ANIMAL BEHAVIOR
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Center for the Integrative Study of Animal Behavior
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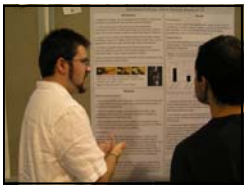
CISAB hosts Turner Program at ABS Meeting

For the first time, CISAB sponsored the Charles H. Turner Program, an NSF-funded event that brings undergraduate researchers to the annual meetings of the Animal Behavior Society. The Turner program, named after the first African American animal behavior researcher, has been a highly successful recruitment tool for encouraging undergraduates from diverse backgrounds to go into animal behavior. It complements CISAB's existing REU program that brings undergraduate researchers to the Bloomington campus each summer. In 2006, the Turner program brought twelve undergraduates to the ABS meeting in Snowbird, Utah, including two Indiana University students, and six students who had formerly participated in the CISAB REU program.

To ensure that the students made the most of the meeting experience, their first day was spent in a hands-on workshop in which they discussed career goals and practiced networking skills. Dr. Godfrey Bourne, NSF program officer, related his experiences and the students were paired with individual mentors chosen from among the researchers participating at the meetings.

Several students presented their research during the meetings. Richie Madewell, an IU student, received the Genesis award for best undergraduate poster.



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See http://www.indiana.edu/~animal for details

News? Story Ideas? Let us know!

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SUMMER 2006
REU STUDENTS

Bill Timberlake welcomed ten students from across the country to CISAB's NSF funded Summer Research Experience for Undergradu-

ates program: Rachel Andrews, Purdue University; Adolfo Arellanos, Hunter College; Mirela Conway, University of MA– Amherst; Erica Davis, Alabama A&M University; Maksymilian Deryl, Dominacan University; Shannon Fredebaugh, Ohio Wesleyan University; Lakeisha Hall, Albright College; Chanin Miller, Tuskegee University; Michael Peace, North Carolina State University; and India Swearingen, Loyola Marymount University.

As they began their stay, they participated in a series of workshops, lunch meetings and social functions to build a sense of community. Workshops were given by Troy Smith, Laura Hurley, Greg Demas, George Rebec, Emilia Martins, and Amy Poehlman. Melissa Seymour and Byron Bangert engaged the students in ethics discussions while Allen Beck spoke about the Human-Animal bond and demonstrated a robotic dog. Noontime talks were sponsored by the biology department each week and Bonnie Erwin offered GRE training.

Other fun events included an evening of swimming, viewing stars at Kirkwood Observatory, attending a cookout at the Graduate School and visiting the Bloomington Farmers' Market. They visited the Indianapolis Zoo with Eddie Fernandez where they got a behind-the-scenes tour of the facilities, including up close meetings with penguins, elephants and dolphins. They were also treated to an excursion to the WonderLab Museum of Science, Health and Technology where everyone got to have lots of fun.

The ten students worked closely with faculty, post-docs and graduate students to design and complete a research project during their summer stay. See the following pages for their research abstracts.

REU RESEARCH ABSTRACTS

Behavior-related changes in dopamine and ascorbate release

Rachel L. Andrews, Dr. George Rebec, Jenelle Dornor and Ceyhun (JaY) Sunsay

FSCV is an important tool that will be used to study the role DA might play in weakening association between a CS and a US. Classic theories of DA state that DA is associated with pleasure, acting as a natural reward system. However, further studies have questioned the classic model, indicating that DA is actually associated with anticipation of a reward. To study this, we inserted an electrode into the striatal region of the brain that is capable of measuring extracellular DA concentrations. After conditioning the rat to respond to an unconditioned stimulus (US) using classic Pavlovian methods, we measured DA release during the conditioned stimulus (CS) and during the US. We are also interested in seeing whether food presented will reinstate DA signal to the CS in extinction after behavioral performance reaches zero. Therefore, after extinction, we reinserted the electrode and measured DA concentrations during the CS and US again. Unfortunately, we were unable to replicate the experiment perfectly due to complications with the lab animals. The rats responded to the CS during the 1st 4 days as shown in Figure A. However, when the electrode was put in place, the rats stopped responding to the CS. Our previous results do show DA mediated association between CS and the US, and that food presentation does reinstate DA signal after extinction.

Ascorbate (AA) is an antioxidant vitamin which is released into the striatum of the brain during behavioral activation. A mouse model of Huntington's disease has 140 CAG repeats knocked into the Huntington's gene. These knock in (KI) mice show a deficit in extracellular AA. Furthermore, deficits in AA are known to impair motor response. In order to study this deficit, we used slow scan voltammetry to measure extracellular AA concentrations in KI mice. KI mice appear to have deficits in both AA release and associated behaviors. We evaluated the cause of this deficit by treating the KI mice with d-amphetamine sulfate (5mg/kg sc). This drug promotes corticostriatal glutamate transport, resulting in increased striatal AA release, and uptake in extracellular glutamate. Compared to wild type (WT) mice, KI mice have lower striatal AA after treatment with d-amphetamine sulfate, indicating that alterations in corticostriatal glutamate transmission may contribute to the AA deficit in Huntington's KI mice. This difference is even more noticeable in male KI mice, indicating a possible gender role in the progression of the disease.

Investigations of learning and memory in an animal model of autism

Adolfo Arellanos, Blair Dina, T.M. Mowery, Preston Garraghty

Autism spectrum disorder is a neurodevelopment disorder that affects speech, communication, behavior, and social cognition (Behrmann et al). Although there are animal models for the disorder, none of them has investigated the behavioral aspect of the disease within the neurological context. Injections with the anticonvulsant compound valproic acid (VPA) intraperitoneally at 600mg/kg on embryonic day 12.5 in pregnant dams induce autistic like features in the pups. The aim of this study is to investigate this animal model for autism in several behavioral tasks with the long-term goal of comparing any possible behavioral deficits with those reported in humans with autism. The tasks employed here included: 1) eye blink- conditioning (a Pavlovian conditioning task), and 2) the Morris water maze (MWM, a spatial memory task), and 3) a delayed match to place (DMP, a spatial working memory task in which the escape platform location is changed daily) with or without prior training in the Morris water maze. "Autistic" rats were trained to perform these paradigms and then compared to saline controls. In the eye blink-conditioning task the animals were trained with an optimal 200 msec ISI, followed by training with a non-optimal 600 msec ISI. We find higher amplitude CRs in the autistic rats, and shorter CR latencies with the longer ISI.
In the MWM task, VPA rats showed a slowed acquisition of the escape response. In the DMP task, the autistic rats showed no working memory deficit whether the animals received prior training in the MWM task or not. Autistic rats did show impairments in Trial 1 performance in the DMP task relative to controls early in training, but only when they were not initially trained in the MWM task, suggesting impairment in the development of an efficient search strategy for the novel platform location.

These results suggest that this model of autism may be a valid one as the behavioral deficits found can, at least in

part, be attributed to brain anomalies shared with autistic humans.

The effects of light intensity on motion perception in the Eastern Fence Lizard, (*Sceloporus undulatus*) and Southern Sagebrush Lizard, (*Sceloporus graciosus*)

Mirela Conway, Emilia P. Martins and Saul Nava

Motion detection is utilized in prey, predator, and mate detection as well as communication. Environmental conditions, such as light intensity, habitat structure, and spectral quality, are likely to have a great effect on an animal's ability to detect various signals. We examined how total light intensity affects motion perception in diurnal lizards from the genus *Sceloporus* (*S. undulatus* and *S. graciosus*). We tested motion detection latency by recording optokinetic response times to two light intensity (10 Lx and 400 Lx) and two motion frequency treatments (1 Hz and 4 Hz). We found some evidence for differences between males of two populations of *S. undulatus* that correspond to major differences in their photic environments. Male *Sceloporus undulatus cowlesi* from White Sands, New Mexico were better able to detect motion at low light intensities whereas male *Sceloporus undualtus consobrinus* from the typical scrub habitat in the Chihuahuan Desert in New Mexico were better able to detect motion in bright light. Sex differences in motion detection corresponded better with previously-observed differences in the function of visual displays. Female S. *graciosus* were consistently better able to detect motion than were males. Because of small sample sizes, these differences were not statistically significant.

The reproductive behavioral displays of male *Sceloporus* towards females

Erica Davis, Emília P. Martins and Mayte Ruiz

Male *Sceloporus* have been shown to choose among females in choice tests. *Sceloporus* females, on the other hand, do not have preferences but only reject when males are attempting to mate. In previous experiments, simultaneous choice tests have been done to show preference among *Sceloporus* with not much emphasis being put on the individuals' behaviors. We compared behavioral tests to other methods of choice that have been used in the past in order to see how males might behave towards females in the wild and to see if any relationship exists between sequential and simultaneous tests. In the sequential behavioral tests, males were allowed to interact for forty minutes with one of two females, and then later tested with the second female. The behavioral displays were scored using an ethogram, and females were determined as either preferred or not preferred depending on the difference in displays exhibited towards each. Behavioral preferences were compared to female preferences in outside enclosure and indoor arena choice tests (both simultaneous), and the time at which the female laid eggs. Although results were not statistically significant, major trends were seen in the data. Males showed a random pattern of preference when comparing total simultaneous choice to the sequential choice. However, the simultaneous choice tests conducted indoors gave results that were very different from the sequential behavioral tests, whereas the simultaneous tests conducted in large outdoor enclosures gave results similar to the sequential tests. Furthermore males did not prefer females that laid eggs sooner in the sequential behavioral test. Many reasons such as the time in which the experiment was held or the gravidness of the female at the time of the test could be factors in determining male choice.

Possible influences of positive scent stimuli on the behavior of captive polar bears (*Ursus maritimus*)

Shannon L. Fredebaugh, William Timberlake and Eddie Fernandez

Predatory animals in captivity often exhibit stereotypic behaviors, such as pacing, which are repetitive and seemingly pointless. One theory is that these stereotypic

behaviors are used as a replacement for species typical behaviors that the animals may exhibit in the wild, for example, pacing may be a substitute for traveling long distances to find food. Previous studies have shown that environmental enrichment in certain zoo animals may help to decrease these stereotypic behaviors. This study will attempt to use environmental enrichment on two captive polar bears (*Ursus maritimus)*, one female and one male, to encourage behavior more closely related to natural foraging. Previous studies have presented animals with a single food enrichment item, but the effects on the animal only last as long as the food available to the animal lasts. By presenting the animals with a stimulus on a fixed interval schedule, such as the beef and fish scent stimulus presented every minute, the animals may be encouraged to search for food around their exhibit and decrease their stereotypic behaviors. They will be monitored five days a week for an hour and half total each day: a half hour before, during, and after the presentation of the scent stimulus. There were five days of baseline observation where no spray bottle was present, five days of scent stimulus, five days of baseline with a water spray bottle, and the last five days were scent stimulus days. The presentation of the spray was always in the same area in the visitor viewing area of the polar bear exhibit area. The animals will not be able to consume food at that time, but the smell of food may help to decrease their stereotypic behaviors and increase recognizable focal foraging behaviors, since the bears can smell odors from far distances. Both polar bears seemed to respond to the scent stimulus by smelling the air during the spray period of observation, but the amount of time spent performing non-stereotypic and stereotypic behaviors appeared to vary from day to day independent of scent stimulus. Data and further results are in the process of being analyzed.

tive activity and triggers gonadal regression and decreased body mass. The physiological signal that transduces photoperiod is the pineal hormone melatonin, which is secreted only during the duration of dark hours, thus encoding the amount of light. The goal of this study was to determine the effects of melatonin on glucoprivation-mediated changes in immune function in Siberian hamsters. Specifically, daily timed injections of melatonin or saline were given to induce SD-like conditions; a subset of hamsters from each group received multiple injections of 2-deoxy-D-glucose (2-DG), a glucose analog, to induce a state of glucoprivation. Immune responses were quantified by measuring anti keyhole limpet hemocyanin (KLH) antibodies and bacterial killing capacity. The results demonstrate that both melatonin and 2-DG inhibited antibody production compared to control animals. Specifically, animals within the SD-like melatonin treatment had lowered antibody production in response to 2-DG as compared with the control animals. Within the LD group there was no effect of 2-DG on antibody production. Furthermore, there was a trend towards increased bacterial killing ability with 2-DG in the SD-like treatment group compared to the other groups. There was no effect of melatonin or 2-DG on cortisol concentrations in any group. SD-like melatonin caused an overall decrease in specific fat pad masses and body weight, but there was no effect of melatonin on reproductive mass. Fat pad and body masses, but not reproductive mass, were also significantly positively correlated with immune function. These data suggest that the immune effects are likely to be driven by changes in resource availability (i.e., energy) rather than changes in reproduction. Collectively, these data provide support for the role of energetic trade-offs between competing physiological functions in mediating seasonal responses.

Seasonal changes in immunity track changes in energetics and not reproduction in female Siberian hamsters (*Phodopus sungorus*)

LaKeisha A. Hall, Devin A. Zysling,
Gregory E. Demas

Non-tropical organisms must deal with marked seasonal fluctuations in their environments. Photoperiod is the primary environmental signal organisms use to predict such changes. In order to maintain a positive energy balance year-round, a variety of physiological and behavioral adaptations have evolved, including seasonal changes in reproduction and immunity. Exposure to short day (SD) lengths (i.e., "winter") inhibits reproduc-

Electrocommunication signal repertoire in *Parapteronotus hasemani*

Maks Derylo, Cameron Turner, and G. Troy Smith

Apteronotid electric fish species (Family Apteronotidae) communicate using frequency modulations of their electric organ discharge (EOD). Some species use this behavior to convey information regarding sex, body size, reproductive status and aggressive intent. The modulations are often sexually dimorphic and exist in several varieties. In *Parapteronotus hasemani* we aimed to test for the differences in chirping behavior between sexes and to inspect the signal repertoire. Due to size constraints it was not possible to sex all of the fish. However the chirp repertoire was described for this species. We used a playback of simulated EODs to examine the types of signals produced. The playback stimuli had frequency values of ±5, ±20, and ±150 Hz relative to the subject's baseline EOD frequency. We compared production of each chirp if fish produced them in response to the stimulus. Four distinct kinds of signals in were measured: gradual frequency rises (GFR), rasps, long (duration) chirps, and short chirps. All of these differed in their structure and fell into separate clusters on a scatter plot of frequency modulation vs. time. Fish produced fewer GFRs in response to presence of a stimulus at all playback frequencies. They also showed a decrease in rasp proportion as a response to different stimulus frequencies. Fish increased long chirp rate in response to playback frequencies closer to their own. Conversely, fish produced more short chirps to stimuli furthest from their own baseline EOD. Additionally it was found that overall chirp duration was positively correlated with each subject's baseline EOD frequency. Understanding the structure of these different responses in *P. hasemani* will allow us to compare them with other apteronotid species.

Odor preference in huddling by rat pups: Comparison between the metabolic consequences of huddling and the sensation of localized warmth as an inducer of odor-guided huddling.

Chanin Miller, Jeffrey R. Alberts and Sayuri Kojima

During the first two postnatal weeks, rat pups huddle with warm objects, either animate or inanimate. Huddling with a warm object in a cooler environment reduces loss of body heat and conserves metabolic energy. By Postnatal Day (PD) 15, pups huddle preferentially with targets bearing species-typical odors. Nevertheless, the odors that elicit and maintain huddling contact can be reassigned by pairing that odor with the experience of the thermotactile component (warmth) of maternal care.

It is possible that the sensation of huddling with a localized source of heat constitutes the mechanism for establishing odor-guided huddling. Alternatively, the metabolic consequences of huddling may be sufficient to induce a specific odor-guided huddling preference. The present study was designed to compare the induction of huddling preferences derived from the metabolic consequences of huddling with those derived from the sensation of localized warmth. Two treatment groups were studied, with each group receiving two kinds of conditioning on alternate days, from PD 9 – 14. Pups in Treatment Group 1 were exposed for 2-hr/day on alternate days to a furry, warm (36°C) tube bearing a fixed amount of odor A (e.g., lemon), all in a cooler (23°c) compartment. On the other days, these pups were exposed to the same amount of odor B (e.g., orange) within a cool (23°C) ambience. Treatment Group 2 received the same regime of access to a scented warm tube in a cool ambience and, on alternate days, these pups were exposed to odor B in a warmer ambience (26° C) that had been shown to be metabolically equivalent to the warm tube condition. Results suggest no effect of treatment on odor preference in huddling. When the treatment variable was excluded from the analysis, however, a sex dependent effect of localized warmth on odor preference was found. . Female pups preferred to huddle with an odor associated with a warm tube compared to an odor associated with no tube; males had no odor bias in huddling.

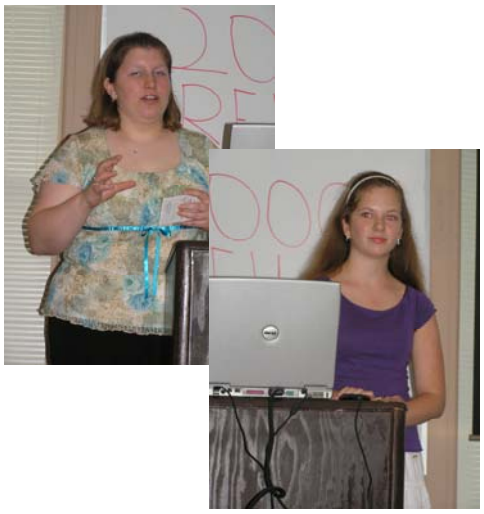
This study suggests that the metabolic consequences of huddling facilitate development of odor-guided huddling on PDs 9-14. Nevertheless, it will be useful to extend the conditioning period and/or introduce the conditioning to pups that are younger. For future research, sex should be considered as a significant factor for establishment of odor-guided huddling. Neuroendocrinological studies could be helpful to explore mechanisms underlying development of filial huddling by rat pups.

(Continued from page 6)

Repeatability in guppy inspection behavior, alone and in groups

Ralph Michael Peace, Bronwyn H. Bleakley, and Edmund D. Brodie III

Guppies, *Poecilia reticulata*, in the wild "inspect" potential predators. The rate at which a guppy inspects is influenced by the historical predation level experienced by their population and interactions with social partners. It is not know how consistent an individual's behavior is in the context of its social group. We utilized a strain of guppies originating from a high predation population of the Quare River that has been in the lab for more than six generations. We tested focal individuals three times alone or twice in a group in the presence of a cichlid model to determine how repeatable individual behavior is alone and within a social group. Individuals were scored for time spent in agitated swimming, in close proximity of the model, foraging, frozen and oriented on the model and how often they inspected the model. Focal individuals tested alone appear to habituate to the model and therefore exhibit low repeatabilities for all measured behavior. Guppies are known to socially learn and are unlikely to interact with predators in the absence of conspecifics. Low repeatabilities are thus not surprising. The second experiment was therefore tailored to both minimize learning and reflect more realistic social settings, providing a more accurate measure of repeatability. The results of the second experiment show much higher repeatabilities for all behaviors. Guppy antipredator behavior is therefore more consistent across repeated encounters with predators in the context of their social groups, suggesting that social context may play a significant role in the evolution of guppy antipredator behaviors.



Cue competition and integration in a blocking procedure in the water maze as a function of beacon type and whether it was switched between Stage 1 and Stage 2 of training

India Swearingen, Joseph Leffel, and William Timberlake

In a blocking procedure in the water maze, subjects are typically trained in Stage 1 to find an escape platform using a Beacon, and in Stage 2 to find the platform using a combination of Beacon and added Landmarks. Timberlake, Sinning, & Leffel. (2006), and male rats, found both cue competition and integration with the Room cues depending on the type of Beacon (Pole or Hanging) and form of training (with or against background cues) in Stage 1. Random Pole Beacons produced cue competition, and Fixed Hanging Beacons produced facilitation relative to a control receiving Stage 2 training only. The purpose of the present research was to determine if (1) cue competition also occurred with females receiving Random Background training with Pole Beacons but not Hanging Beacons; (2) the effects of changing the Beacon type between Stages 1 and 2 disrupted cue competition effects as predicted from Roberts & Pearce (1999) and (3) whether the direction of change mattered as might be assumed if the novel pole detracted from learning the Room cues in Stage 2.

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