The 15th Indiana University

ANIMAL BEHAVIOR CONFERENCE

Friday, April 25, 2008

Indiana Memorial Union Solarium
Bloomington, IN

8:30am - 5:30pm

http://Indiana.edu/~animal

The 15th Annual Indiana University Animal Behavior Conference Schedule

Thursday, April 24

5:30– 8:00pm	**Hang Posters (IMU / Solarium)**
7:00– 8:00pm	**Reception at CISAB, 402 N. Park Avenue (corner of 8th & Park)**

Friday, April 25

8:00 — 8:30	**Hang Posters & load talks**
8:30 — 8:55	**Continental breakfast**
8:55 — 9:00	**Welcome from CISAB director, Greg Demas**

ORAL PRESENTATIONS

Session I (Moderator: Mayte Ruiz)

9:00 — 9:15 **Jorge Morales**
IS ANIMAL PERCEPTION A BUZZING BLOOMING CONFUSION? AGAINST THE IMPOSSIBILITY OF ANIMAL PERCEPTION IN MCDOWELL'S MIND AND WORLD.

9:15 — 9:30 **Shely Ferguson**
DENDRITIC ATROPHY FOLLOWING PARTIAL MOTONEURON DEPLETION: TIME COURSE OF RECOVERY AND PROTECTION WITH TESTOSTERONE.

9:30 — 9:45 **Aaron Wilber**
BRIEF NEONATAL MATERNAL SEPARATION ALTERS EXTINCTION OF CONDITIONED FEAR AND CORTICOLIMBIC GLUCOCORTICOID AND NMDA RECEPTOR EXPRESSION IN ADULTS.

9:45 — 10:00 **Brendon Fussnecker**
THE ROLE OF CGMP IN REGULATION OF HONEY BEE KRÜPPEL HOMOLOG-1.

10:00 — 10:15 **Skyler Place**
MATE COPYING IN HUMANS.

10:15 — 10:30 Refreshment Break

Session II (Moderator: Alex Bohorquez)

10:30 — 10:45 **Gissella Vasquez**
DIFFERENTIAL PHEROMONE RECEPTION BETWEEN TWO SPECIES OF MOTHS: GENE EXPRESSION VS. GENE SEQUENCE VARIATION.

10:45 — 11:00 **Alysia Vrailas Mortimer**
P38 MARK REGULATES AGE-DEPENDENT MOTOR DYSFUNCTION IN DROSOPHILA.

11:00 — 11:15 **Benjamin Miller**
DYSREGULATED INFORMATION-CODING BY MEDIUM-SPINY NEURONS IN STRIATUM OF FREELY BEHAVING MOUSE MODELS OF HUNTINGTON'S DISEASE.

11:15 — 11:30 **Joseph Normandin**
NATURE'S CHASTITY BELT: ANATOMY AND PHYSIOLOGY OF NUCLEUS PARAGIGANTOCELLULARIS AFFERENTS.

11:30 — 11:45 **Jennifer Akst**
A ROLE FOR SOCIAL CONTEXT IN COURTSHIP BEHAVIOR – LESSONS FROM SEAHORSE LOVE TRIANGLES.

11:45 — 1:00 Lunch Break (listing of local restaurants available at information table)

Session III (Moderator: Karen Acree)

1:00 — 1:15 **Dustin Reichard**
SPATIAL DYNAMICS OF FEMALE DARK-EYED JUNCOS DURING THE NESTLING STAGE

1:15 — 1:30 **Danielle Satre**
EFFECTS OF AN ANTI-ANDROGENIC PESTICIDE, VINCLOZOLIN, ON SONG PRODUCTION IN THE DARK-EYED JUNCO *(JUNCO HYEMALIS*).

1:30 — 1:45 **Jim Goodson**
DUDS AND STUDS: VASOTOCIN AND DOPAMINE SYSTEMS DIFFERENTIATE COURTING AND NON-COURTING MALE ZEBRA FINCHES.

1:45 — 2:00 **Becky Fuller**
MULTIPLE EFFECTS OF LIGHTING ENVIRONMENT ON COLOR PREFERENCE IN BLUEFIN KILLIFISH, *LUCANIA GOODEI.*

Session IV (Moderator: Winnie Ho)

2:00 — 2:15 **Richard W. Vogel**
A DIFFERENTIAL ROLE FOR CEREBELLAR CORTEX IN LEARNING OPTIMAL VERSUS NON-OPTIMAL INTERVALS IN EYEBLINK CLASSICAL CONDITIONING.

2:15 — 2:30 **Kristal Cain**
DOES DIGIT RATIO PREDICT GONAD FUNCTION: A TEST OF A PRIMARY ASSUMPTION OF 2D:4D.

2:30 — 2:45 **Cameron Buckner**
INTENTIONAL PSYCHOLOGY AND THE SCIENCES OF ANIMAL BEHAVIOR: COMPETITION, COOPERATION, AND THE WAY FORWARD.

2:45 — 3:00 **Kyle Robertson and Jonathan Atwell**
CHANGES IN THE PARENTAL CARE OF DARK-EYED JUNCOS FOLLOWING THE COLONIZATION OF A NOVEL ENVIRONMENT.

3:00 — 3:15 **Ian Hall**
THE NEUROMODULATION OF AUDITORY PROCESSING CHANGES WITH BEHAVIORAL STATE.

3:15 — 4:15 POSTER SESSION and Refreshment Break

4:15 — 4:30 Awards Ceremony – Greg Demas

4:30 — 5:30 **Plenary Speaker** (introduced by Greg Demas)

Irving Zucker

WHY WE STUDY 'WEIRD' SPECIES AND TWO SEXES.

7:30 — 9:30 **Evening Reception**

Laura Hurley & Troy Smith's home
3660 E. Robin Road (see map below)
IU-ers are asked to bring a dish to share

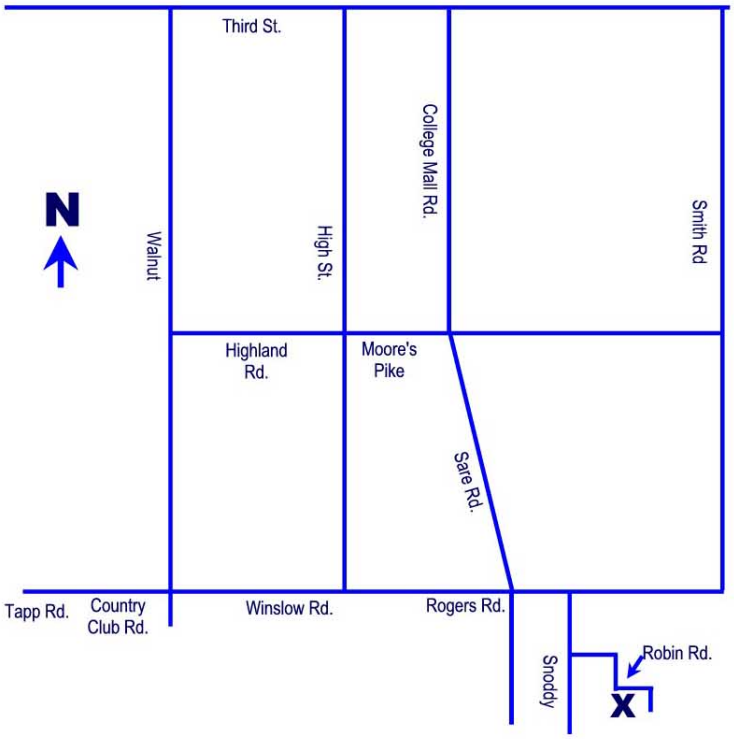
A special 'Thank You' to the Student Committee members for organizing the conference:

Tim Greives	Mayte Ruiz	Emily Chester	Margaret Hirschauer	Winnie Ho
Katy Lenz	Karen Acree	Saul Nava	Sayuri Kojima	Kristal Cain
Ben Miller	Jennifer Miller	Ian Hall	Melissa Scotti	Idelle Cooper
Andrea Gillman	Aaron Wilber	Carolina Penalva-Arana		Alex Bohorquez
Dawn O'Neal	Jenelle Dorner	Bob Bowers		

MAP to Smith/Hurley house

Directions:

1. Take your favorite route south (unless you live even further south) to Tapp/Country Club/Winslow/Rogers.
2. Go east on Tapp/CountryClub/Winslow/Rogers (unless you're coming down Smith Rd., in which case, go west).
3. Turn south onto Snoddy Rd.
4. Turn left onto Robin Rd. (at the bottom of the hill).
5. Robin Rd. will turn to the right. Our driveway will be right in front of you (where Robin Rd. turns left again). Our house is white with red brick. The address is 3660. Phone 332-1691.



TALK PRESENTERS AND ABSTRACTS
(in order of presentation)

1. Jorge Morales (jorgemlg@gmail.com)

IS ANIMAL PERCEPTION A BUZZING BLOOMING CONFUSION?
AGAINST THE IMPOSSIBILITY OF ANIMAL PERCEPTION IN MCDOWELL'S MIND AND WORLD.

J. Morales
Instituto de Investigaciones Filosóficas, The National University of Mexico (UNAM), Mexico City, Mexico

In Mind and World (1994), John McDowell asserts that perception is always filtered by concepts or spontaneity. Without concepts rooted all the way down to perception, it would be impossible to have "ordered" or "intelligible" perceptions. In this paper, I will challenge this view. In order to do so I will focus on the animal perception debate and try to show how the concept-dependant perception occurs just in some cases and it is not necessary at all in order to have a simple perception. At a first stage, I will refute what I call the Traditional Argument of Animal Perception, which states that animal perception is just as human perception minus rationality. Then I will show the implausibility of McDowell's arguments and, in a third moment, I will show that the difference between simple seeing and seeing as is quite useful both for refuting McDowell and for understanding the possibility of animal perception. This will allow attributing full-ordered non-conceptual perceptions to animals, pre-linguistic humans and, in some cases, even to adult linguistic humans.

2. Shely Ferguson (asf@indiana.edu)

DENDRITIC ATROPHY FOLLOWING PARTIAL MOTONEURON DEPLETION:
TIME COURSE OF RECOVERY AND PROTECTION WITH TESTOSTERONE

A. S. Ferguson & D. R. Sengelaub
Department of Psycholoical and Brain Sciences & Program in Neuroscience, Indiana University

In male rats, motoneurons of the spinal nucleus of the bulbocavernosus (SNB) project to the highly androgen sensitive bulbocavernosus and levator ani (BC/LA) muscles. We have previously demonstrated that partial depletion of motoneurons from the SNB induces dendritic atrophy in remaining motoneurons, and that treatment with testosterone (T) is neuroprotective against this atrophy. We assessed dendritic atrophy after partial motoneuron depletion in SNB motoneurons at a variety of time points, to determine its time course and pattern with and without T treatment. Motoneurons innervating the BC/LA muscles in gonadally intact males were selectively killed by intramuscular injection of cholera toxin-conjugated saporin. Simultaneously, saporin-injected males were given T implants (45mm) or left untreated. At 2, 4, 6, or 10 weeks after motoneuron depletion, motoneurons innervating the contralateral BC were labeled with cholera toxin-conjugated HRP, and dendritic arbors were reconstructed in 3 dimensions. Dendritic atrophy in remaining SNB motoneurons progresses linearly over several weeks, with a decrease of 32% present at 2 weeks after motoneuron depletion, a decrease to 66% at 4 weeks, evidence of recovery in dendritic lengths at 6 weeks post depletion (only 43% decreased), and by 10 weeks SNB dendritic lengths had returned to those of normal, intact males. These findings suggest that SNB dendrites undergo a protracted atrophy and subsequent recovery following partial motoneuron depletion, and that the neuroprotective effects of T attenuate the magnitude of the induced atrophy.

3. Aaron Wilber (awilber@indiana.edu)

BRIEF NEONATAL MATERNAL SEPARATION ALTERS EXTINCTION OF CONDITIONED FEAR AND CORTICOLIMBIC GLUCOCORTICOID AND NMDA RECEPTOR EXPRESSION IN ADULTS.

A. A. Wilber, C. J. Southwood, & C. L. Wellman.
Department of Psychological and Brain Sciences & Program in Neuroscience, Indiana University.

Neonatal maternal separation alters adult HPA axis responsivity to stress, adult emotionality, and glucocorticoid receptor concentrations in forebrain regions such as the hippocampus. To investigate effects of neonatal maternal separation on emotion regulation and its neural substrates, we assessed acquisition and extinction of conditioned fear in adult rats that underwent neonatal maternal separation. Corticolimbic circuitry including basolateral amygdala and medial prefrontal cortex are critical for acquisition and extinction of conditioned fear, and such learning is NMDA receptor-dependent. Thus, we used immunohistochemistry to assess expression of the glucocorticoid receptor and the NR1 subunit of the NMDA receptor in basolateral amygdala and medial prefrontal cortex. On postnatal days 2-14, pups underwent control rearing or maternal separation for 15 min per day. Adult fear conditioning and extinction were then assessed. Rats received 5 tone-alone habituation trials, then 7 tone/footshock pairings. After 1 h, rats received tone-alone extinction trials to criterion, and 15 recall of extinction trials the next day. Brains were processed for immunohistochemical labeling of glucocorticoid receptors and NR1, and staining was quantified. Brief maternal separation did not alter acquisition or initial extinction, but impaired recall of extinction. Brief maternal separation did not alter glucocorticoid receptor or NR1 expression in basolateral amygdala. However, brief maternal separation reduced GR and NR1 expression specifically in the infralimbic region of medial prefrontal cortex, consistent with work implicating this area in recall of extinction. Thus, brief maternal separation impaired recall of extinction and reduced glucocorticoid receptor and NR1 expression in its neural substrate.

4. Brendon Fussnecker (blfussne@ncsu.edu)

THE ROLE OF CGMP IN REGULATION OF HONEY BEE KRÜPPEL HOMOLOG-1

B. L. Fussnecker & C. Grozinger
Departments of Entomology and Genetics & W.M. Keck Center for Behavioral Biology,
North Carolina State University.

Little is known about the genetic impetus and regulation of honey bee foraging, a complex and fascinating behavior. Krüppel homolog-1 (Kr-h1) was originally identified as one of the few genes stably downregulated by queen mandibular pheromone (QMP) in young worker bees over a period of several days. Subsequently, it was found that Kr-h1 is expressed at higher levels in forager honey bees than in young bees that perform in-hive tasks. We hypothesize that Kr-h1 expression in foragers may be correlated with one or more aspects of foraging such as phototaxis. To determine if Kr-h1 is associated with phototaxis, we treated caged bees with cGMP, which increases activation of protein kinase G (PKG) leading to increased phototaxis and precocious foraging. We found a significant difference in brain Kr-h1 levels between treatment groups. Worker honey bees treated with cGMP were also found to be unresponsive to queen mandibular pheromone (QMP), the primary pheromone used by the queen to exert control over the honey bee colony. Finally, we discovered a cGMP response element in the promoter of the Kr-h1 gene. This element is also found in the promoters of mosquito and fruit fly Kr-h1 orthologs. These results suggest that Kr-h1 expression may be regulated by the cGMP/PKG pathway and that Kr-h1 is correlated with behaviors that aid in the preparation for tasks outside the hive.

5. Skyler Place (ssplace@indiana.edu)

MATE COPYING IN HUMANS

S. S. Place & P. M. Todd
Department of Psychological and Brain Sciences & Cognitive Science Program, Indiana University

In mate choice, animals and humans alike must gather information regarding a target's quality to make an informed choice. One source of information is to watch the choices of others, and then mimic their decisions. This phenomenon, known as mate copying, is well documented in fish and bird species. Recently, scientists have tried to find a similar mate copying effect in humans. Some new research has shown that humans do appear to utilize peer preferences; however, the methodology of these experiments calls into question their external validity and comparability to animal results. Our experiments utilize a new methodology—having people watch mate-choice related interactions of others and subsequently rate their attractiveness as mates—that bridges the gap between previous mate copying research done with humans and animals. Our results show that a degree of mate copying exists in this setting, strengthening the argument that the utilization of social information in mate choice is present in humans as well as other species.

6. Gissella Vasquez (gmvasque@ncsu.edu)

DIFFERENTIAL PHEROMONE RECEPTION BETWEEN TWO SPECIES OF MOTHS: GENE EXPRESSION VS. GENE SEQUENCE VARIATION.

G. Vasquez, P. Fischer, S. Lorick, C. Grozinger, & F. Gould
Department of Entomology, North Carolina State University

In moths, females emit a pheromone composed of a species-specific blend of two or more volatiles that attract conspecific males that respond selectively to that blend. This long-distance sexual communication system is highly diverse as indicated by the broad array of pheromone signals and responses observed among moth species, raising the question of how this signal/response diversity may have evolved. To better understand the genetic changes involved in evolution of male moths species-specific responses, we determined levels of expression of four *Heliothis virescens* pheromone receptor candidate genes and compared them with those of homologous genes of the closely related H. subflexa. Pheromone receptor candidate genes were selected based on results from backcross QTL analysis that indicated that these genes cosegregated with male response to species-specific pheromone components. Candidate pheromone receptor gene expression levels were measured in male and female adult antennae to determine male-specific expression in both species and whether differences in gene regulation occurred between species. Structural regions of candidate pheromone receptor genes were sequenced to identify specific allelic differences that could be involved in species-specific male response to pheromone compounds. Results are discussed in terms of the role that interspecific differences in gene expression levels and specific genetic differences in coding regions of these candidate pheromone receptor genes play on specificity of male antennal receptors in moth species with complex pheromone blends and male responses.

7. Alysia Mortimer (avraila@emory.edu)

P38 MAPK REGULATES AGE-DEPENDENT MOTOR DYSFUNCTION IN DROSOPHILA

A. V. Mortimer[1,2], J. Gu[1], & S. Sanyal[1,2]
[1]Department of Cell Biology, Emory University, Atlanta, GA, 30322-3030, USA
[2]Center for Behavioral Neuroscience, Atlanta, GA, 30302, USA

Several neurodegenerative disorders in humans include progressive deterioration of motor function. Parkinson's Disease (PD), for instance, is characterized by tremors, stiffness of the body, bradykinesia, and impaired balance and coordination. Prior studies in human and animal models of PD have implicated increased oxidative stress in disease incidence. Oxidative stress activates a variety of signaling cascades, including the stress activated protein kinase, p38 MAPK (p38K). However, cellular mechanisms of p38K stress response in neurons, which influence PD remain unclear. To understand how p38 MAPK regulates neural function and behavior, we are studying the conserved p38K signaling cascade in Drosophila, a genetically amenable model organism.

To initiate studies on p38K, we first generated a mutant fly strain in which both p38K homologues have been knocked out. Interestingly, removing both genes, but not either one alone, results in premature lethality. We have characterized several parameters of motor control in these p38K knockouts and find that they exhibit age dependent locomotor defects. Furthermore, like other Drosophila models of neurodegeneration, p38K knockouts display increased sensitivity to oxidative stress. We are further investigating the electrophysiological and cellular correlates of these behavioral phenotypes.

Potential cellular regulators of p38K function include phosphorylation and nuclear translocation. Therefore, we have developed novel in vivo reporters of p38K nuclear translocation. Initial results suggest that p38K nuclear entry is restricted to motor neurons and higher "learning centers□Ein the CNS. Future studies will explore these mechanisms of p38K regulation in neurons and test interactions between p38K and known models of age-dependent neurodegeneration.

8. Benjamin Miller (benmille@indiana.edu)

DYSREGULATED INFORMATION-CODING BY MEDIUM-SPINY NEURONS IN STRIATUM OF FREELY BEHAVING MOUSE MODELS OF HUNTINGTON'S DISEASE

B. R. Miller and G. V. Rebec
Program in Neuroscience & Psychological and Brain Sciences, Indiana University

The striatum, which serves as the information processing hub of the basal ganglia (BG), integrates sensorimotor, cognitive, and motivational information arising from the entire cortical mantel to control behavioral. Medium-spiny neurons (MSNs), which constitute > 90% of striatal neurons, are the sole output, thus representing a critical node for information coding in the BG. In fact, increasing evidence implicates MSNs in the behavioral phenotype of Huntington's disease (HD), an autosomal dominant condition caused by an expansion of a polyglutamine (CAG) repeat in the coding region of the huntingtin gene. Although the loss of these cells may play a role in the cognitive, emotional, and motor symptoms of HD, recent evidence suggests that the onset and progression of the behavioral phenotype is likely caused by deficits in corticostriatal information processing that precede cell death. Mice that model HD, for example, show behavioral symptoms long before significant cell loss. These behavioral changes, moreover, are accompanied by changes in the intrinsic properties of MSNs. There is little evidence, however, about how MSN malfunction contributes to their spike output during behavior, which depends on the spatiotemporal convergence of glutamatergic signals arising from cortex. To investigate how MSN output is compromised in HD we used chronically implanted micro-wire electrodes to record from MSNs in symptomatic HD mice and WT controls as they behaved freely in an open field. Our results suggest an important role in both bursting and synchrony for information coding by MSNs. Dysregulation of these parameters, moreover, are key components of HD pathophysiology.

9. Joseph Normandin (jnormandin1@gsu.edu)

NATURE'S CHASTITY BELT: ANATOMY AND PHYSIOLOGY OF NUCLEUS PARAGIGANTOCELLULARIS AFFERENTS

J. J. Normandin & A. Z. Murphy
Center for Behavioral Neuroscience, Department of Biology, Georgia State University

Sexual dysfunctions, which disrupt genital reflexes, impede fertility and also interfere with quality of life experiences. However, little is known about how the brain regulates genital reflexes. The brainstem nucleus paragigantocellularis (nPGi) of rats is a well-established source of tonic inhibition of genital reflexes. To delineate the anatomical and physiological organization of nPGi afferents, which have not been fully characterized, the retrograde tracer Fluorogold (FG) was injected into the nPGi of male and female rats, and animals engaged in sexual behavior one hour before sacrifice. Cells containing FG, estrogen receptor alpha (ERα), androgen receptor (AR), and the immediate-early gene product Fos were identified immunocytochemically. A multitude of brain regions project directly to the nPGi in both sexes, and many of the FG+ cells in these regions also contained ERα or AR. However, retrograde labeling was most prominent in a minority of regions, such as the paraventricular nucleus (PVN) and periaqueductal gray (PAG). Sex differences were observed in the caudal medial preoptic area (MPO), a region critical to the expression of sexual behavior, with significantly more FG+ cells observed in males, and in the PAG and where more FG+ cells were observed in females. The proportions of FG+ cells that co-localized with sex-induced Fos was high in the PVN of both sexes, high in the MPO of males, but low in the PAG of both sexes. The characterization of these afferents furthers our understanding of the neural regulation of genital reflexes and provides targets for treatment of human sexual dysfunction.

10. Jennifer Akst (jakst@indiana.edu)

A ROLE FOR SOCIAL CONTEXT IN COURTSHIP BEHAVIOR – LESSONS FROM SEAHORSE LOVE TRIANGLES.

J. Akst
Department of Biology, Indiana University

In the family Syngnathidae (seahorses and pipefishes), females deposit their unfertilized eggs into male brood pouches where embryos are carried until independence (Vincent and Sadler 1995). Thus, only males can provide postzygotic care to the offspring, and certainty of paternity is very high (Masonjones and Lewis 2000). Many syngnathid species show polyandrous and polygynandrous mating systems and exhibit reversed sex roles, as might be predicted of species with high paternal care (Trivers 1976). However, the most derived of this family, seahorses (genus Hippocampus) (Wilson, Ahnesjo et al. 2003) exhibit similarly strong paternal care but do not show such obvious signs of sex-role reversal and appear to maintain monogamous relationships within and even across breeding seasons ((Wilson, Ahnesjo et al. 2003)). Monogamy has been suggested to increase reproductive success in populations of fish with low population densities or low mobility, or those that rely on camouflage for predator avoidance, and such qualities of seahorse populations have been noted as possible contributors to the maintenance of monogamy (Vincent and Sadler 1995). In this study, I investigate the effects of social context on the courtship behavior in the lined seahorse (Hippocampus erectus). Social context indeed significantly affected many of the behaviors measured, with individuals in threesome treatments being more active than those housed in pairs. In addition, across all social environments, males appeared more active than females. These results indicate that both social environment and sex have a significant influence on courtship behavior in this species, and the implications of these effects on the evolution of mating system are discussed.

11. Dustin Reichard (dgreicha@indiana.edu)

SPATIAL DYNAMICS OF FEMALE DARK-EYED JUNCOS DURING THE NESTLING STAGE

D.G. Reichard and E.D. Ketterson
Indiana University, Department of Biology

Studies of spatial activity in songbirds during the nesting cycle have largely focused on male activity, and neglected female use of space outside the fertile period. Using radio telemetry and GIS software, we estimated the home-range size of seven female Dark-eyed Juncos *(Junco hyemalis*) three days after their nestlings had hatched. We attached radio transmitters using a leg-loop harness and tracked these females for two hours on the afternoon of day three of nestling life and two hours in both the morning and afternoon on days four and five. Female location and behavior was noted every ten minutes for the duration of the tracking. Home-range size was found to vary greatly between individuals, which may be attributable to differences in resource availability and the relative densities of conspecifics. Female home-range decreased between the fertile stage and nestling stage and males maintained home-ranges about twice as large as females during the nestling stage. Studies of home-ranges such as this provide unmatched insight into a species' resource management, time budget, and social interactions under free-living conditions.

12. Danielle Satre (dasatr01@louisville.edu)

EFFECTS OF AN ANTI-ANDROGENIC PESTICIDE, VINCLOZOLIN, ON SONG PRODUCTION IN THE DARK-EYED JUNCO *(JUNCO HYEMALIS*).

D. Satre, M. S. Reichert, and C. Corbitt
Department of Biology, University of Louisville

Endocrine disrupting chemicals (EDCs) produce subtle changes in physiology and behavior by acting as hormone mimics or antagonists. The fungicide vinclozolin acts as an anti-androgen and has been shown to affect reproductive and other behaviors in rodents. To investigate the possible effects of exposure to EDCs on the development of song (i.e., song crystallization), we examined the effects of vinclozolin in wild-caught adult Dark-eyed Juncos (*Junco hyemalis*). Songbirds sing to establish and defend territories, as well as attract mates, and this behavior is largely under hormonal control. For many temperate species, testosterone has powerful activational effects on neuroplasticity and song production in adulthood. We hypothesized that vinclozolin would disrupt song production, or affect the degree of song crystallization. Starting in February, adult male juncos received daily oral gavage for 10 weeks with 100uL of either vehicle (organic canola oil) or 2mM vinclozolin dissolved in vehicle. After one week of dosing, juncos were photostimulated (16L:8D) and once singing began, were audiotaped using a directional microphone, twice for 15 minutes each. In addition, they were videotaped during song sessions. Audiotapes were digitized and analyzed using Syrinx software. Spectrograms produced by Syrinx were then used to describe each individual's song repertoire. While some song measures did not differ significantly between groups (# songs types and song duration), we found a statistically significant difference in the variation of inter-syllable distance (the time between syllables), suggesting that vinclozolin may disrupt seasonal song development by affecting the degree of song crystallization in adult male juncos.

13. Jim Goodson (jlgoodso@indiana.edu)

DUDS AND STUDS: VASOTOCIN AND DOPAMINE SYSTEMS DIFFERENTIATE COURTING AND NON-COURTING MALE ZEBRA FINCHES

J. L. Goodson, J. Rinaldi, A. M. Kelly, & D. Kabelik.
Department of Biology, Indiana University.

A variety of sociosexual behaviors are influenced by vasotocin/vasopressin (VT/VP) projections from the medial bed nucleus of the stria terminalis (BSTm) and by dopamine (DA) projections from the ventral tegmental area (A10 cell group) and midbrain central gray (A11). However, it remains unclear whether constitutive properties of DA and VT/VP neurons contribute to constitutive differences in behavioral phenotype. We now demonstrate that male zebra finches that exhibit a non-courting phenotype have dramatically fewer VT-immunoreactive (-ir) neurons in the BSTm than do normal (courting) males. Non-courting males also fail to show normal levels of Fos induction within VT-ir neurons following exposure to a female, although constitutive Fos expression in these neurons is equivalent to courting males. BSTm VT neurons exhibit Fos responses to a variety of positive social stimuli (i.e., those that elicit affiliation), but we here show that a non-social reinforcer induces no such response. Thus the VT neurons that differentiate courting and non-courting males are socially selective. A similar but less robust selectiveness was observed in the A11 DA neurons. No group differences were observed between courting and non-courting males in the midbrain DA populations, although the number of tyrosine hydroxylase-ir neurons in the central gray did correlate positively with the number of courtship songs given during behavioral prescreenings. These findings indicate that VT and DA cell groups both contribute to constitutive differences in behavioral phenotype.

14. Becky Fuller (fuller@life.uiuc.edu)

MULTIPLE EFFECTS OF LIGHTING ENVIRONMENT ON COLOR PREFERENCE IN BLUEFIN KILLIFISH, *LUCANIA GOODEI.*

B. Fuller,
School of Integrative Biology, University of Illinois.

Differences in lighting environment can have profound effects upon visually mediated behaviors. First, differences in lighting environments can affect the immediate perception of coloration due to differences in the ambient light spectrum and transmission properties of the environment. Second, differences in lighting environment can result in divergent selection for different sensory systems properties that maximize the ability of animals to obtain visual information resulting in genetic differences in visual systems between populations. Third, differences in lighting environment may induce developmental plasticity whereby animals differ in visual properties as a function of the conditions they experienced during development. Here, I present results from a study that tease apart the roles of genetics, rearing environment, and testing environment on foraging preferences in the bluefin killifish, *Lucania goodei*. My results indicate that there are effects of genetics, rearing environment, and testing environment. There are also non-additive interactions between rearing and testing environment which means that the effects of the current environmental conditions on perception will depend critically on the environments in which animals were raised. Three important implications emerge from this work. First, population differences in visually mediated animal behavior may differ for a multitude of reasons. Second, the ability to detect differences in behavior depends critically on the lighting environments in which animals are tested. Third, and most important, in nature dispersal between lighting habitats can result in populations with significant variation in visual perception simply due to long-lasting effects of developmental plasticity.

15. Richard W. Vogel (rivogel@indiana.edu)

A DIFFERENTIAL ROLE FOR CEREBELLAR CORTEX IN LEARNING OPTIMAL VERSUS NON-OPTIMAL INTERVALS IN EYEBLINK CLASSICAL CONDITIONING.

R. W. Vogel[1,2] & J. E. Steinmetz[2].
[1]Psychological and Brain Sciences & Neural Science, Indiana University
[2] Psychology & Molecular Biosciences, The University of Kansas.

The cerebellum is known to be important for a variety of complex behaviors that range from smooth coordination of movement to attention, language, memory and thought. My research investigates the role of cerebellar neurotransmitters in motor learning and memory. One common model for studying motor learning is eyeblink classical conditioning. In this approach, we present an auditory stimulus (CS) just prior to a blink-eliciting stimulus (US), and this training eventually results in a learned blink (CR) to the CS. The underlying neural circuitry for this behavior has been delineated, and critical regions include the cerebellum and associated hindbrain circuitry. My approach to studying this behavior has been to pharmacologically perturb discrete regions of the cerebellum with direct drug infusions, and analyze changes in the behavioral characteristics of the eyeblink CR. I will present data from an ongoing series of studies that examines the role of the cerebellar cortex in eyeblink classical conditioning, and how the importance of this region may be related to task parameters such as the interval between CS and US onset.

16. Kristal Cain (caink@indiana.edu)

DOES DIGIT RATIO PREDICT GONAD FUNCTION:
A TEST OF A PRIMARY ASSUMPTION OF 2D:4D.

K. Cain, C. Bergeon, & E. Ketterson
Department of Biology, Indiana University

The hormonal environment an animal experiences during development can have long-term effects on its behavior, morphology and physiology. Because birds are unable to alter the hormonal environment once the egg is laid, they serve as an excellent model for understanding these effects. Studies of mammals, including humans, have found a relationship between testosterone (T) exposure in utero and digit length ratios (DR), possibly due to the co-regulatory roles of specific homeobox genes on both digit and uro-genital development. These genes are highly conserved and recent work has examined this relationship in birds, where females are known to vary in the amount of T they deposit in eggs. If T during development affects the development of digits and gonads as thought then DR and gonad function should co-vary. I examined correlations between DR and gonad function, estimated by the ability of the testes to respond indirectly to Gonadotropin Releasing Hormone (GnRH), in a free-living songbird species, the dark-eyed junco. Preliminary results indicate evidence for a relationship between DR and gonadal function. Implications for the use of DR in birds and future work will be discussed.

17. Cameron Buckner (cbuckner@indiana.edu)

INTENTIONAL PSYCHOLOGY AND THE SCIENCES OF ANIMAL BEHAVIOR: COMPETITION, COOPERATION, AND THE WAY FORWARD.

C. Buckner
Department of Philosophy, Indiana University Bloomington

Philosophers and psychologists have had a difficult time defining the relationship between folk psychological explanations of behavior and current scientific alternatives, such as might be provided by behaviorism or neurophysiology. A full spectrum of views have been defended: it has been suggested that they are rivals locked in competition (Paul Churchland and C. L. Morgan), semi-autonomous denizens of different levels of explanation related at best by an implementation story (Fodor), non-overlapping methods of explanation with different explananda (Dretske), and that folk psychology provides a pragmatically necessary stopgap as we await the development of a mature neuroscience (Dennett).

Rather than trying to answer this question in a fully general way, I suggest that the question is better broached by considering the theoretical choices of scientists as they are made in particular contexts of application. I will consider several prominent uses of roughly folk-psychological reasoning in cognitive ethology and animal psychology. Reflection on these cases will show two things: 1) the relationship between folk psychological explanation and alternatives depends upon the nature of the appeal to the method and its context of application, and 2) in all cases, the legitimacy and utility of applying folk psychological reasoning to animals is threatened by the lack of a well-defined, psychologically plausible model of animal practical inference. Finally, a sketch of such a model will be defended which hinges on the notion of practical inference as categorization by similarity.

18. Kyle Robertson (kyrobert@indiana.edu) and Jonathan Atwell (jwatwell@indiana.edu)

CHANGES IN THE PARENTAL CARE OF DARK-EYED JUNCOS FOLLOWING THE COLONIZATION OF A NOVEL ENVIRONMENT.

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Colonization of novel environments may lead to changes in suites of associated traits, including socially selected behaviors, however there are few documented examples from natural populations. We studied the parental behavior of a songbird *(Junco hyemalis*) following its recent (ca. 1981) colonization of a novel, urban environment in coastal San Diego County, CA. We also studied the probable source population in the ancestral, montane breeding range near Mount Laguna, CA, in order to assess how parental care has rapidly changed post-colonization. We used two different methods to observe parental care at the nest in both populations: 1-hr focal watches in 2006; and 4-hr video-recordings in 2007. In both years, we found evidence for increased parental care in males of the colonist population, however, there was little or no difference in levels of parental care for females or pairs as a whole. Previous research has also shown that birds in the colonist population exhibit increased breeding season length, reduced levels of territorial aggression, and reduced plumage ornamentation, which together suggest rapid changes in a suite of associated socially selected traits post-colonization.

19. Ian Hall (ichall@indiana.edu)

THE NEUROMODULATION OF AUDITORY PROCESSING CHANGES WITH BEHAVIORAL STATE.

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Neuromodulation by serotonin plays an important role in the regulation of auditory processing. In the inferior colliculus (IC), a midbrain auditory nucleus, the effect of serotonin on evoked response properties can be dramatic but little is known about how the level of this neuromodulator changes with behavior. Voltammetry, a method of electrochemical measurement, was used to assay extracellular serotonin in behaving animals.

Levels of extracellular serotonin in the IC were monitored in response to pharmacological manipulation of the 5-HT1A inhibitory autoreceptor. Activation of this receptor decreases the activity of serotonin releasing neurons and thereby the level of serotonin in the IC. Blocking the 5-HT1A inhibitory autoreceptor prevents serotonin from activating the receptor, thus increasing raphe unit activity and serotonin in the IC.

Behavioral and environmental factors also influence IC serotonin. Serotonin levels in the IC increases in response to stress-inducing stimuli. In addition, serotonin levels in the IC increase during recovery from anesthesia. These results indicate that the neuromodulation of auditory processing by serotonin is dynamic and is strongest during periods of elevated behavioral state.

20. Irving Zucker (irvzuck at berkeley.edu)

WHY WE STUDY "WEIRD" SPECIES AND TWO SEXES"

I. Zucker
Department of Psychology, University of California-Berkeley

Three decades of local work on activity cycles of cotton rats, Syrian hamsters and golden-mantled ground squirrels, reproduction in white-footed mice, fat, gonadotropin and hibernation cycles of ground squirrels, food intake in hamsters, partner preferences in meadow voles, and pineal physiology of Turkish hamsters, illustrate that the answers to fundamental questions depend on the species and sex one studies. I'll argue that concentration on a few "official" species is premature, the anthropocentric approach to animal research has limitations as well as advantages, and laboratory analyses should be informed by field data. I'll discuss liabilities and advantages of species choice, document the neglect of females in physiological research on mammals, and why it is imperative to study both sexes in many contexts.

POSTER PRESENTERS AND ABSTRACTS
(in alphabetical order of presenter's name)

1. Rishi Ardeshna (rardeshn@indiana.edu)

CEFTRIAXONE EFFECTS ON NEURONAL FIRING IN STRIATUM OF MICE TRANSGENIC FOR HUNTINGTON'S DISEASE

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Huntington's disease (HD) is a progressive, neurological disorder with autosomal dominant inheritance. Electrophysiological recordings from mice transgenic for human HD show higher firing rates and decreased bursting in striatal neurons when compared to wildtype (WT) littermates. These changes may be linked to an abnormally high concentration of extracellular glutamate caused by dysfunction of GLT1, the transporter responsible for the clearance of most extracellular glutamate. In HD mice, the β--lactam antibiotic, ceftriaxone, up-regulates GLT1 expression, increases glutamate uptake, and ameliorates the behavioral symptoms in HD mice. Here, we test the hypothesis that ceftriaxone attenuates the altered firing properties of striatal neurons in symptomatic HD mice.

Mice transgenic for human HD (the R6/2 and 140 knock-in lines) and their corresponding WT controls were treated with 5 daily injections of ceftriaxone (200 mg/kg). Chronically implanted micro-wire bundles were used to record striatal electrophysiological activity under freely behaving conditions. Our results indicate that ceftriaxone lowers striatal neuronal firing rates and increases periods of bursting in HD mice compared to vehicle-treated animals. Thus, up-regulation of GLT1 not only improves behavioral symptoms but also enhances striatal information processing, implicating GLT1 as a key target in the development of an effective HD treatment.

2. Zachary Beals (zbeals@indiana.edu)

MALE DISPLAY QUANTITY MAY INFLUENCE FEMALE RECEPTIVITY IN SAGEBRUSH LIZARDS

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During the breeding season, males of many species need to identify and court the appropriate females in order to enhance their fitness. Some females will not respond to male courtship signal unless a certain physiological condition is reached. Still, the quality of male courtship has been shown to increase female reproductive state and investment. In this experiment, we explore whether the quantity of male displays similarly influences receptivity in female sagebrush lizards, *Sceloporus graciosus*. We presented females with one of two treatments: (1) display presentation every other day, (2) display presentation four times daily. We used a mechanical lizard to present displays; this model has been previously determined to be an accurate representation for natural male displays. After two weeks of exposure to display presentations, males were placed into the home aquarium of females and interactions were video recorded for 30 minutes. Male and female behaviors were assayed from these videotapes. Male and female display behavior did not differ between treatment groups. Nevertheless, females who had received more display presentations were further apart from males and looked towards males more during behavioral assays. Males exhibited more chemical behavior towards females that were exposed to more displays. These data suggest that females exposed to greater amounts of male courtship are paying more attention to conspecific male presence. Furthermore, males seem to be detecting a difference in the chemical signal of females that had received more displays. Future work should consider identifying hormonal differences between females receiving different levels of male display.

3. Anuradha Bhat (anubhat@indiana.edu)

BEHAVIORAL PLASTICITY AMONG ZEBRAFISH POPULATIONS IN RESPONSE TO FLUCTUATING HABITATS

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Early rearing experience can influence development of behavioral responses among fish populations. Recent studies on juvenile fish have shown that fish exposed to more variable cues during rearing exhibit more flexible shoaling responses when moved between different habitats. Based on these findings, we would expect wild populations of fish collected from natural habitats with highly variable environmental conditions to be behaviorally more flexible than fish reared in conventional hatchery environments. Here we measured behavioral traits among 2 wild ('Uttarbhag' and 'Pargana North' recently collected from natural habitats in India) and 1 hatchery bred ('Scientific Hatcheries') zebrafish populations and tested their responses when groups of individuals were switched between environments with variable flow and vegetation regimes. Behavioral responses of groups of 6 individuals from each population were tested and the extent of behavioral variation across 4 treatment (habitat) conditions was analyzed. While both flow and vegetation were found to significantly affect behavior among these populations, their plasticity in response varied widely across the different traits. We found that wild and hatchery bred populations showed significant differences in their behavioral responses across tank treatment conditions. These results have important implications for captive breeding and reintroduction of species into their wild environments.

4. Sonya Bierbower (sbierbower@uky.edu)

COMPARATIVE STUDY OF ENVIRONMENTAL MODULATION OF INTRINSIC BEHAVIOR IN SIGHTED AND BLIND CRAYFISH

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Agonistic behavior is well studied in crayfish during social interactions. Typically, encounters escalate from visual threats to physical confrontations, ultimately establishing social hierarchies. It is well documented that sensory cues play a major role in social interactions whether through chemosensory (odors), visual (opponent posturing) and/or tactile (physical combat). A social interaction behavioral scoring index was developed for species comparison of *Procambarus clarkii* (sighted) and *Orconectes australis packardi* (blind) crayfish in two environmental conditions, water present (typical) and water absent (undocumented). Currently, little is known of interaction dynamics in the absence of water which eliminates the typical escape response (i.e. tail flip) and introduces other factors including higher energy demand (no buoyancy), greater injury probability and reduced chemical cues (assessment). Preliminary findings of animals out of the water reveal both species do not tail flip, reduce antennule flicking, and show less intrusion into conspecifics territory. Surface crayfish showed an increase in visual displays (possible bluffing mechanism), but failed to escalate the interaction while cave crayfish were less responsive to the presence of conspecifics (fewer interactions). Therefore, interactions occurring out of water showed crayfish were less likely to interact and more likely to explore their environment. Currently, these behaviors are being compared to social interactions in water with reduced olfaction (coating antennules with Vaseline). Importantly, this will determine the environmental influence on behavior by removing the role of olfaction.

5. Dean Bowker (dbowker@indiana.edu)

NEURONAL PROCESSING IN THE BASOLATERAL AMYGDALA DURING COCAINE SELF-ADMINISTRATION AND CUE-INDUCED REINSTATEMENT.

D. B. Bowker, I. M. White, & G. V. Rebec.
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The reinstatement of drug-seeking behavior after a period of abstinence or withdrawal is a major obstacle in the search for an effective treatment of addiction. The basolateral nucleus of the amygdala (BLA) appears to play a critical role in reinstatement. Electrical stimulation of the BLA can reinstate cocaine self-administration (SA) following extinction, and an intact BLA is required for cue-induced reinstatement, suggesting that the BLA is involved in the associative aspects of reward processing. The present study tested this hypothesis by examining the electrophysiological characteristics of BLA neurons in rats (n=12) during cocaine SA training, extinction, and subsequent cue-induced reinstatement. Neuronal activity and behavioral events were recorded continuously throughout SA training, extinction, and reinstatement. Single-unit signals, amplified and discriminated by computer software, were categorized as cue- or response-related if a significant change in firing occurred 1 s after cue onset or 1 s before and after response onset, respectively. Rats showed relatively steady lever-presses throughout cocaine SA, during which an equal proportion of neurons responded to the cue (~21%) and lever press (~22%). During extinction sessions, when the cue was absent, ~29% of BLA neurons showed lever press-related activity. When drug seeking was reinstated, however, cue-related activity returned (~25% of neurons). Our data suggest that the BLA processes learned associations during cocaine addiction and that these associations are critical for cue-induced reinstatement of drug-seeking behavior.

6. Joanna Campodonico (jcampodo@indiana.edu)

AN INTERACTION BETWEEN PKC AND LIPOXYGENASE SIGNALING MAY UNDERLIE CONDITIONED INHIBITORY LEARNING IN HERMISSENDA

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Learning that one stimulus predicts the absence of another is an important form of associative learning, conditioned inhibitory (CI) learning. Research has shown that Hermissenda can learn that light (visual stimulation) predicts the absence of turbulence (vestibular stimulation). In Hermissenda Type B photoreceptors (a major site of plasticity), CI learning decreases light evoked spike frequency and application of arachidonic acid (AA) mimics the effect of CI learning. Further research has shown that metabolism of AA by the 12-lipoxygenase enzyme decreases spike frequency in untrained Hermissenda as well as in CI trained Hermissenda. However, AA has also been shown to activate PKC in several systems. Previous studies have shown that PKC is present in Hermissenda and involved in conditioned excitatory learning. Therefore, we asked if AA can activate PKC in untrained Hermissenda by applying H7 (a non-selective inhibitor of many serine/threonine kinases, including PKC). In the presence of H7, AA decreased spike frequency 52.0% +/- 4.0% (n=2), while AA alone decreased spike frequency by only 16.4% +/- 8.13% (n=11). This indicates that PKC opposes the spike frequency decrease produced by 12-Lipoxygenase signaling. For CI trained Hermissenda, we found that, in the presence of H7, AA decreased spike frequency 95.9% (n=1), while AA alone decreased spike frequency 98.5% +/- 0.3% (n=3). These experiments indicate that AA can activate PKC to oppose the effect of 12-lipoxygenase signaling in untrained. As a result, the interaction between the PKC and 12-lipoxygenase signaling pathways may be important in CI learning.

7. Joel Cavallo (jcavallo@indiana.edu)

BIDIRECTIONAL CHANGES IN INTRACELLULAR CALCIUM CONCENTRATIONS IN HERMISSENDA TYPE B PHOTORECEPTORS DURING REPETITIVE LIGHT STEPS: IMPLICATIONS FOR NON-COINCIDENCE DETECTION.

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Previous research suggests that induction of learning-produced changes in Hermissenda Type B photoreceptors are calcium-dependent phenomena. During explicitly-unpaired (EU) conditioning, rotation is presented many min (4-7) following light-offset. Thus, the synaptic effects of rotation impinge on B cells when light-induced [Ca 2+]i increases are expected to be attenuated. We directly measured B cell somatic [Ca2+]i levels throughout 10 consecutive 30 s light steps (ISI = 9 min) delivered as in EU conditioning. Following ionophoresis of fura-2 into a B cell, dye fluorescence was measured using dual-wavelength (340/380 nm) microphotometry. In standard ASW, baseline [Ca2+]i averaged 94.1 ± 15 nM (n = 13). Light produced a large increase in [Ca2+]i (peak change of ~ 246%) that remained elevated for ~ 2.5 min following light offset. About 4 min following light offset, [Ca2+]i levels dipped below the pre-light level for 2-3 min before recovering to the original baseline. This [Ca2+]i dip (~ 16 %) coincides with the time when delivery of rotational stimulation during EU-training results in decreased B cell excitability. To explore the contributions to the changes in [Ca2+]i of Ca2+-release from intracellular stores vs. Ca2+-influx (via light- and/or voltage-gated channels), light-induced [Ca2+]i changes were first measured in Ca2+-ASW and then again in the same cells after a switch to Ca2+-free ASW. These B cells (n=2) showed the customary large light induced [Ca2+]i increases (~395%) when Ca2+ was present. Removal of extracellular Ca2+ decreased (by 55%), but did not eliminate, the light induced [Ca2+]i increases. The [Ca2+]i dips were also disrupted.

8. Emily Chester (emcheste@indiana.edu)

SOCIAL INTERACTIONS MODULATE PHOTOPERIODIC CHANGES IN IMMUNE FUNCTION IN SIBERIAN HAMSTERS (*PHODOPUS SUNGORUS*)

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Social interactions can affect both the endocrine and immune systems. Prolonged exposure to physical stressors causes decreased immune function, and recent studies suggest social stressors, such as a defeat by a conspecific, have similar consequences. Exposure to stressors during winter, when resources may be limited and energetic demands relatively high, may further suppress immunity and increase disease susceptibility and mortality. In many species, however, seasonally recurrent variations in the environment such as changes in day length mediate physiological and behavioral mechanisms that can buffer the animals from the effects of stress and facilitate survival. Siberian hamsters are known to be more aggressive during short days (SD). In the laboratory, animals housed in SD display “winter-like” characteristics (e.g., gonadal regression, reduced body mass, increased aggression), whereas those housed in long days (LD) display “summer-like” characteristics. The effects of physical stressors in different photoperiods have been studied, but the effects of social stressors are still unknown. Chronic social stress in LD increases serum glucocorticoid levels via activation of the hypothalamo-pituitary-adrenal (HPA) axis and has immuno-modulating effects. Here, I test whether a social stressor, defeat by same-sex conspecifics over 5 days, has differential effects on the immune and endocrine systems in male Siberian hamsters housed in LD photoperiod as compared to those housed in SD photoperiod. Collectively, the results of this study contribute to broader understanding of the influence of agonistic social interactions on seasonal patterns of disease susceptibility.

9. Ann Cooper (asc1029@hotmail.com)

THE EFFECTS OF CAPSAICIN ON DROSOPHILA

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Capsaicin was investigated for its possible action to serve as a natural repellent or insecticide. A background strain and a genetically engineered strain of Drosophila that contains 3 inserted genes which codes for the TRVP receptor (i.e. the capsaicin receptor) were used. The expression was targeted specifically for sensory neurons. The sensitivity to capsaicin was compared in background strains to the over expresser strain in both larvae and adults. The flies were examined with 4 different experimental paradigms: adult taste, larval taste, egg laying, and adult smell. Capsaicin was exposed to the flies in its pure form mixed with cornmeal to compare with ground up red pepper mixed with cornmeal. From these experiments we showed that red pepper and pure capsaicin did not serve as a natural repellent, but it did act as an insecticide for larvae but not adults in control stains of flies. However, the adults and larvae in the over expresser strain is very sensitive to capsaicin. This study relates to the potential use of red pepper as means to control insects from growing in exposed foods prior to the use of refrigeration. This study may also help one to understand the range of sensitivities to capsaicin in humans and other animals by varied expression levels of the receptors to capsaicin.

10. Jenelle Dorner (jdorner@indiana.edu)

17β-ESTRADIOL PROTECTS STRIATUM FROM ASCORBATE LOSS IN A KNOCK-IN MOUSE MODEL OF HUNTINGTON'S DISEASE

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Huntington's disease (HD) is an inherited, autosomal dominant condition caused by an expanded trinucleotide (CAG) repeat resulting in degeneration of striatum and corticostriatal pathway. Symptoms include cognitive deficits and adventitious movements (e.g. chorea, tremor, dystonia). A behavior related deficit in release of an antioxidant vitamin, ascorbate (Vitamin C; AA), has been observed in the striatum of symptomatic male mice expressing the human mutation for HD. In a recently developed knock-in mouse model (KI) of HD, we showed that this striatal AA deficit is sex specific. Female KI mice did not exhibit the decrease in AA release upon behavioral activation that was observed in males. This may be due to sex differences in activity of the gonadal steroid hormone 17β-estradiol (E2). Interestingly, E2 modulates brain AA levels and prevents ischemia-induced AA loss in the hippocampus. Like ischemia, HD also results in oxidative stress which may account for the striatal AA loss observed in male mice. E2 may prevent this loss in female HD mice. In this study we used slow-scan cyclic voltammetry to measure striatal ascorbate release in ovariectomized (OVX) KI mice and their wild type (WT) controls treated with subcutaneous silastic capsules containing either E2 or placebo. Results suggest that E2 protects female OVX KI mice from loss of AA in the striatum. These findings likely account for the sex differences that we have observed in striatal AA release and behavior in KI mice. E2 likely plays a critical role in motor function and neuroprotection and may represent a therapy for movement disorders and neurodegenerative conditions that is currently not well investigated.

11. Susannah French (sufrench@indiana.edu)

GLUTAMATE AGONIST, NMDA BLOCKS GONADAL REGRESSION AND ENHANCES ANTIBODY RESPONSE TO AN IMMUNE CHALLENGE IN THE PHOTOPERIODIC SIBERIAN HAMSTER (*PHODOPUS SUNGORUS*).

S. S. French, T. J. Greives, D. A. Zysling & G. E. Demas
Department of Biology, Indiana University

Seasonal changes in immunity often correspond to changes in energy reserves and reproductive state. Siberian hamsters (Phodopus sungorus) present an interesting model to examine this phenomenon, where seasonal immunosuppression follows body mass and available body fat stores, but is not concurrent with the breeding stage. In order to investigate the underlying regulation of these immune fluctuations, we attempted to uncouple seasonal reproductive changes from energetic changes. Photoperiod is used as a cue to mimic changes in season in Siberian hamsters, and so adult males were maintained on either long summer-like days (breeding stage) or short winter-like days (non-breeding stage). We treated all animals daily with either N-methyl-D-Aspartate (NMDA) suspended in vehicle or vehicle alone. NMDA is a glutamatergic agonist known to block photoperiodic gonadal regression. After eight weeks of treatment all animals underwent a humoral immune challenge (Keyhole limpet hemocyanin, KLH). Antibody production in response to KLH and bacterial killing, an assay to measure innate immunity, were assessed. We predicted that NMDA treatment in short-day animals would block gonadal regression and suppress immunity relative to vehicle treated control animals. NMDA treatment did indeed block testes regression in short-day animals, but not photoperiod-induced decrease in body mass or fat reserves. However, unexpectedly NMDA treatment resulted in a greater immunoglobulin response to a KLH challenge in both short- and long-day groups relative to vehicle treated controls. There is also a trend for greater bacterial killing in NMDA treated short-day animals relative to short-day control animals. Therefore NMDA appears to provide an immunomodulatory signal that maintains immune function at elevated levels regardless of photoperiod.

12. Andrea Gillman (aggillma@indiana.edu)

RATS ANTICIPATE THE EFFECTS OF ADDICTIVE DRUGS IN A CIRCADIAN PATTERN.

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There is increasing evidence that the biological systems which mediate endogenous circadian rhythms are involved in drug addiction. A series of drug-screening studies has revealed that addictive drugs act as zeitgebers to entrain locomotor, water drinking, and feeding activity rhythms to a daily drug administration time. Drug-induced circadian activity entrainment requires four behavioral effects: (1) pre-injection anticipatory activity must be evident 1-2 hours prior to the administration time in the absence of any predictive cues; (2) the drug must produce a post-injection elicited activity effect; (3) on days when the drug is withheld and the rats are left undisturbed, entrained activity bouts persist around the administration time for multiple days; (4) when the drug is administered on an infradian schedule that is longer than the range of circadian entrainment, ensuing activity is apparent approximately 24 hours after administration, and no pre-injection activity is evident in the 1-2 hours immediately prior the injection time. Addictive drug-induced entrainment of circadian activity rhythms has implications both for neuroanatomical models and for the treatment of drug addiction.

13. Grant Goodrich (gtgoodri@indiana.edu)

REMEMBRANCE OF GRUBS PAST? EPISODIC MEMORY AND NON-LINGUISTIC THOUGHT

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History and Philosophy of Science, Indiana University.

Recent experiments suggest that some non-human animals have episodic-like memory. How to interpret these experiments is hotly debated. Skeptical scientists argue that the experiments are best interpreted as showing that animals have semantic memory and not episodic memory. Their arguments are similar to the a priori arguments of some prominent philosophers who claim that non-linguistic creatures are incapable of genuine episodic memory. I argue that the recent experiments do in fact show that animals are capable of episodic memory and that these empirical findings have deep implications for the nature of non-linguistic thought.

14. Timothy Greives (tjgreive@indiana.edu)

PHOTOPERIOD AND CIRCULATING TESTOSTERONE ALTER KISSPEPTIN CONTENT IN THE ANTEROVENTRAL PERIVENTRICULAR BUT NOT ARCUATE NUCLEUS IN THE PHOTOPERIODIC SIBERIAN HAMSTER (*PHODOPUS SUNGORUS*).

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In temperate, seasonally breeding rodents, changes in photoperiod induce marked changes in reproduction; long “summer-like” days maintain functional gonads whereas short “winter-like” days induce gonadal regression and inhibit reproduction. We recently demonstrated that the neuropeptide kisspeptin potently stimulates the reproductive endocrine axis in hamsters, and that photoperiod influences hypothalamic kisspeptin expression, indicating a potential role for kisspeptin in the regulation of seasonal reproduction. In non-photoperiodic laboratory mice, kisspeptin is down-regulated following castration and up-regulated in response to testosterone (T) treatment. Thus, it is unclear whether photoperiodic changes in kisspeptin staining are in direct response to photoperiod cues, or modulated indirectly by seasonal changes in sex steroids. The goal of the current study was to assess the relative contributions of photoperiod and gonadal steroids in regulating hypothalamic kisspeptin in seasonally breeding animals. Siberian hamsters were housed in long (L:D 16:8), or short days (L:D 8:16) for 8 weeks and were subsequently either castrated or sham operated, and received a Silastic implant containing either T or left empty. Castration reduced but did not eliminate kisspeptin staining in the anteroventral periventricular (AVPV) nucleus, whereas nearly all staining in short days was eliminated. Interestingly, testosterone replacement induced long day like kisspeptin staining. These data suggest a role for both gonadal-dependent and independent mechanisms regulating seasonal kisspeptin expression in Siberian hamsters.

15. Winnie Ho (wwho@indiana.edu)

POPULATION DIFFERENCES IN SEXUALLY DIMORPHIC ELECTROCOMMUNICATION BEHAVIORS

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Animal behaviors often exhibit striking sexual dimorphisms that vary across taxonomic levels. In apteronotid electric fish, animals produce electric organ discharges (EODs) for electrolocation and communication. EOD frequency (EODf) is often sexually dimorphic, and can convey information about species, sex and dominance status. During social interactions, fish can modulate the frequency of their EODs to produce chirps, the structure and production of which can also be species- and sex-specific. Here, I focused on populations of a single species, *Apteronotus albifrons* (black ghost knifefish) to ask (i) whether the magnitude and direction of sex differences in EOD varied at the population level and (ii) how this behavioral variation was distributed both phylogenetically and geographically. EODs were recorded and playbacks of EOD mimics were used to elicit chirps in black ghost populations from Ecuador (EC), Colombia (CO and HF), and Brazil (BR). A portion of the cytochrome-b gene (approx. 300 base pairs long) was sequenced to obtain preliminary data on phylogenetic relatedness between individuals of different populations. The magnitude and direction of sex differences in EODf and chirping appeared to be highly labile across populations, such that EOD behavior was very sexually dimorphic in CO fish, while being monomorphic in BR fish. Taken together, these results pave the way for additional studies on the physiological mechanisms underlying sexually dimorphic behavior, and further suggest that divergence in electrocommunication signals may have been important in the early stages of apteronotid speciation.

16. Jerrah Jackson (jacksoje@indiana.edu)

THE BEHAVIORAL RESPONSE OF FEMALE RED-SPOTTED NEWTS (*NOTOPHTHALMUS VIRIDESCENS*) TO SEX-RATIO VARIATION.

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The behavioral responses of females to male sexual behavior can vary among different sex-ratios. Although reproduction is the key to fitness, it must be weighed against the costs and benefits that accompany it. Operational sex-ratios (OSR) have been used in many studies to measure the variation in male and female interactions. The aim of this study was to determine if male pheromones affect female behavior in red-spotted newts (*Notophthalmus viridescens*). We utilized male chemical cues present in water to assess behavioral responses in females. Specifically, we placed either 2 or 4 males in a plastic container filled with water for one hour which was used as the chemical cue. Either 2 or 4 males were used to simulate both a high sex ratio (e.g., 4:1 males to females) and a low sex ratio (2:1), respectively. Trials began with placing a female into either a cue or a non-cue container and comparing the amount of movement and latency to initial movement for five minutes. Male chemical cues affected female movement, but only in females exposed to the stronger chemical cues (i.e., 4 males). These results suggest that females may not only respond to physical interactions intersexually but also to male chemical cues. Furthermore, these results demonstrate that females perform more escape behaviors in response to higher male-biased sex ratios. Overall, since harassment can be costly to females, they may avoid males when sex-ratios are male-biased which may explain the difference between the two cue responses.

17. James Klatt (jklatt@indiana.edu)

SEX-SPECIFIC EFFECTS OF AN OXYTOCIN ANTAGONIST ON NESTING BEHAVIOR IN THE ZEBRA FINCH

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The nonapeptide family that includes oxytocin (OT) has been evolutionarily conserved and exists in similar forms in taxa ranging from fish to mammals. In mammalian species, oxytocin has been shown to exert a number of sex-specific effects on female reproductive behavior and physiology. For instance, OT is essential for maternal care, and at least in some species, for monogamous pair bonding, as well. However, little is known about the evolutionary precursors of these sex-specific effects, or about the evolution of nonapeptide influences on maternal behavior. We now show that an OT antagonist (OTA; ornithine vasotocin) exerts effects on zebra finch nesting behaviors that are strongly sex- and context-specific. Subjects were administered peripheral injections of OTA (either 5ug or 0.5ug) or vehicle control during three separate phases of reproduction: nest building, incubation, and parental care of nestlings. OTA injections virtually abolished nesting behavior in females, but produced no effect in males, and showed no effects during incubation and chick care. These findings suggest an evolutionarily ancient origin of the sex-specific effects of oxytocin-like peptides. Finally, in an effort to localize the sex-specific effects in the brain, we are currently examining OTA binding in male and female finch brains. Preliminary results show that the OTA binds in numerous brain regions that are associated with parental care, including the lateral septum, preoptic area, and various regions of the hypothalamus.

18. Kathryn Lenz (kmlenz@indiana.edu)

MATERNAL CARE EFFECTS ON MALE COPULATORY BEHAVIOR AND SNB MOTONEURONS: THE MEDIATING ROLE OF SENSORY AFFERENTS

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Early maternal care shapes the sex behavior of male rats, with reductions in maternal licking of the perineum producing adult copulatory deficits. Maternal care also influences the spinal nucleus of the bulbocavernosus (SNB), a sexually dimorphic spinal motor nucleus that controls penile reflexes. Reducing maternal licking produces decreased adult SNB motoneuron number, size and dendritic length in offspring, especially in the rostral portion of the nucleus. In these studies, we investigated whether maternal licking influences the development of SNB motoneurons via effects on local spinal cord activity. We mapped the spinal distribution of cutaneous sensory afferents from the perineal skin, to determine if regional differences in their distribution could underlie the regional effects of maternal care on the SNB. Using WGA-HRP, we labeled perineal sensory afferents in male pups and mapped their spinal distribution. Perineal sensory afferents showed a caudally biased distribution relative to the SNB. This distribution may sufficiently support the caudal SNB dendritic arbor even when maternal licking is decreased, but render the rostral arbor more vulnerable to decreases in afferent activity. We have also begun to investigate whether licking-like stimulation increases local spinal cord activity, as measured by expression of the immediate early gene, c-fos. We simulated maternal licking by stroking neonatal rats with a paintbrush and measured c-fos expression in the lumbosacral spinal cord using immunohistochemistry. Relative to unstimulated controls, stimulated pups show a dramatic increase in c-fos expressing neurons. These results suggest that maternal care effects on the SNB are mediated by sensory afferent activity.

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UNDERSTANDING THE GENETIC BASIS OF PAIR-BONDING: A PRELIMINARY ANALYSIS OF AVPR1A VARIATION IN SEVERAL PRIMATE SPECIES.

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The proposed research analyzes variation in the arginine vasopressin receptor 1a gene and its promoter region (together known as the AVPR1A gene) in several primate species. This particular gene has come under considerable attention in recent years due to its effect on pair-bonding behavior in small rodents. Microtine voles exhibit microsatellite variation in the 5' regulatory region of the AVPR1A gene that impacts gene expression and alters distribution patterns of vasopressin 1a receptors in the brain. Because certain brain areas, such as the nucleus accumbens and ventral pallidum, are involved in reinforcement and reward circuitry, increased vasopressin 1a receptors in these areas can facilitate the formation of pair bonds. Thus, a "gene to brain to behavior" model for mammalian monogamy has arisen (Nair and Young, 2006). The goal of the proposed research was to test this model to determine whether it is suitable for animals that are more complex, such as primates. DNA from ten individual primates of various species was analyzed for AVPR1A genotype. The results show that pair-bonded primates exhibit at least one microsatellite in the 5' regulatory region of the AVPR1A gene, while non-pair-bonded primates exhibit either zero, one or two microsatellites in this region. The results also show that intraspecific variation in AVPR1A genotype was present, which merits further investigation. The proposed research is a summary of this preliminary dissertation data, and outlines future avenues for investigation.

20. Saul Nava (snava@indiana.edu)

DIVERGENCE OF VISUAL SENSITIVITY BETWEEN *SCELOPORUS UNDULATUS* POPULATIONS FROM THE TULAROSA BASIN, NEW MEXICO

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As explained by the sensory drive model, receiver sensory performance plays an important role in the design of animal signals. The sensory drive model predicts that when populations inhabit divergent habitats, the sensory capabilities of individuals from those populations may also diverge, and in turn guide the evolution of communicative signals and behavioural preferences. *Sceloporus undulatus* lizards from the Tularosa Basin in New Mexico offer a unique opportunity to study how populations from extremely divergent habitat types (white sand dunes, black basalt lava flow, and typical Chihuahuan desert scrub) may diverge in not only adaptive dorsal coloration but in visual performance as well. To determine whether populational differences in adaptive dorsal and ventral coloration are associated with mechanistic shifts in visual processing and I tested and compared visual performance of three dorsal coloration morphs from the three different habitat types. Specifically, I used an optomotor assay to test visual sensitivity to the blue hue exhibited on male *S. undulatus* ventral coloration. Data and results will be presented.

21. Kathryn Smith (Kdfische@indiana.edu)

ROLE OF GLT1 IN COCAINE SELF ADMINISTRATION IN RATS

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Increasing evidence implicates glutamate, an excitatory amino acid transmitter, in drug craving and addiction. A key component of glutamate transmission is its removal from the synapse by GLT1, a glial glutamate transporter responsible for the uptake of more than 90% of extracellular glutamate. In fact, preliminary data from our laboratory indicates that treatment with ceftriaxone, a beta-lactam antibiotic that increases brain GLT1 expression, attenuates the reinstatement of cocaine-seeking behavior in rats trained to self-administer cocaine. It appears that enhancing glutamate removal decreases cocaine relapse. This conclusion is consistent with recent evidence that cocaine elevates extracellular glutamate. To determine if increased GLT1 expression decreases drug craving, rats trained to self-administer cocaine received 200 mg/kg ceftriaxone intraperitoneally or vehicle immediately after self-administration testing each day for 5 consecutive days. Drug self-administration responding was monitored on each subsequent day. A separate group of ceftriaxone- or vehicle-treated rats was tested on food self-administration to assess ceftriaxone effects on responding for natural rewards. Our results will have implications for focusing on GLT1 as a potential target for the treatment of cocaine addiction.

22. Helena Soini (hsoini@indiana.edu)

FUNCTIONS AND CAPABILITIES OF THE INSTITUTE FOR PHEROMONE RESEARCH (IPHERO)

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Institute for Pheromone Research is located in the Department of Chemistry, IU-Bloomington. IPHERO was established in 1999 by Professor Milos Novotny. It continues tradition of his laboratory in the study of mammalian pheromones and the molecular aspects of chemical communication, in general. In fact, the first definitive mammalian pheromones were structurally identified in the house mouse, chemically synthesized and tested in behavior assays in this laboratory during 1980's. To date, more than 100 papers have been published in the wide range of studies involving chemical communication and pheromones in mice, rats, hamsters, canids, etc.

IPHERO has been collaborating with numerous laboratories in the areas of neurobiology and chemical ecology. We have developed highly specialized methods for the detection and quantification of small organic compounds in complex biological samples present at very low concentrations. For example, stir bar sorptive extraction in conjunction with gas chromatography/mass spectrometry and sulfur-sensitive atomic emission detection have been the key methodologies in finding the compounds of interest for "the scent communication" of different species.

Recent examples of collaborative research include seasonal scent changes in a bird *(Junco hyemalis*) and Siberian hamster (*Phodopus sungorus*). Results of the urinary volatile compound screening of the mound-building mouse *(Mus spicilegus*) related to parenthood and kinship, and the signals related to prey-predator behavior in ferret (*Mustela putorius*), domestic cat (*Felis catus*) and red fox (*Vulpes vulpes*) will be described. Additionally, some results of our recent research related to human odor will be summarized.

23. Carolina Tamara (ctamara@indiana.edu)

EFFECTS OF GOAL PROXIMITY ON EGOCENTRIC AND ALLOCENTRIC SEARCH BY RATS IN A WATER MAZE.

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We examined the contribution of allocentric (mapping) and egocentric (route) search strategies to find a hidden platform located near or far from a release point, based on different combinations of predictive and unpredictive landmark and background cues. Following training, a common 1 minute test condition assessed time spent by location by 20 sec intervals, total distance traveled, average velocity, and the initial choice vector. Rats showed evidence of both allocentric and egocentric search strategies when both landmark and background cues were equally predictive; in the far distance condition, animals showed an initial trajectory direction followed by greater allocentric search; in the short distance condition animals favored an egocentric search even in the presence of predictive landmark and background cues.

24. Cuauhcihuatl Vital (cvital@indiana.edu)

SOCIAL DYNAMICS AND GROUP LEARNING IN ZEBRAFISH, *DANIO RERIO.*

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Social learning is an important part of foraging skills transmission (Krutzen et al. 2005, Whiten et al. 2007). It improves foraging skills and foraging success (Brown and Laland 2001 and Swaney et al. 2001) in gregarious animals. Individuals acquire and improve foraging skills through social learning in the form of local enhancement or area copying (e.g., 2002). Social learning however, is not limited to the interactions between a dyad: observer and the tutor, rather it is formed by the full suite of interactions among group members. Previous studies have looked at how individuals influence other individuals' behavior. Here, we look at group dynamics and how these affect the acquisition of foraging skills through social learning. In my dissertation I use cohesion metrics from graph theory that describe the tightness of a group and ask how group dynamics influence group learning and the acquisition of foraging skills of zebrafish, *Danio rerio*, under different scenarios. Specifically I ask:

1 What role do different individuals play in group cohesion?

2 How does group dynamics influence social learning?

3 What is the effect of previous learning on future learning tasks?

25. Adam Walker (agwalker@indiana.edu)

RECALL OF EXTINCTION OF CONDITIONED FEAR IN MOUSE MODELS OF HUNTINGTON'S DISEASE.

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Huntington's disease (HD) is a dominantly inherited neurodegenerative disorder characterized by prominent motor and cognitive deficits. Evidence indicates that both cortical and basal ganglia structures are dysfunctional in HD. We have recently shown that multiple aspects of information processing in the prefrontal cortex (PFC) are disrupted in two genetic mouse models of Huntington's disease. Specifically, knock-in and R6/2 transgenic mice exhibit a profound reduction in spike synchrony, indicating processing of information is disrupted at the level of PFC neuronal populations in HD. Additionally, individual PFC neurons in R6/2, but not knock-in mice, exhibit multiple disruptions relative to wild-type controls, potentially reflecting differences in symptom severity. In order to determine if changes to PFC activity are behaviorally relevant, we are examining performance of HD mice in recall of extinction of conditioned fear, a PFC dependent task. On day one, mice are classically conditioned to fear a tone. The second day, mice undergo extinction training where they learn to no longer fear the tone. On day three, mice were presented with tones and fear behavior (freezing) is assessed. We hypothesize that, relative to WT mice, HD mice will exhibit a high degree of freezing on day three, indicating that they do not recall their extinction training.

26. Lauren Walker (lajwalke@indiana.edu)

DYSFUNCTIONAL CORTICOSTRIATAL COMMUNICATION IN R6/2 MOUSE MODEL OF HUNTINGTON'S DISEASE

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Huntington's disease (HD) is a progressive autosomal dominant genetic disorder that ultimately causes cell loss in the striatum, the portion of the basal ganglia that integrates cortical information for behavioral output. The striatum receives massive glutamatergic innervation from the cerebral cortex. In the R6/2 line of mice transgenic for human HD, behavioral symptoms appear long before neuronal death occurs, indicating that the HD phenotype is the result of neuronal dysfunction rather than neurodegeneration. Indeed, abnormally high firing rates have been recorded in both striatum and prefrontal cortex. We are now recording from striatum and motor cortex simultaneously to investigate communication in diseased corticostriatal motor pathway.

Three 25 μm electrodes were surgically implanted unilaterally into both striatum and motor cortex of male R6/2 and wildtype (WT) control mice. Extracellular spike activity was recorded for 60 minutes. Cortical cells in WT showed more bursting (clusters of action potentials) than HD mice; however, striatal cells in R6/2 tended to burst more than in WT mice. HD neurons exhibited faster firing rates and a wider range of spike frequency in both cortex and striatum. Our results show no correlation (synchrony) between striatal and cortical cells in R6/2 mice, supporting disruption of communication in the HD corticostriatal pathway.

27. Zachary Weil (weil.20@osu.edu)

PHOTOPERIOD ALTERS PAIN RESPONSIVENESS VIA CHANGES IN PELAGE CHARACTERISTICS.

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Small mammals use day length to adjust morphology and physiology to anticipate seasonal changes in environmental conditions. The canonical photoperiod-mediated seasonal adaptation is seasonal breeding. However, increasing evidence suggests that day length information can induce plasticity in the nervous system and thus provoke behavioral plasticity that can aid in winter survival. We hypothesized that low temperatures and reduced food availability in the winter would necessitate the evolution of increased pain tolerance mediated by short day lengths. Siberian hamsters *(Phodopus sungorus*) housed in short days regressed their reproductive tracts and molted to winter pelage. Short-day hamsters also displayed elevated latencies of nociceptive responses in the hotplate test, suggesting reduced pain responsivity. Prior to assessing potential neuronal or neuroendocrine mediators of altered pain responses, however, we investigated the possibility that changes in fur characteristics mediated photoperiod differences in pain responsivity. Removal of fur with a depilatory cream eliminated photoperiod differences in pain responsivity. Taken together, these data indicate that day length regulates thermal pain responses via changes in fur properties; also, changes in pelage properties have both thermoregulatory and thermal insulatory properties.

28. Joanna Workman (workman.1113@osu.edu)

PHOTOPERIOD AND ENRICHMENT INTERACT TO AFFECT SPATIAL LEARNING AND HIPPOCAMPAL SPINE DENSITY IN WHITE-FOOTED MICE

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In seasonally-changing environments, small mammals must coordinate endogenous processes with ambient conditions. Winter is a particularly challenging time in regards to survival and reproduction. In order to anticipate decreased food availability and low temperatures in winter, many rodents use day length as a precise cue for temporal information. Short day lengths alter reproductive tissues and behavior, immune function, aggressive behavior, affective responses, and spatial learning. Specifically, short days impair spatial learning in white-footed mice (*Peromyscus leucopus*) and alter dendritic complexity in the hippocampus. The goal of the current study was to determine whether short days constrain neural plasticity. If short days limit the capacity for plasticity, then environmental enrichment, a manipulation that induces plasticity, should alter dendritic morphology in long, but not short, days. Male white-footed mice were assigned to long (16:8 LD) or short (8:16 LD) photoperiod in either enriched or standard cages. Enrichment consisted of a larger cage, cage mates, Habitrail® tubes, a nest box, and a running wheel. After 12 weeks, mice were tested in the Morris water maze. After testing, reproductive tissues were collected and weighed and brains were processed for dendritic morphology. As predicted, short days impaired spatial learning in the water maze and altered spine density. However, enrichment prevented short-day-induced deficits in learning and also altered hippocampal spine density in short-day mice. These results suggest that day length and other non-photic environmental factors interact to regulate dendritic morphology and that short days do not constrain the capacity for functional neural plasticity.

29. Devin Zysling (dzysling@indiana.edu)

EFFECTS OF FOOD RESTRICTION ON IMMUNE FUNCTION IN LONG- AND SHORT-DAY HOUSED SIBERIAN HAMSTERS (*PHODOPUS SUNGORUS*)

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Many non-tropical organisms must contend with extreme seasonal fluctuations in their respective environments and thus physiological and behavioral adaptations have evolved in order to maintain a positive energy balance year-round. These adaptations include seasonal changes in reproduction and immunity. Photoperiod is the primary signal animals use to predict environmental changes. Exposure to short day lengths inhibits reproductive activity and triggers gonadal regression, decreases body mass and food intake, and suppresses various aspects of immunity. Despite accumulating evidence for seasonal changes in immune function, little is known regarding how seasonal changes in energy availability or reproduction may mediate seasonal changes in immunity. The goal of this study was to determine the effects of food restriction on photoperiodic changes in immune function. Specifically, long- and short-day housed Siberian hamsters received either a 30% food restriction or were fed ad lib for 2 weeks. Restriction values were calculated based on baseline levels of food intake for each animal, as determined by a 10-day assessment of ad lib intake. Immune responses were quantified by measuring anti-keyhole limpet hemocyanin (KLH) antibodies and bacterial killing ability. Body mass was measured over the course of the experiment and at the conclusion of the study necropsies were performed and final gonadal and fat pad masses were recorded. Data will be discussed in the context of energetic trade-offs between competing physiological functions. Additionally, the role of these trade-offs in mediating seasonal responses will be reviewed.

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