL CALLING DURING THE 2024 TOTAL SOLAR ECLIPSE

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Animals rely on the sun's light-dark cycles as an environmental cue to regulate their circadian and circannual rhythms. Therefore, anthropogenic light pollution disrupts animal behavior. The 2024 total solar eclipse provided a unique opportunity to study how changes in photic conditions impact avian calling behavior on a short timescale. To detect these changes, we took acoustic recordings at three Midwest prairies, each with their own unique avian biodiversity profiles, before, during, and after the eclipse. We then identified the birds calling during each period to the species level. Finally, we compared results from 1) the eclipse time period to the same time on non-eclipse days and 2) the eclipse time period to dawn and dusk on the day of the eclipse. The results of this study help us better understand which species are most affected by changing

photic conditions and have implications for wildlife conservation in areas impacted by anthropogenic light.

## 29 CIRCALUNIDIAN RHYTHMS OF VERTICAL MIGRATION IN LARVAE OF THE AMERICAN HORSESHOE CRAB, *LIMULUS POLYPHEMUS*

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The American horseshoe crab, *Limulus polyphemus*, is a medically, economically, and ecologically important animal. This foundational species lays its eggs in the spring in intertidal zone sediment and most larvae hatch and exit the sediment shortly after a summer high tide inundation, although overwintering in the nest has been documented. Previous work has shown that large groups of horseshoe crab larvae exhibit circatidal rhythms (τ=12.4) of vertical swimming that can be entrained by agitation in the lab. However, the individual patterns of activity and the effects of other early environmental factors on the activity patterns of larvae are unknown. In the present study, when larvae were housed individually in vertical migration chambers in constant conditions, most exhibited circalunidian (τ=24.8) rhythms of vertical swimming although some exhibited circatidal rhythms. Freshly hatched, field collected larvae generally exhibited higher percentages of rhythms than lab-raised animals and appeared to synchronize their activity to dusk and ebb-tide of the photoperiod and tidal cycles they developed in. These results suggest that horseshoe crabs are sensitive to both photoperiodic and tidal influences while still in the egg and further indicate a clear preference for nighttime ebb-tide activity. Lastly, lab-hatched larvae that were artificially overwintered in the lab at 4<o>C for nine months exhibited only circalunidian rhythms with significantly shorter periods compared to other groups. Overall, these results indicate that horseshoe crab larvae exhibit primarily nocturnal, ebb-tide circalunidian rhythms, perhaps to help them to avoid both stranding on intertidal substrate and diurnal predators. In addition, the presence of these circalunidian rhythms is more strongly expressed in overwintered animals and provide particularly strong support for the hypothesis that circatidal rhythms are controlled by dual circalunidian clocks in horseshoe crabs.

## 30 DIFFERENTIAL EFFECTS OF EXERCISE AND HORMONE TREATMENT ON SPINAL CORT INJURY-INDUCED CHANGES IN MICTURITION AND MORPHOLOGY OF EXTERNAL URETHRAL SPHINCTER MOTONEURONS

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Spinal cord injuries (SCI) induce deficits in locomotor and autonomic function. After SCI, surviving motoneurons innervating hindlimb muscles exhibit extensive dendritic atrophy, which is attenuated by exercise or treatment with gonadal hormones. Moreover, both exercise and hormone treatment improve urinary function after SCI. Here, we examine the potential protective effects of exercise or hormone treatment on the structure and function of motoneurons innervating the external urethral sphincter (EUS) after SCI. Male rats received either a sham or thoracic contusion injury. One cohort of SCI-animals was immediately implanted with subcutaneous capsules filled with estradiol (E) and dihydrotestosterone (D); continuous hormone treatment occurred for 4 weeks. A separate cohort of SCI-animals received 12 weeks of forced wheel running exercise starting two weeks after injury. At the end of treatment, void volume was measured using metabolic cages and EUS motoneurons were labeled with cholera toxin-conjugated horseradish peroxidase, allowing for assessment of dendritic morphology. Void volumes increased in all SCI-animals; void volume was unaffected by treatment with exercise,

but was dramatically improved by treatment with E+D. Dendritic length of EUS motoneurons was significantly decreased after SCI compared to sham animals; exercise did not reverse this injury-induced atrophy, however E+D treatment significantly improved dendritic length. These results suggest that some aspects of urinary dysfunction after SCI can be improved through treatment with gonadal hormones, potentially through their effects on EUS motoneurons; however, a more comprehensive treatment regime that addresses multiple SCI-induced sequalae, i.e., locomotor and voiding deficits, would include both hormones and exercise.

## 31 THE IMPACT OF HEAT ON NEST SITE SOCIAL INTERACTIONS IN TREE SWALLOWS (*TACHYCINETA BICOLOR*)

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As climate change intensifies, animals are increasingly exposed to extreme heat, which can alter key behaviors such as foraging, singing, and nest defense. Sociality is particularly important for many species, influencing the formation of social bonds and overall fitness. However, the effects of high temperatures on social interactions remain unclear. In this study, we examine how ambient temperature influences nest visits in a population of free-living tree swallows (*Tachycineta bicolor*). Tree swallows regularly visit their neighbors' nests throughout nestling development, a behavior that may play a role in social cohesion. Using an automated tracking system, we will quantify visit frequency and assess how heat affects time allocation to social behaviors. Specifically, we will analyze how nest visitation by neighbors varies across life stages and temperature conditions. This study provides a critical first step in understanding how rising temperatures may reshape avian social structures.

## 32 REPRODUCTIVE TIMING IN DARK-EYED JUNCOS: DISENTANGLING PLASTICITY AND HERITABLITY IN FIRST EGG DATES

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The timing of many songbirds' seasonal life-history stages have changed in response to rapid climate change. Dark-eyed juncos (*Junco hyemalis*) exhibit an overall advancement in reproductive timing, as well as phenotypic plasticity in response to weather. Furthermore, females that breed earlier experience higher fitness than those that breed later in the season, possibly due to better resource availability or increased opportunities for multiple broods per season. Therefore, a selective pressure may grant an advantage to early breeders. Although breeding early may confer a fitness advantage, it is unclear whether there is a genetic basis underlying early breeding behavior. We investigated whether there is a genetic component contributing to the advancement of reproductive timing in a population of wild non-migratory dark-eyed juncos near Pembroke, Virginia by answering two primary questions: (1) Do individuals exhibit repeatability of reproductive timing across years? (2) Is there a correlation between mother and daughter reproductive timing? We surveyed nests between 1983-2024, documenting variables including the date the first egg was laid and the parental identity. We measured the repeatability of individuals' reproductive timing using the intraclass correlation coefficient, an estimate of within- versus between-individual variation in first egg dates for first broods. Next, we used a linear mixed effects model to determine whether a mother's average first egg date relative to the larger population predicts that of her daughter's. Initial results indicate low repeatability of reproductive timing within individuals. For a trait to be heritable, it must also be consistent within an individual; therefore, preliminary evidence suggests that the limits of plasticity, rather than the pace of

genetic adaptation, drives the annual onset of female reproduction in dark-eyed juncos and will determine this species' potential for continued adaptation to climate change.

## 33 INVESTIGATING THE EFFECT OF AVIAN CUES ON WOLF SPIDER COURTSHIP BEHAVIOR

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Brush-legged wolf spiders *Schizocosa ocreata* are commonly found on leaf litter in the mid-west's eastern deciduous forests. During their breeding season, male wolf spiders have been shown to respond to predatory avian cues by ceasing courtship and engaging in antipredator behavior. Given the widespread distribution of *S. ocreata* and the variety of bird species that consume them, we aimed to investigate this relationship further. We hypothesized that wolf spiders would switch from courtship to antipredator behavior when exposed to acoustic avian cues. To test this, we exposed adult males to female silk draglines in a playback arena. When males detected female silk, they often engaged in jerky-tapping behavior. After a given duration, one of three acoustic stimuli was played: 1) predatory bird call, 2) non-predatory bird call, or 3) non-threatening call. Using BORIS, we plan to score each trial (n=60, 30 / treatment) and analyze courtship behavior before and after the stimuli. We expect to find that male spiders reduce jerky-tapping behavior in response to predatory bird calls. If confirmed, we will further investigate the relationship between their response to avian cues and local bird species that consume them, providing insight into whether aversion to avian cues is locally relevant or a general innate response.

## 34 BIOAMINE DISRUPTION LEADS TO MEMORY DEFICITS IN THE WHIP SPIDER *PHRYNUS MARGINEMACULATUS*

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Amblypygi (whip spiders) are an order of arthropods (Subphylum: Chelicerata, Class: Arachnida) that navigate primarily by their unusually keen olfactory abilities. Experiments in the laboratory reveal that the species *Phrynus marginemaculatus* form both short and long-term memories for odors associated with access to a shelter. While bioamine function and location in the whip spider remains completely unexplored, comparative anatomy indicates that their olfactory memory likely depends on serotonin and dopamine signaling in a brain region relevant to olfactory input. Hence, if serotonin or dopamine activity is pharmacologically disrupted within the whip spider brain, their performance in an associative olfactory learning task should be significantly impaired. Subjects (n = 40) were trained on an olfactory memory paradigm, then injected with either 0.9% physiological saline, the serotonin receptor antagonist methiothepin mesylate (MET), or the dopamine receptor antagonist SCH-23390, and tested for memory retention 24 hours afterward. Controls injected with saline performed above chance (serotonin control: $p = 0.006$, dopamine control: $p = 0.039$), while treated groups performed at chance (MET: $p = 0.375$, SCH-23390: $p = 0.892$). There was a significant difference in performance between the treated and control groups on test day (serotonin groups: $p = 0.048$, dopamine groups: $p = 0.016$). Additionally, there were no significant differences in locomotion between the treatments and control groups on test day ($p > 0.05$). Taken together, these results indicate that these serotonin and dopamine antagonists impair olfactory memory consolidation without impairing locomotion in *Phrynus marginemaculatus*.

## 35 A ROLE FOR CANNABINOID CB1 RECEPTORS IN OLFACTORY IDENTIFICATION OF KINSHIP?

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Airborne chemical messengers enable organisms to convey and receive a variety of information. Mice use chemical messengers to communicate information regarding sexual states, social status, and kinship. The endogenous cannabinoid signaling system consists of cannabinoid receptors (CB1, CB2), lipid messengers, and enzymes that synthesize/metabolize these messengers. Previous research has demonstrated that the endocannabinoid system plays a role in the reception and integration of olfactory cues information in a sex-dependent manner. An intact olfactory CB1 signaling system may be required for detection of some pheromonal and appetitive scents. To better understand the role that endocannabinoids play in olfactory chemical messenger signaling, we used an olfactory assay to determine preference using a variety of fluids known to contain these chemical messengers. Urine from same-cage siblings or non-siblings were applied to the walls of a sterile cage, the time spent investigating these fluids was recorded as a measure of preference in attention. We found that male mice are able to distinguish the smell of urine from non-cage-mates relative to cage-mates, spending more time investigating the former. Mice treated with SR141716 (4mg/kg, IP), a CB1R antagonist do not show a difference in investigation time. CB1R-/- mice also did not demonstrate any preference. Interestingly, CB1R-/- mice spent less overall time investigating scents. In contrast to males, female mice did not spend more time investigating non-cage-mate over cage-mate scents, though they did spend more time investigating urine relative to saline, indicating that their ability to detect the scents was intact. These experiments were spurred by the observation that CB1 receptor knockout mice appear to be less aggressive toward non-cage-mates. We hypothesize that block or deletion of CB1 receptors impedes the ability of male mice to distinguish unrelated male mice by scent, and these experiments are ongoing.

## 36 CONTEXTUAL AND TEMPORAL CONTROL OVER NOVELTY-FACILITATED EXTINCTION: EXTENSIONS INTO OTHER CASES OF CONFLICT

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Contrary to the expectations generated by popular models of associative learning, including a novel stimulus during the extinction of conditioned Pavlovian fear has been reported to facilitate response reduction over training as well as in follow up tests. However, these reports often lack rigorous testing to determine the efficacy of this treatment against the many documented extinction recovery effects (e.g., renewal, spontaneous recovery, reinstatement), which would be crucial for establishing any clinical value to novelty-facilitated extinction (NFE). Using a conditioned suppression measure in rodents, this project explores whether contextual (i.e., renewal) and temporal (i.e., spontaneous recovery) control over extinction are still evident following NFE compared to standard extinction treatments. Furthermore, the efficacy of novelty treatments on reversal learning and second order conditioning were also examined due to the core similarities between these forms of learning and extinction, insofar as generating conflict between information content and different points in space/time. Preliminary findings struggle to find much advantage of NFE over standard extinction, and little evidence that recovery is markedly attenuated.

37 PERIADOLESCENT BLUE LIGHT EXPOSURE AND BRAIN DEVELOPMENT

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Nighttime exposure to blue light has been shown to disrupt circadian rhythms, neural functioning, and cognitive behavior. Blue light exposure in rats can alter learning and memory and can affect pubertal onset and sexual behavior. However, most of the work on the effects of blue light have focused on adult male subjects. Given the near ubiquitous use of blue light-emitting electronic devices, an emerging concern is the effects of blue light on the developing adolescent brain in both male and female subjects. In the present study, periadolescent (P25-55) male and female Long Evans rats (n=52) were exposed to blue light for 6 hours per night. In early adulthood (P60), subjects underwent a battery of tests to assess anxiety-like behavior, exploratory behavior and hippocampal-dependent memory. Brain tissue was then collected at P90, and prefrontal cortex and hippocampal sections were nissl-stained and immunohistochemically stained with MAP-2. Results showed significantly ($p < 0.05$) altered behavior in novel object recognition task along with decreased cortical thickness in BL subjects. These results suggest that adolescent blue light exposure may alter neural development, especially in learning. Subsequent research on the extent to which chronic blue light can exert long-term effects on the brain and behavior should be considered.

38 EFFECT OF PERCEIVED PREDATOR CUE ON COURTSHIP IN *PHOLCUS MANUELI*

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Second-male sperm priority in *Pholcus manueli* suggests that males preferentially court mated females to maximize their paternity success. This study investigates how male *P. manueli* adjust their courtship behaviors in response to two factors: female mating status (virgin or mated) and predator cues (absent or present). Previous research indicates that predator presence can influence male courtship strategies, often reducing courtship intensity or selectivity toward female mating status. In this study, male spiders exhibited increased searching behaviors (e.g., web plucking, web tasting, tarsus tasting) when courting mated females, regardless of predator cue presence. However, courtship behaviors involving direct interaction with females (e.g., leg tapping, pedipalp extension, adjusting) showed no significant differences under predator cues. The findings suggest that male *P. manueli* prioritize mated females due to second-male sperm priority but may not alter their courtship intensity toward virgin females in the presence of predators. These results highlight the nuanced effects of predation risk on mating strategies in *P. manueli*.

39 DOES WITHIN-NEST POSITION INFLUENCE IMMUNE RESPONSE TO HEAT IN TREE SWALLOWS (*TACHYCINETA BICOLOR*)?

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As heat waves increase in intensity and frequency due to global climate change, understanding their effects on health is critical. While extreme heat can directly cause mortality, sublethal effects—such as those on immune function—may also influence fitness. Previous research has linked temperature to immune responses, but findings have been inconsistent. Cavity-nesting birds provide an ideal model for addressing this question. As diurnal animals with conserved physiological responses to stress, they share key similarities with humans. Additionally, nest box temperatures can be experimentally manipulated, allowing for precise control of heat exposure. Our pilot data suggest that within-nest position affects the temperature a nestling experiences,

with areas near the nest box entrance remaining cooler. As a result, even individuals exposed to the same ambient conditions may experience different physiological challenges. This study will examine whether within-nest position mediates immune function in tree swallows (*Tachycineta bicolor*) by measuring bacterial killing ability following a moderate, simulated heat challenge. By identifying how temperature effects on immune response vary among individuals, we aim to provide new insights into the physiological consequences of heat exposure in nestling birds.

## 40 NEST FEATHER PREFERENCES AND ENDOCRINE RESPONSES IN MALE TREE SWALLOWS (*TACHYCINETA BICOLOR*)

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Behavior plays a crucial role in how animals navigate environmental challenges, and nest building is a key behavior that directly affects fitness. Nest architecture significantly influences offspring survival, leading to strong selection for adult nest material preferences. Feathers are commonly used in nest construction due to their insulating properties, which help buffer against temperature fluctuations. With climate change increasing the frequency of extreme cold snaps—a major cause of avian mortality—insulatory nest-building behaviors may become even more critical. However, the extent to which birds prefer specific types of feathers for insulation remains unclear. In this study, we examine male tree swallow (*Tachycineta bicolor*) preferences for two feather characteristics: color (light vs. dark) and texture (down vs. flight). Males will be presented with feather choices that vary in these attributes, and we will measure their latency to choose and overall preference. Additionally, we will assess whether feather collection elicits a physiological reward response by analyzing post-choice blood samples for beta-endorphin levels, a hormone associated with well-being/reward. This study provides insight into how cognitive and endocrine mechanisms shape material selection in nest-building birds, with implications for understanding behavioral adaptations to a changing climate.

## 41 AN OPPORTUNISTIC STUDY OF EFFECTS OF FOOD COMPETITION ON DOMINANCE STRUCTURE IN CAPTIVE VAMPIRE BATS

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In many social species, members form a dominance hierarchy. Relative ranking within a hierarchy predicts the outcome of competitions over resources like food. However, little is known about how the structure of dominance hierarchies might vary with the amount of food competition. Past studies of food competition in female vampire bats have found evidence for one of the shallowest dominance hierarchies among female mammals, suggesting that cooperative food-sharing relationships in vampire bats might cause or be caused by egalitarian relationships. However, these studies were done under conditions of food abundance. In this study, we compared social interactions among 21 captive vampire bats on nights with unlimited food (blood in feeders) versus two nights where food was limited (due to blood clots in the feeders). As expected, interactions on food-limited days were more common and more likely to be aggressive rather than affiliative. We are currently testing whether group-level dominance interactions are less structured on food-limited nights, relative to food-unlimited nights. Future research should manipulate food scarcity to properly test effects on group-level dominance structure.

## 42 ARTIFICIAL FOREST GAPS AND THE SEASONAL PROGRESSION OF MOLT IN FOUR SELECT NEOTROPICAL MIGRANTS

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Molting is a cyclical process in which a bird's old feathers are replaced with new feathers. Replacement of worn-out feathers is crucial as feathers provide essential biological functions to birds. For example, birds use their feathers to thermoregulate and control flight. Comparing molt duration and speed between species can also provide insights about the evolutionary history of bird species due to variations in the annual cycle across taxa. In this project, the pre-basic molt in adult birds was studied, which occurs on the breeding ground before migration. Here, I provide a detailed quantification of the timing, intensity, and patterns for four passerine species: the Hooded Warbler (*Setophaga citrina*), the Ovenbird (*Seiurus aurocapilla*), the Wood Thrush (*Hylocichla mustelina*), and the Gray Catbird (*Dumetella carolinensis*), on their breeding grounds in Pennsylvania. The occurrence of the pre-basic molt was confirmed in all four of my study species; I started by assessing the influence of stand age on molt score for all species recorded. During this analysis, molt scores were shown to be highest in the gaps of earliest succession (4-7 years). Then limiting the study down to the four focal species, I discovered that the mean molt score was higher in gaps that are a younger age (7-10 years) vs. older gaps (11-14 years). The capture rate of these gaps were also analyzed. Taken together, this research has important implications for the future of sustainable forestry practices and their effects on bird physiology. Partnerships that forward bird conservation efforts should have an interest in understanding how sustainable forestry practices affect the body condition of birds, and understanding which habitats are preferred for molting to occur is essential information for ornithologists.

## 43 CHARACTERIZATION OF AGE-RELATED SEX DIFFERENCES IN ORGANIZATION OF MOUSE OPEN FIELD BEHAVIOR

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Previous work investigating sexual dimorphism in age-related changes of spatial orientation performance has focused on environmental cue learning (i.e., Morris water task). Self-movement cues have also been observed to guide movement in the open field; however, a limited number of studies have investigated potential sexual differences in using both cue types. This present study investigated spontaneous open field behavior in male and female mice, using kinematic and topographical measures. Each group was tested at 3,6, 9 & 12 months of age, under both dark and light conditions in an open field apparatus. Mice exhibited age related differences in movement organization; however, no significant differences were observed between the sexes at any time point. These results indicate that any neurobiological differences between female and male mice were not sufficient to influence use of environmental or self-movement cues. Future research should further investigate sex-differences in spontaneous open field behavior using models with additional contributing factors, such as older mice or genetic mouse models of neurological conditions.

## 44 I MUSTACHE YOU A QUESTION: DO VIBRISSAE CONTRIBUTE TO MOUSE BI-MANUAL COORDINATION IN A STRING-PULLING TASK?

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Many mammals have vibrissae, long thick hair commonly found on the face, which can be seen represented in the barrel cortex. While previous research states the importance of vibrissae for behaviors such as orienting and locomotion, it is not entirely clear if vibrissae contribute to coordination in a bi-manual task such as string pulling. In the current study, six C57BL/6 mice (female: n=4; male: n=2) were given baseline string pulling tests then placed under anesthesia where half received a bimanual trim of their vibrissae. Twenty-four hours after vibrissae removal, mice underwent a final string-pulling test. Afterwards, right- and left- hand bouts of string-pulling were examined topographically and kinematically for characteristics of bi-manual coordination. Trimmed and no-trimmed mice exhibited differences in the heading concentration across both hands. These results suggest that the bilateral lack of vibrissae affect coordination during a string-pulling test. No significant differences in other measures may suggest compensation for the lack of vibrissae, for example, increased contact with snout to the string.

## 45 USING AN ACOUSTIC CAMERA TO DIFFERENTIATE INDIVIDUAL CONTRIBUTIONS IN DUETS OF NEOTROPICAL WRENS

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Many species of Neotropical wrens engage in complex duets in which individuals take turns alternating vocalizations with little to no overlap between phrases. The timing is so precise that it often sounds as if a single bird is singing. Both male and female wrens engage in duetting behavior, with duets serving multiple functions, including territory defense, social bonding, and mate acquisition. Given the rapid and seamless alternation of phrases, distinguishing individual contributions within a duet is challenging. To address this issue, we evaluated the efficacy of determining individual contributions to duets with an ACAM-120 acoustic camera. Acoustic cameras employ an array of microphones surrounding a central camera to spatially map sound sources. To test whether the ACAM-120 distinguishes individual contributions, we conducted a controlled experiment using modified recordings of Plain-tailed Wrens (*Pheugopedius euophrys*), played from two speakers to simulate natural vocal interactions. The acoustic camera was capable of distinguishing multiple audio sources and accurately determining the source of playback on a moment-to-moment basis. These findings suggest that acoustic cameras are an effective tool for analyzing duetting behavior in Neotropical wrens. This approach has the potential for broader applications in bioacoustics and behavior research as a tool to isolate individual vocalizations in pair interactions.

## 46 THE LONG-TERM EFFECT OF PARASITISM ON MALE COPULATION SUCCESS IN *DROSOPHILA SULFURIGASTER*

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Parasites often reduce the copulation success of male hosts by decreasing their competitive ability and/or causing them to be less attractive to females, thus generating sexual selection. Whereas the negative effect of parasites on male copulation success is well documented in many systems, the capacity of male hosts to recover from parasitism is relatively understudied. Understanding the rate of recovery after infection can elucidate how parasitism affects the strength of sexual selection in host populations. We tested whether ectoparasitic mites, *Gamasodes pachysetis* (Yao

& Jin 2020), can generate sexual selection in their natural fruit fly host, *Drosophila sulfurigaster* (Duda 1923). Under laboratory conditions, when competing against unparasitized males for mating opportunities, males parasitized by a single mite acquired significantly fewer copulations. Next, we tested whether the copulation success of parasitized males would improve over time after mites were experimentally removed from their hosts. We found that previously parasitized males continued to exhibit significantly reduced copulation success compared to control, never-parasitized males at recovery intervals of 2, 24, 48, 72, 96, 120, and 336 hours. The copulation success of previously parasitized males improved to the level of control males after 480 hours of recovery and remained statistically similar to controls after 600 hours. Our results suggest *G. pachysetis* can generate sexual selection in *D. sulfurigaster*. Furthermore, the prolonged recovery time post-parasitism should amplify the negative effect mites have on the copulation success of their host, thereby intensifying the strength of sexual selection. Although the reduction in copulation success persisted for a prolonged period after infestation, it was not permanent, indicating that males can recover from parasitism.

## 47 SIGNAL TRANSMISSION OF BAY WREN DUETS AND SOLO SONGS

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Duets are cooperative vocal signals that may be used for joint territory and resource defense, mate guarding, reproductive pair synchrony, or pair bond maintenance. Neotropical wrens perform duets that involve both a male and a female. Bay Wrens (*Cantorchilus nigricapillus*) also perform solos, albeit not as frequently as duets. In this study, we evaluated the acoustic transmission of solos and duets of Bay Wrens in their habitat, the tropical rainforest. We found that compared to solos, duets experience lower attenuation in the forest, defined as the decrease in signal-to-noise ratio. This result suggests that duets are better adapted for long-range transmission and may explain why Bay Wrens use duets more frequently than solos. The decreased transmissibility of solo songs may imply an evolutionary trade-off between individual and cooperative singing in wrens.

## 48 USING COMPUTER VISION TO EXPLORE THE LINK BETWEEN BEAK MOVEMENTS AND BIRDSONG IN THE WILD

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Birdsong is a complex, multimodal behavior crucial for communication and fitness. Song production originates in the syrinx, the bird's vocal organ, then the final acoustic output is filtered through coordinated body movements—such as those of the beak and throat—that modify key song characteristics like frequency and tonality. Despite previous studies on specific species, the relationship between acoustics and body posture remains largely unexplored across taxa. Advances in machine learning and computer vision, particularly DeepLabCut, now enable high-throughput, precise tracking of this biomechanical filtering during song production. Using 159 field-recorded songs and crowd-sourced videos from the Macaulay Library, we applied DeepLabCut to quantify beak gape movements in White-crowned Sparrows. Our analysis revealed a positive correlation between beak gape angle and dominant frequency, mirroring patterns observed in manually-scored videos of related species, White-throated and Swamp Sparrows. These findings suggest a biomechanical constraint or adaptation influencing song filtering, such as beak size or maneuverability. By leveraging DeepLabCut's precise tracking capabilities, this approach will be expanded in future research to analyze a broader range of New World sparrows

(Passerellidae), enabling a detailed, data-driven investigation of the evolutionary drivers of song filtering and their role in shaping species-specific vocal traits.

### 49 THE EFFECT OF TEMPERATURE ON MALE ZEBRA FINCH (*TAENIOPYGIA CASTANOTIS*) SOCIAL INTERACTIONS

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Extreme weather events are becoming increasingly frequent, posing significant risks to small endotherms worldwide. While heatwaves are known to disrupt breeding behaviors, their effects on same-sex social interactions remain poorly understood. In this study, we will investigate how elevated temperatures influence social dynamics in zebra finches (*Taeniopygia castanotis*). Male pairs will be exposed to temperatures within and above their thermal neutral zone, and we will quantify their aggressive and affiliative behaviors. This research will provide insight into how social behaviors shift in response to thermal stress, offering a foundation for predicting potential impacts on avian social dynamics in a rapidly changing climate.

### 50 DIALING UP THE COMPETITION: MALE TREEFROGS DYNAMICALLY ADJUST CALLING BEHAVIOR IN RESPONSE TO RIVAL MALES

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Male treefrogs exhibit substantial within-individual variation in calling traits, which can obscure differences among individuals and influence female mate choice. Understanding how signaling behavior is modulated in response to competition offers insights into behavioral plasticity and performance trade-offs, yet the functional role of this plasticity in competitive male interactions remains less understood. We examined the calling behavior of Cope's Gray treefrog (*Hyla chrysoscelis*) across different competitive environments using a field playback experiment. Calling males were recorded before, during, and after stimulus playback (3 minutes each period, 9 min total; n = 59 males). Competitive intensity was manipulated via call rate, with males receiving either a slow, standard, or fast playback treatment using temperature-corrected stimuli. Preliminary results suggest that males exposed to the fast-treatment stimulus significantly increased call duration and call rate during the stimulus period. In contrast, males in the slow-treatment group decreased call duration and showed a non-significant trend toward increased call effort. Across treatments, call rate variability increased during the stimulus period compared to the pre-stimulus period and remained elevated post-stimulation, highlighting competition-related changes in calling behavior. These results provide evidence that males adjust their signaling behavior in response to male-male competition. More broadly, our findings suggest that plasticity in calling behavior may serve not only to enhance mating success but also to mediate competitive interactions between males.

### 51 A SYSTEMATIC STUDY OF FREEZING BEHAVIOR IN EARTHWORMS IN RESPONSE TO AUDITORY AND VIBRATORY STIMULI

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This study examined the parameters needed to reliably induce a freezing response to a predator-like auditory stimulus (grunting), with and without added vibration, in the earthworm species *Eisenia fetida*. Forty earthworms (0.3 - 0.6 g in weight, clitellum not required) were presented with a series of eight, 23s grunting sounds at varying amplitudes (55.15 dB - 64.75 dB), and were presented in either serial or random order with a mean interstimulus interval of 3 min. In addition,

the speaker location was varied; either placed 1-inch away from the apparatus or touched the apparatus, producing a physical vibration with the sound. This resulted in a 2 x 2 design with 10 subjects per group. The first behavior exhibited following each stimulus presentation was recorded. Behaviors were codified. We hypothesized that the addition of physical vibration would elicit higher rates of freezing but that the order of presentation (serial amplitude changes or random) would have no effect on freezing behavior. The amplitude series was split in half with a "low" (55.15 dB - 61.30 dB) range and "high" range (63.55 dB – 64.75 dB). A 2x2x2 mixed factorial ANOVA was used to assess the statistical significance of order (serial or random), stimulus (auditory- alone versus auditory- vibratory compound), and level (low or high) on freezing behavior. The main effect of stimulus type was significant, with the auditory- vibratory compound causing significantly higher freezing compared to sound-alone, $f(1,36)= 6.78$; $p=.01$. The main effect of amplitude level (low, high) indicated that higher amplitudes elicited significantly more freezing compared to the lower amplitudes $f(1, 36)=7.28$; $p=.01$. No interactions between the variables were observed.

## 52 IMPACT OF TEMPERATURE ON SONG PRODUCTION AND DURATION IN ZEBRA FINCHES (*TAENIOPYGIA CASTANOTIS*)

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Global climate change is driving increases in ambient temperatures and the frequency of extreme heat events, which may significantly affect animal behavior. For songbirds like zebra finches (*Taeniopygia castanotis*), rising temperatures could alter reproductive behaviors by forcing trade-offs between thermoregulation and song production, a key component of mate attraction. While previous studies have shown that male zebra finches sing less in hotter conditions, the precise temperature threshold at which this decline begins remains unknown. This study aims to identify that threshold by quantifying changes in song length, motif number, and song production across five temperature treatments ranging from 28ºC to 43ºC. Using a within-subjects design, we systematically measured song characteristics at each temperature. Our findings will provide insight into how climate change may alter avian communication and mating strategies in a songbird.

## 53 A COVER OBJECT EXCLUSION EXPERIMENT BETWEEN ZIGZAG SALAMANDERS (*PLETHODON DORSALIS*) AND NATIVE CENTIPEDES

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Salamanders are important terrestrial and fossorial vertebrates that provide a critical trophic link in forests in the Eastern United States. Decades of anecdotal observations suggest that various species of native centipede interact negatively with terrestrial Plethodontid salamanders. To assess this interaction, we conducted an exclusion experiment in the laboratory to determine the nature of the interaction (competitive, predatory, etc.) between these species. Salamanders were individually housed in petri dishes with a cover object and allowed to establish a territory. A size-matched centipede (*Scolopocryptops sexspinosus*) was then introduced into the arena and the position (edge, open, partial cover, full cover) of both species was recorded for 72 hours; a control treatment was also established in which salamanders did not receive a centipede. Our results indicate a complex interaction between the salamanders and centipedes that may be competitive in nature. These results are discussed in light of previous research with other species of salamanders and in the context of the natural history of both organisms.

## 54 OUTCOME DEVALUATION REVEALS THE TRANSITION TO HABIT IN ACTIVE AVOIDANCE

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Previously published work in reward learning shows that goal-directed behavior transitions to habitual (outcome-independent) control with extended training. Additional studies show that underlying this transition is the migration of neural control over instrumental behavior from one region to another. Whether the same transitional and migratory processes underlie the formation of habits driven by fear and anxiety is not clear. Given the procedural and interpretive complications present in the dominant model with which to study these processes (i.e., avoidance learning), progress has been slow, but early findings suggest there may be similarities across motivational domains. To further analyze this, an outcome devaluation task was incorporated into a Sidman avoidance procedure using rodents, as well as an aversive Pavlovian-Instrumental transfer (PIT) task. By counter conditioning avoidance feedback stimuli with shock, avoidance and PIT was significantly attenuated. Additional studies show evidence that avoidance and transfer effects are sexually dimorphic, and current work is evaluating whether outcome devaluation may be as well.

## 55 EFFECTS OF CADMIUM EXPOSURE ON THE BEHAVIOR, HEALTH, AND DEVELOPMENT OF A DUNG BEETLE (*DIGITONTHOPHAGUS GAZELLA*)

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Heavy metals have been shown to have a wide range of harmful effects in both humans and non-human animals, but there is a comparative lack of research on how they affect invertebrate decomposers. This study investigates how the presence of heavy metals affects the behavior, health, and development of a dung beetle (*Digitonthophagus gazella*) through both acute and chronic exposure to cadmium. As an environmentally abundant and almost universally toxic heavy metal, cadmium has been shown to negatively affect a wide range of traits in many other species, with an emphasis on studying mortality-related events. In this study, we are conducting a three-part experiment to comprehensively assess the effects of cadmium on *D. gazella*, an important decomposer and nutrient cycler. First, using a two-choice test, we will assess whether *D. gazella* shows a preference or aversion to the presence of cadmium. For the second part, adult beetles will be chronically exposed to cadmium across a concentration gradient mixed into the dung they feed on and the soil they live in. We will measure cognition, aggression, and fecundity after 2 weeks of exposure, as well as lifespan when exposed indefinitely. For the third part, we are raising *D. gazella* offspring from the egg stage in dung contaminated with the same concentration gradient of cadmium as the adult exposure experiment. We will monitor developmental outcomes through the larval and pupal stages as well as cognition, aggression, morphology, and lifespan in adults for these individuals. This experiment will support our understanding of how decomposers handle toxic environmental pollutants like heavy metals. Results of this study will provide new information on how exposure to sublethal doses of environmental toxins affects phenotypes such as behavior and fecundity, which are vital to an organism's success and ecological function but have received comparatively less attention.

## 56 FORAGING EFFICIENCY OF RURAL AND URBAN HOUSE SPARROWS, *PASSER DOMESTICUS*, AMONG NATURAL AND UNNATURAL OBSTACLES

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Urbanization may lead to food displacement for many animals. Urban birds are exposed to man-made objects that can result in variable food locations, unlike rural birds who inhabit areas where food locations are typically consistent. The introduction of unnatural obstacles may affect a sparrow's ability to find and reach food sources. Scientific studies have yet to find a significant increase in problem-solving skills related to foraging in urban versus rural birds. Our research seeks to determine the foraging efficiency of rural and urban house sparrows when exposed to obstructed food sources. Novel objects near a food source may scare birds away, but the necessity for food may overcome fear. House sparrows, *Passer domesticus*, are excellent model organisms to study urbanization effects because they inhabit both rural and urban environments. In our experiment, birds were habituated and trained to forage from a feeding grid. Using either natural or unnatural materials, we covered the entirety of a grid structure; food was placed in the same squares as when uncovered. Foraging efficiency was measured as the latency for a sparrow to uncover the food source and begin eating once released into the enclosure. We hypothesized that urban and rural house sparrows will differ in their foraging behavior. Therefore, we predicted that urban birds would exhibit higher foraging efficiencies when exposed to unnatural obstacles (e.g. plastic, snack wrappers) than rural birds. Regarding natural barriers (e.g. leaves, woodchips), we predicted that both urban and rural house sparrows will exhibit no behavioral differences. This study will provide insights into the foraging habits and, therefore, the survival of sparrows in an increasingly urbanized world. By identifying differences between rural and urban house sparrows' foraging strategies, the effects of urbanization on animal behaviors will be better understood.

## 57 USING THE ZOOMONITOR APP FOR BEHAVIORAL DATA COLLECTION AT LINCOLN PARK ZOO

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As behavior is the leading indicator for assessing animal welfare in zoos, a standardized, systematic method for behavioral data collection is essential for continuous and reliable welfare insights. The ZooMonitor app, developed by Lincoln Park Zoo and Tracks Data Solutions, is a free app that allows users to create projects for monitoring behavior and space use for focal individuals or groups and score individual characteristics (i.e., body/feather condition). These data can then be analyzed using ZooMonitor to conduct inter-observer reliability tests, create activity budgets, and generate heat maps to visualize how animals use their space. Organizations using ZooMonitor can also collaborate with one another on multi-institutional projects through the ZooMonitor Community. Since the app was launched in 2016, over 1500 groups have registered for ZooMonitor and it has become a leading tool for behavior research in zoos and aquariums. Here, we present some examples of how the ZooMonitor app has been used at Lincoln Park Zoo for ongoing behavioral monitoring.

## 58 BALANCING LEVELS OF VIGILANCE UNDER DIFFERENT LEVELS OF PREDATION RISK TO MAXIMIZE FORAGING SUCCESS IN GREY SQUIRRELS USING AN INDIVIDUAL-BASED MODEL APPROACH

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Squirrels commonly display vigilance behavior while foraging, which affects their foraging efficacy. Vigilance behavior is necessary if there is a non-zero risk of predation. Thus, there is a tradeoff between vigilance behavior and foraging efficiency, which must be balanced against predation

risk. We hypothesized that vigilance would affect foraging success. To test this hypothesis, we used a custom-built individual-based model in NetLogo. We predicted that moderate levels of vigilance would be the most effective strategy to maximize the number of nuts cached under different levels of predation risk. Our simulations focused on three scenarios: 1) no competition for nuts and low predation risk, 2) high competition for nuts and moderate predation risk, and 3) low competition for nuts and high predation risk. We ran each scenario using three levels of vigilance: two levels set (med and high), and the 3rd level (low) was based on field observations of grey squirrels on KWC's campus. We found that squirrels who engaged in high vigilance were too observant to forage and collect food; conversely, squirrels with too low vigilance were not attentive enough and, therefore, consumed. These findings imply that moderate levels of vigilance in simulated squirrels may be a successful strategy when faced with different levels of predation risk.

59 THE ROLE OF BODY SIZE IN VOCAL PRODUCTION OF ECUADORIAN HUMMINGBIRDS

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A common trend seen throughout many taxonomic groups is an allometric relationship between an organism's body size and physical characteristics. Typically, species that are larger in size will develop larger vocal organs that produce lower-pitched vocalizations. Inversely, smaller species develop smaller vocal organs that produce higher-pitched sounds. In these cases, body size can become a reliable predictor of frequency of vocal production. Some species of hummingbirds produce vocalizations with a fundamental frequency greater than 8 kHz, which falls beyond the known hearing capabilities of most birds. Furthermore, our current knowledge of HF vocalizers shows that these species exhibit a wide range of body sizes. Therefore, we are interested in understanding whether hummingbirds, including those that produce HF vocalizations, follow this acoustic allometry. If hummingbirds followed standard allometric trends, then smaller hummingbirds would vocalize at higher frequencies and would be more likely to produce HF vocalizations. Using a publicly available repository, we conducted a detailed acoustic analysis of 621 recordings of 126 species of hummingbirds that occur in Ecuador. Our preliminary analysis using phylogenetic regression to compare body mass to fundamental frequency suggests that there was no correlation between body size and fundamental frequency of vocalizations in this group of birds. This means that factors other than body size influence the production of HF vocalizations in hummingbirds, raising questions about the mechanisms involved in determining their vocal frequencies and how hummingbirds recognize and use HF vocalizations in communication.

60 EXPERIMENTAL OBSERVATIONS OF ARBOREAL BEHAVIOR IN MULTIPLE SPECIES OF FOSSORIAL SALAMANDERS

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Salamanders provide a critical link in food webs between leaf-litter invertebrates and higher vertebrates such as small mammals and birds. While their perception as secretive and fossorial is well deserved, observations from night-time field excursions suggest that many species frequently exhibit arboreal behavior. This arboreal activity includes climbing vertical tree trunks, ferns and other herbaceous plants, and rocky structures up to heights including several meters. We set out to determine the propensity for arboreal behavior in various species of salamander including the genera *Plethodon*, *Desmognathus*, and *Eurycea*. Salamanders were placed in an arena with a substrate of sphagnum moss and a vertically oriented set of platforms coupled with

interconnected ramps. A single salamander was placed in each arena and diurnal and nocturnal movements within the arena were monitored. All species climbed the vertical structures, but the propensity to climb differed between species and genera. While observational in nature, these results suggest that arboreal behavior is common among terrestrial salamanders with climbing behavior likely corresponding to the ecology and natural history of each clade.