

# ANIMAL BEHAVIOR BULLETIN

## CISAB 12th Annual Symposium

The annual CISAB Animal Behavior Symposium will be held Friday, April 22, 2005 in the Frangipani Room of the IMU from 9am-5pm, with a light breakfast served at 8:30.

Undergraduate and graduate students, postdoctoral fellows and faculty are invited to submit presentations (talks/posters) for the

symposium using our on-line form (see CISAB main webpage). Abstracts should be submitted no later than March 4, 2005.

The conference talks will be 10 minutes with 2 minutes for questions. All talks must be loaded onto our windows XP or MAC OSX laptops. Please bring your presentation and

all associated files on a CDR, USB thumb drive or zip disk. Posters should be no larger than 3' wide x 4' high (notice the boards are VERTICAL format).

Questions may be directed to:

Sue Anne Zollinger ([szolling@indiana.edu](mailto:szolling@indiana.edu))  
Hanna Kolodziejski ([hkolodzi@bio.indiana.edu](mailto:hkolodzi@bio.indiana.edu)).

Center for the  
Integrative  
Study of Animal  
Behavior

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### Special points of interest:

- *Annual Symposium*
- *Careers Workshop*
- *Research Spotlights*
- *Internship Program*

## Town Hall Meeting & Careers Workshop

This year CISAB will sponsor its first Animal Behavior Careers Workshop entitled: *Integrative Animal Behavior Careers Workshop: Breaking Through Disciplinary Boundaries*. The workshop will be held Thursday April 21 at CISAB (402 N. Park Ave) from 7pm – 8:30pm following the annual CISAB Graduate Student Town Hall Meeting at 6pm. The usual pizza and refreshments will be served.

Five CISAB faculty panelists will discuss some of the interdisciplinary issues they faced in their careers and will address student and postdoctoral fellow questions on how to break through disciplinary boundaries within the field of animal behavior.

Panelists include:

**Dr. Colin Allen**  
(Department of History and Philosophy of Science)

**Dr. Gregory Demas**  
(Department of Biology)

**Dr. Laura Hurley**  
(Program in Neural Science)

**Dr. Christine Quirk**  
(Medical Sciences)

**Dr. William Timberlake** (Department of Psychology).



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# CONSCIOUSNESS AND THE EVOLUTION OF MIND

As a new CISAB member, Colin Allen, Professor of History and Philosophy of Science/Cognitive Science, offers new insights into the study of animal behavior and broadens CISAB's integrative approach to behavior research. Colin's main interests include investigating questions of cognition, both in humans and non-human animals. His current publications include articles on cognitive ethology and the evolution of cognition, concepts of play, death and pain, and the ethical ramifications of conscious thought in non-human animals. As a philosopher, he offers a unique perspective on questions of animal cognition and research methods used to test conscious behavior in animals.



Non-human animal cognition has been the subject of debate in philosophy since at least the 17<sup>th</sup> century when Descartes argued that animals lacked language and therefore lacked minds. Subsequent philosophers continued to argue the question, often without any empirical data to back their statements. Colin believes that today's philosophers have an unprecedented opportunity to work with scientists as logicians to investigate scientific methods as well as catalysts to inspire new directions of study. Researchers in the fields of biology, psychology, neurology and developmental

biology are often so specialized they are only able to test one small portion of the cognitive behavior puzzle at a time. Philosophers can step back from the immediacy of research goals and place priority on the wider, more integrative view of cognition, helping to clarify standards and definitions.

Colin has published several papers on consciousness and evolution of mind, bringing to the forefront questions on conscious thought. He asks, "How does one define consciousness? If there is no clear definition for consciousness, how can it be tested?" Philosophers categorize consciousness into simple states of awareness such as being awake vs. coma or sleep, perceiving surroundings and intentional response to the environment, as well as more complex states such as phenomenal consciousness and self-consciousness. Phenomenal consciousness is sometimes identified with qualia or sentience and is a qualitative, subjective and experiential form of conscious thought. Self-consciousness is the capacity for second-order representation of the organism's own mental states. Some suggest that mammals, birds and some cephalopods exhibit phenomenal consciousness, but that only chimpanzees and maybe the great apes are self-conscious. At this point in time, there is no consensus about what physical or neurological properties identify consciousness. Colin asks: "Can we have a theory of what consciousness is before we try to determine whether animals have it? Have we put the conceptual cart before the empirical horse?"

Colin is interested in developing empirical approaches to identify the existence of phenomenal consciousness and self-consciousness in ways that are non-anthropomorphic but at the same time rely on the astute observations that only a scientist acutely aware of his/her study species can ascertain. He has co-authored several papers with biologists, interpreting empirical results and discussing theoretical and methodological problems in ascribing complex mental process to non-human animals. He has examined the function of communication as an indication of the

internal mental state of signalers. "Research on intentionality in primates," he says, "doesn't establish absolutes, but offers future avenues of research and for the development of computer models." He recommends social play be used for much more comparative and evolutionary work on intentionality, communication and information sharing. He also points out that scientific and philosophical studies of animal cognition are of great importance in establishing ethical treatment of non-human animals.

In a recent publication on animal pain, Colin tackles the debate on animal welfare. Like consciousness itself, how does one assess the conscious experience of pain? Animals obviously respond to noxious stimuli. Animal welfare organizations want to protect species using anthropocentric criterion, often evading questions about the extent to which other species experience pain consciously. Some scientists and philosophers claim that non-human animals are only zombie-like automata and only humans can consciously experience noxious stimuli. Colin states that there is a "clear need for case-sensitive criterion that can be applied to different species," and that philosophers must assess the arguments on each side. "Recent scientific work suggests a more nuanced view about the functions of pain, and provides us with the best hope for progress in understanding the nature of pain and its distribution in the animal kingdom."

Colin has been consulting and programming for The Stanford Encyclopedia of Philosophy (<http://plato.stanford.edu/>) and is presently its Associate Editor. His current projects include a series of papers on animal pain that may lead to a book, a paper on scientific/evolutionary concepts of culture, a book on artificial moral agents, and the capture and analysis of data from web-based logic instructional software to provide context-sensitive feedback to students and to test hypotheses about strategies for teaching and learning logic.

#### Representative Publications:

Allen, C. 2004. Animal Pain. *Noûs* 38:617-643.

Allen, C. 2004. Transitive inference in animals: Reasoning or conditioned associations? In S. Hurley and M. Nudds (eds.) *Rational Animals?* Oxford University Press.

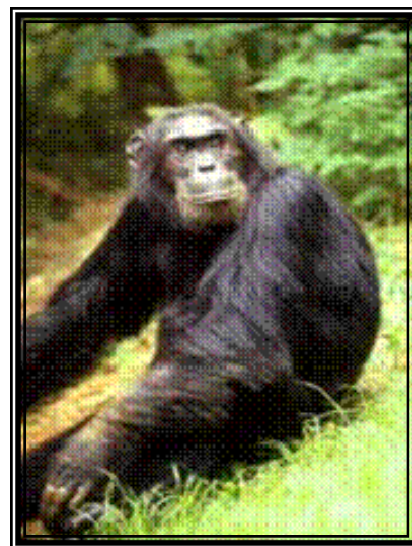
Bekoff, M., Allen, C. & Burghardt, G.M. (eds) 2002. *The Cognitive Animal*, Cambridge, MA: The MIT Press. An anthology of original essays on comparative psychology, cognitive ethology and the study of animal cognition.

Cummins, D. & Allen, C. (eds) 1998. *The Evolution of Mind*. New York: Oxford University Press. An anthology of original essays on evolutionary theory, psychology and ethology.

Allen, C. & Bekoff, M. 1997. *Species of Mind: the philosophy and biology of cognitive ethology*. Cambridge, MA: The MIT Press. An original monograph on cognitive ethology.

Allen, C. & Hauser, M. 1992. Communication and cognition: Is information the connection? *PSA* 2: 81-91.

Allen, C. & Hauser M.D. 1991. Concept attribution in nonhuman animals: theoretical and methodological problems in ascribing complex mental processes. *Philosophy of Science* 58: 221-240



# W.M. KECK CENTER SYMPOSIUM ATTENDED BY TWO CISAB MEMBERS

Heather Bleakley and Jill Villarreal traveled to North Carolina to participate in the 6<sup>th</sup> Annual Student and Postdoctoral Symposium of the W.M. Keck Center for Behavioral Biology at North Carolina State University. They were joined not only by 11 students and postdocs from NCSU, but also by Heather Rupp from Emory University and the Center for Behavioral Neuroscience, making this a multi-regional affair. In addition to the diverse universities involved, the Keck Center displays amazing cultural diversity as well, including students from India, Japan, China, France, Germany, Belgium and Russia and a director who hails from the Netherlands. In keeping with the diverse backgrounds of the participants, the conference boasted talks covering a variety of topics, including animal-plant interactions, theoretical applications of host-parasite interactions, behavioral genetics, behavioral endocrinology, developmental plasticity, human sexual behavior and evolution of behavior (abstracts are available!). In addition, the complement of speakers comprised a majority of women.

The talks presented at the symposium focused on 4 major questions in the field of animal behavior: (1) how does the genome and environment interact to shape the behavior, (2) how the nervous system and endocrine system interact to drive behaviors, (3) how behaviors evolve and how in turn behaviors influence evolution, and (4) how organisms interact with their environment and how habitat conditions affect populations. While all of the talks presented were integrative and examples of extremely innovative and interesting science, two in particular stood out.

Astrid Groot, a postdoctoral research associate in the laboratory of entomology professors Dr. Fred Gould and Dr. Coby Schal, presented the results from her elegant study on fitness effects of one designed 'mutation' in the sex pheromone of heliothine moths. Her work addressed the third of the four central questions of the symposium: how behaviors evolve and how in turn behaviors influence evolution. She explained there has

been an ongoing debate about the processes that enable evolution of complex traits under strong stabilizing selection. She gave the example of population of insect species using sex pheromones, where females that produce atypical pheromones are likely to be less attractive to males than females with the population's common blend. Similarly, rare males that respond to atypical blends are expected to be at a disadvantage in finding mates. Moth pheromone communication systems, she added, show such species-specificity, which is generally based on blends of related chemicals.

Astrid noted that current conceptual models of how changes in sexual communication could evolve missed one important thing: empirical data that have measured the fitness costs of one mutation, while the magnitude of this cost determines to a large extent whether and under what circumstances a mutation may persist in the population. She measured the fitness costs of one mutation, by artificially hybridizing two closely related moth species, *Heliothis virescens* (*Hv*) and *H. subflexa* (*Hs*), and introgressing one quantitative trait locus into the *Hs* background through repeated back crossings. She developed two sets of bioassays to determine whether the *Hs*-females with one mutation were selectively disadvantaged compared to *Hs* identical females. She then assessed the attractiveness of these females to males in the field, followed by cage experiments in a greenhouse to determine the mating fitness of the females. The results from her experiments suggest that the evolution of sexual communication in the two closely related moth species may be the result of a combination of genetic drift and selection.

Heather Rupp, who was also visiting the Keck Center representing Emory University and the Center for Behavioral Neuroscience, presented her work on brain activation in response to sexual stimuli in human males and females. Her work is focused on understanding cognitive differences in human male and female sexual response, addressing at a broad level how the neural system and the endocrine system interact with the

environment to generate behavior. Heather's work combined traditional assays of arousal and sexual response in the form of genital arousal and subject self-reports of arousal with fMRI brain scans to assess differences in male and female response to sexual stimuli. fMRI supports subjective descriptions of levels of arousal, showing different levels of neural activation in males and females, irrespective of sexual orientation, suggesting sex differences in cognitive processes underlying arousal. While men responded strongly to images of women but not men, women responded equally to pictures of men and women, suggesting greater sexual plasticity in females.



**Back Row (L-R)** Elsa Youngstead, Heather Bleakley (IU), Molly Puente, Ping Wang, Tatiana Morozova, Erica Marsh, Astrid Groot.

**Front Row (L-R)** Dorit Eliyahu, Heather Rupp (Emory), Jill Villarreal, Deepa Sambandan, Alexis Edwards, Nicola Benda, Bryce Ryan

While in NC, Heather and Jill were treated to southern hospitality, with resident grad students meeting them at the airport and taking them to an art museum, as well accompanying them to dinner the first evening and a center-wide party hosted at the home of one of the faculty members following the symposium. The Keck Center does an amazing job of facilitating contact between students working in disparate areas of animal behavior, hosting not only weekly seminars, but also monthly social/discussion meetings at the home of the director, Dr. Robert Anholt. The gather-

ing after the symposium, while providing fabulous Italian food, also provided a great forum for people to wander about and discuss the talks they had seen during the day. And every presenter was greeted with thought-provoking questions as well as suggestions after their talk. In addition, the Keck Center took pains to incorporate visiting prospective graduate students into the proceedings.

By Heather Bleakley and Jill Villarreal

## CISAB ANIMAL BEHAVIOR LAB

The CISAB Animal Behavior Lab (Jordan Hall 136) is a wet lab set up for molecular genetic, endocrine, immune and biochemical assays. Services offered by the facility include genetic techniques such as: DNA and RNA extraction, PCR; Microsatellite genotyping; RFLP/SNP genotyping; cloning and sequencing; software for primer design and genotyping analysis. In addition, neuroendocrine techniques can be completed such as RIA and EIA.

For more information on the CISAB Animal Behavior Lab, stop by 136 JH or contact:

Amy Eklund, PhD  
 CISAB Animal Behavior Lab Manager  
 Jordan Hall 136  
 Phone: (812) 856-1139  
 E-mail: [aeklund@bio.indiana.edu](mailto:aeklund@bio.indiana.edu)



# THE AUDITORY SYSTEM, SEROTONIN & THE MEXICAN FREE-TAILED BAT



Laura Hurley doesn't have bats in her belfry, but she certainly has them in her lab. She has found that Mexican free-tailed bats make excellent models for studying the auditory system. These rather small bats, found in the south and southwestern U.S., are one of the most social of all bats, found in colonies of one thousand or more, living in caves or buildings. Their auditory system has two important functions. First, it interprets frequency modulated echolocation calls that enable the bats to navigate and locate prey. Low frequency, narrowband calls increase the bat's detection range while higher frequencies provide information about the texture and special position of the target. Secondly, it's crucial in evaluating social vocalizations. These squeaks and squawks include calls from mothers to offspring, territorial defense and other forms of communication. Because sound perception is an important component of their survival and reproduction, a hypertrophied auditory system has evolved that is relatively easy to study and at the same time representative of the typical mammalian system.

Although commonly thought of as hard-wired, the nervous system is highly plastic in its response to incoming stimuli. It has been known for some time that a class of chemicals known as neuromodulators can alter the function of neural circuits which underlie behavior. Laura's research deals with a specific neuromodulator, serotonin (5-hydroxytryptamine or 5-HT), and its effects on the auditory system. Serotonin has been studied in humans, the main focus being on depression and the development of anti-depressant drugs that change serotonin transmission. But serotonin is found ubiquitously in the mammalian auditory system and there has been little research on how it alters sound processing.

Laura has examined both anatomical and neurophysiological aspects of serotonin. Histological techniques have confirmed the presence of serotonin in the inferior colliculus (IC), a midbrain nucleus that is the center for numerous ascending and descending auditory pathways. As in other mammals, serotonin is distributed non-randomly, suggesting that it selectively modulates certain regions of the auditory system.

Imposed on the ICs hardwired circuitry are inputs from a large variety of neuromodulators, including serotonin, dopamine, norepinephrine, acetylcholine, cholecystokinin, and somatostatin. Laura investigated the modulatory effects of serotonin on the tuning of neurons in the central nucleus of the IC in bats. Serotonin was found to exert a gain control in most neurons, facilitating or depressing responses to all frequencies in the neurons of the response area. This suggests that serotonin reconfigures IC circuitry to modulate perception of acoustic signals under different behavioral states. More interesting was the identification of a class of neurons in which serotonin changes the selectivity for different types of sound including tones, frequency modulated sweeps similar to echolocation calls and actual echolocation and social communication calls.

Laura's present research has led to many new questions. Few data link state-dependent neuromodulatory

# CISAB INTERNSHIP PROGRAM

effects to specific behaviors. To link brain biology and behavior, a number of techniques including extracellular electrophysiology in different behavioral states will be needed. The effect of endogenous sources of serotonin on the IC is also unknown; extracellular application might be lower or higher than the physiological range. Endogenous release is also likely to be timed with behavioral events. Interactions among multiple neuromodulators at the level of target neurons also needs to be examined as well as variation of density and distribution patterns of serotonin sensitive neurons among species. As Laura continues to investigate the functions of serotonin in the auditory brainstem in mice as well as bats, these and many other questions will be answered.

## Representative Publications:

Hurley, L.M. & G.D. Pollak. 1999. Serotonin differentially modulates responses to tones and frequency-modulated sweeps in the inferior colliculus. *Journal of Neuroscience* 19: 8071-8082.

Hurley, L.M. & G.D. Pollak. 2001. Serotonin effects on frequency tuning of inferior colliculus neurons. *Journal of Neurophysiology* 85: 828-842.

Hurley, L.M., A.M. Thompson, & G.D. Pollak. 2002. Serotonin in the inferior colliculus. *Hearing Research* 168: 1-11.

Thompson, A.M. & L.M. Hurley. 2004. Dense serotonergic innervation of principal nuclei of the superior complex in mouse. *Neuroscience Letters* 356: 179-182.

Hurley, L.M., D.M. Devilbiss, & B.D. Waterhouse. 2004. A matter of focus: monoaminergic modulation of stimulus coding in mammalian sensory networks. *Current Opinion in Neurobiology* 14:488-495.



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Faculty are encouraged to announce CISAB's new internship program to undergraduate and graduate students and refer them to CISAB for more information. The program is created to expose the student to hands-on experience in the application of animal behavior knowledge. Internship sites may include private and public research facilities, zoos, conservation groups, museums, animal rescue organizations, pet adoption centers, pet training centers, and veterinary hospitals.

The basic undergraduate internship program will be offered as a 3 credit course. Students will be required to invest 9-12 hours per week at the internship site, including a minimum of 3 hours volunteer time and 6-9 hours collecting ethogram data. Students will be required to submit a report to their faculty/ grad student mentor at the end of the semester. An advanced internship will be offered to students interested in completing a research project

Organizations currently participating in the program are:

**Bloomington Animal Shelter**  
**WonderLab Museum**  
**Indianapolis Zoo**  
**The Exotic Feline Rescue Center**

Students interested in participating may contact:

Susan U. Linville, PhD  
CISAB  
402 N. Park Ave  
Phone: 812-855-5895  
E-mail: [sulinvil@indiana.edu](mailto:sulinvil@indiana.edu)

## Center for the Integrative Study of Animal Behavior

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Indiana University  
402 N. Park Avenue  
Bloomington, IN 47405  
Phone: 812-855-9663  
Fax: 812-855-0411  
Email: cisab@indiana.edu

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## SUPPORT ANIMAL BEHAVIOR RESEARCH

Private contributions are an important way in which we can expand our efforts. Even a small amount can go a long way. For example, \$500 can send a student to a major scientific meeting to present their research, \$200 can buy supplies for a museum exhibit, \$25 can purchase chemicals to do DNA fingerprinting or other genetic tests, \$10 can cover the cost of distributing our Kid's Page to an elementary school class.

Charitable gifts are tax-deductible and can be mailed to: CISAB, 402 N. Park Ave, Bloomington, IN 47405  
(payable to IU Foundation).

**Yes, I would like to support Animal Behavior Research at Indiana University. I have  
included a contribution of \_\_\_\_\_**

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Those contributing over \$25 are entitled to receive paper copies of the Animal Behavior Bulletin for one year (also available as PDF copy on our web page). If you wish to receive the Bulletin please check here. \_\_\_\_\_