**Psychology 331 (Laboratories in Biopsychology, Cognition, and Neuroscience)**

**Description and Enrollment Procedures**

***Purpose***

The purpose of this 4-credit course is three-fold: (1) Provide students with opportunities to gain practical laboratory experience by assisting an individual faculty member in the Biopsychology or Cognition and Perception Program with his/her ongoing research. (2) Introduce students to selected general methods used in the field of biopsychology and cognitive neuroscience (brain and behavior and animal behavior). (3) Provide practical knowledge about research design, quantification of behavior, scientific writing, the use of animals in research, and miscellaneous techniques used by biopsychologists and cognitive neuroscientists in laboratory research.

***Prerequisites***

Psychology 230 (Intro. to Biopsychology) and permission of the instructor (some instructors may require Psychology 240 - Intro. to Cognitive Psychology or one further upper level course in Biopsychology; see Description of Lab Sections below). A lab course in Biopsychology is required of students concentrating in ‘Biopsychology and Cognitive Science,’ or Neuroscience leading to the B.S. degree, and therefore, these students will receive priority to register.

 ***Instructions for Enrollment***

Sections are identified by individual faculty INDI numbers (see below). Each student will be expected to devote approximately 10-12 hours/week in the laboratory to meet course requirements. What the students do during this time will vary depending on the nature of the research in each specific lab. Admission to a lab section is by *permission of that instructor* *only*. Students should first examine the list of the laboratory sections to be offered in a given Term (see below), decide on what section they want, and then apply for admission using the following procedures. Students are encouraged to apply for a lab section as soon as possible after the enrollment period opens.

**Application Procedures: *Note: To be admitted to Psychology 331, a student must first get permission from an individual faculty member to work in his/her lab.* Please follow these procedures:** (1) Fill out an application form (obtained on the Psychology Website:

http://www.lsa.umich.edu/psych/downloads/undergrad/courseinfo/psy331app.pdf) (2) Hand in the application form *directly* to the Professor in whose lab you wish to work. If you apply to two labs, the maximum number allowable, hand in a separate form to each Professor, and note this on the application. (3) After the Professor has reviewed the application he/she may set up an appointment for an interview. (4) You should contact the professor again before the end of the term in which you submitted an application to learn whether you have been accepted into the section. The professor “accepting” your application will authorize the Psychology Student Academic Affairs Office (1343 East Hall) to issue you permission to register for both the lecture section (001) and their specific lab section.

***Grading*** Grades in Psych 331 will be based on a subjective assessment of your performance in the lab (e.g., facility in acquiring specific skills; reliability; industriousness, accuracy and attention to experimental protocols, etc.) as well as writing assignments and participation in the weekly seminar.

R***elationship of Psychology 331 to Psychology 422 (Independent Research)****:*

Typically, Psych 331 will serve as a prerequisite to 422. That is, the normal sequence by which students will get Biopsychology lab experience will be to first take 331, and then if further exposure to this type of lab work is desired, to then take 422. Students who obtain additional lab experience via the 422 mechanism will be able to use the 331 plus 422 credits to fulfill the two natural science laboratory course requirement that is part of the concentration program in Biopsychology, Cognition, and Neuroscience.

***Description of Lab Sections***

**Section 107 – O.J. AHmed**

**(****ojahmed@umich.edu****, 4040 East Hall, 764-3853)**

*Description:* Our lab studies the neural correlates of reward, space, time and speed, as well as how the same circuits are altered in neuropsychiatric disorders. We train rodents on a range of simple behavioral tasks (real-world & virtual navigation, working memory and Pavlovian Conditioned Approach) to try to understand these circuits. Students will learn to train rodents and then also be exposed to the various neuroscience methods we use to record the activity of individual neurons in the brain as rodents perform these tasks. These methods include electrophysiology, optogenetics and imaging, as well computational modeling to make sense of these large datasets.

**Section 322 – J. B. Becker**

**(jbbecker@umich.edu, 1050 MBNI, 936-3670)** *Description:* Our lab examines sex differences in and effects of hormones on brain and behavior in laboratory rodents. There are on-going experiments exploring: a) aspects of female sex behavior, b) effects of gonadal hormones on the effect of cocaine on neurochemistry and behavior, and c) sex differences and effects of hormones on the motivation to self-administer cocaine; Students will work under the supervision of a graduate student or post-doc, and will learn a variety of general laboratory procedures, including handling rats, behavioral testing, giving drug injections, preparation of solutions, small animal surgical procedures, neurochemical methods, and molecular biology.

**Section 549 - J. Beehner**

**(****jbeehner@umich.edu****, 4052 East Hall, 764-2415)**

*Description:* Research in our laboratory is focused around the evolution of social behavior – particularly with respect to sexual selection in social mammals such as non-human primates. More specifically, our current research is examining the hormonal bases behind various behaviors that are related to acquiring, choosing, and/or keeping a mating partner in wild geladas (Theropithecus gelada) – a monkey that lives in the highlands of Ethiopia. Such behaviors include dominance, aggression, and quality signaling. We obtain our hormone samples non-invasively by collecting fecal samples from known individuals and extracting the hormones in the field. Samples are then further extracted and analyzed in our hormone laboratory at the University of Michigan. Students will participate in several stages of the hormone extraction and analysis process, gaining experience with the scientific method, experimental design, standard operating procedure for accurate pipetting, solid-phase extraction, radioimmunoassays, enzymeimmonoassays, and data analysis. Students accepted to work in our lab should expect to be assigned a methodological study related to the preservation of steroid hormones. Although students will be working with animal samples, students will not work directly with animals in our lab (since all of our subjects are wild-living). Priority will be given to students who have had Animal Behavior (Psych 335), Hormones and Behavior (Psych 448), and who can commit to more than one semester of research.

**Section 340 - K. C. Berridge (berridge@umich.edu, 4038 East Hall, 763-4365)**

*Description:*Our lab research focuses on affective neuroscience, particularly on brain mechanisms of reward liking and wanting, related emotions, and addiction.   We study neural bases of sensory pleasure, such as hedonic hotspots in the brain that generate reward 'liking'.  We also study brain mechanisms for ‘wanting’ and learning that control normal desires for the same rewards, but can also be turned into addictions.  Some of our studies also examine mechanisms of negative disgust and fear. Students will gain experience in behavioral techniques in animal neuroscience (ethological video analysis, behavioral testing) and neurobiological techniques (optogenetic viral & laser brain manipulations; microinjections; brain tissue analysis). Most studies involve rats or mice, so it is helpful to be comfortable with animals.

 **Section 542 – J. Boland**

**(jeboland@umich.edu, 4428D East Hall, 764-4488)** *Description*: Students working in this laboratory will learn about the cognitive processes involved in word recognition and sentence comprehension. Several current projects are related to bilingualism or second language learning. Students will participate in designing experiments, developing stimuli, collecting data, and interpreting results. We investigate language processing in both spoken and written modalities, using tools such as eye tracking, reading time paradigms, and cross-modal techniques. Students are encouraged to take Psychology 240 (formerly 340, Introduction to Cognitive Psychology) and Linguistics 200, 210, 211, or 212 either before or concurrently with 331.

<http://www-personal.umich.edu/~jeboland>

**Section 039 – B. Dantzer**

**(****dantzer@umich.edu****, 4038 East Hall, 615-2352)**

*Description:* Our lab examines how wild animals change their behavior, physiology, and reproduction to cope with changing environmental conditions. This includes a focus on understanding the hormonal mechanisms contributing to variation in social behavior. We study wild animals in the field like red squirrels in the Yukon, meerkats in South Africa, mice in Michigan, and prairie voles in Ohio. During our field studies, we collect fecal, hair, and blood samples for subsequent hormone analysis in our laboratory at the University of Michigan. Participating students should expect to gain hands on experience in several steps in the process of measuring hormones in fecal or hair samples. This includes weighing samples, pipetting, using a centrifuge, learning the basics of enzyme-immunoassays, and data curation and analysis. Priority will be given to students that have taken PSYCH 335 (Introduction to Animal Behavior) or PSYCH 448 (Hormones and Behavior) and who can commit to more than one semester in the lab.

**Section 579 – P. Deldin**

(**pjdeldin@umich.edu****,** **2255 East Hall, 647-9863)**

*Description:* Our laboratory studies emotional information processing in psychopathological populations utilizing neurophysiological measures. Specifically, the goal of the research is to examine emotional and cognitive (memory, attention, and expectancy) dysfunction in major depressives, schizophrenics and controls. ERP, fMRI and behavioral studies measures will be utilized.

**Section 132 – S. Flagel**

**(****sflagel@umich.edu****, 1024 MBNI Lab G059 MBNI, 936-2033)**

*Description:* Research in our laboratory focuses generally on individual differences in susceptibility to mental illness. Specifically, we use rats to study addictive behavior and related traits. Ongoing studies are designed to understand both the behavior and underlying brain mechanisms that might render one more susceptible to addiction. Students will gain experience in the areas of neuropsychopharmacology and classical Pavlovian learning mechanisms. Moreover, students will have the opportunity to learn about neuroendocrinology, neuroanatomy, and translational research relevant to psychiatric illness. The procedures routinely used in the laboratory include a number of behavioral techniques such as intravenous drug self-administration, repeated psychostimulant administration (i.e. psychomotor sensitization), Pavlovian conditioning, and tests for impulsive and anxiety-like behavior. In addition, pharmacological approaches as well as in situ hybridization, immunohistochemistry, tract-tracing and chemogenetic techniques are used to examine the neural circuitry underlying the behaviors of interest. Students will have the opportunity to assist with surgeries, behavioral testing of the animals, cryostat sectioning of brain tissue, and quantification of neuromolecular markers, among other things.

**Section 458 - W.J. Gehring**

**(wgehring@umich.edu, 4052 East Hall, 763-4381)** *Description:*Current work in the Human Brain Electrophysiology Laboratory concerns the cognitive and neural basis of executive control processes, the high level cognitive, affective, and motivational processes that govern behavior.  The primary methodology is event-related brain potential (ERP) activity recorded from 50 or more scalp electrodes.  Students will gain experience in ERP recording, including the application of electrodes and the testing of human subjects.  Computer analysis and interpretation of ERP data will involve training with specialized software for electrophysiological data as well as Windows-based word processing and graphing programs.  Major topics include:  (1) medial frontal lobe (anterior cingulate cortex) activity related to error detection and the processing of rewards and penalties,    (2) disruptions of brain electrical activity in individuals with psychiatric and neurological disorders, and (3) the development of executive control in children. A current focus is the role of dysfunctional error processing in pediatric obsessive-compulsive disorder.

**Section 578 – R. Lewis**

**(****rickl@umich.edu****, 4428F East Hall, 763-1466)**

*Description:*Current work in the Language and Cognitive Architecture lab focuses on understanding computationally rational decision making, the adaptive control of perceptual, motor and cognitive  processes; language processing (especially the role of working memory in sentence comprehension); and flexible artificial intelligence (AI) agents.We use a variety of methodological approaches, including high-speed eye-tracking and pupilometry, and computational modeling. PSY331 students may be involved in any aspect of the research process, including experimental design, implementation and execution, literature review, and data processing and analysis. For more on our work, see the lab website at <http://www-personal.umich.edu/~rickl>.

**Section 529 - I. Liberzon**

**(****liberzon@umich.edu****, 116 VAMC, 769-7392)**

*Description:*Students will work on one of the ongoing projects described below with a senior member of the lab. 1) Neuroimaging research: We use functional MRI to measure brain activity in human subjects with and without psychiatric disorders like anxiety, depression, and post-traumatic stress disorder. Students interested in neuroimaging of emotions, stress and cognitive-emotional interactions can learn relevant neuroanatomy and get involved in data collection, processing and analysis. 2) Pre-clinical research: We use basic science techniques to investigate the neurobiology of stress and trauma. We work with animal models of post-traumatic stress disorder and traumatic brain injury to assess the impact of stress and trauma on aspects of brain and behavior. We conduct behavioral (e.g. fear conditioning), molecular (e.g. western blot, in situ hybridization) and endocrine studies.

**Section 586 – C. Monk**

**(****csmonk@umich.edu****, 2000 East Hall, 615-9583)**

*Description:*Research in the Monk Lab involves two active and related lines of research. In the first line, lab members are examining how specific poverty-related stressors (e.g., neighborhood violence, parental neglect) and the developmental timing of those stressors impact brain development, stress hormone regulation and anxiety as well as depression symptoms during adolescence. For the second line of research, members are investigating how effective treatments for anxiety (cognitive behavioral therapy or medication) alter brain function and how these brain alterations relate to outcome in children adolescents.

**Section 001 – J. Morrow**

**(**[**jonmorro@med.umich.edu**](file:///%5C%5Cumroot%5Clsa%5CDept%5Cpsych%5Cdept%5CSAA%5CUndergrad%20Student%20Records%5CForms%5Cpsych331app%5Cjonmorro%40med.umich.edu)**,** **5047 BSRB,764-4283)**

*Description:* My research focuses on delineating the neurobiology of individual differences in vulnerability and resilience to comorbid psychiatric disorders, particularly addiction and post-traumatic stress disorder (PTSD). The Morrow lab employs behavioral, pharmacological, immunohistochemical, and neurosurgical techniques in rodents to identify and manipulate specific neural circuits that are both relevant to multiple psychiatric disorders and that show functional variability from one individual to the next. Findings suggest that functional connectivity within the limbic system, particularly involving the mesoaccumbens system, may affect vulnerability to a large number of psychiatric disorders, including both addiction and PTSD. We are planning to adapt these behavioral models for screening human subjects such that potential treatments and preventative strategies can be more effectively tested in both humans and animals.

 **Section 473 - T. Polk (tpolk@umich.edu, 4428E East Hall, 647-6982)**

*Description:*  Our lab is currently studying how the brain changes as we age, using functional MRI, functional magnetic resonance spectroscopy, and behavioral experiments. Psychology 331 students in the lab typically are involved in implementing an experiment, helping with literature reviews, and/or running a behavioral experiment using subjects from the undergraduate subject pool.

S**ection 256 - T. E. Robinson**

 **(ter@umich.edu, 4024 East Hall, 763-4361)** *Description:*  Students will gain experience in the general area of neuropsychopharmacology, especially as related to the mechanism of action of selected drugs of abuse. Ongoing projects are designed to understand the long-term consequences of psychomotor stimulant drugs (e.g., amphetamine, cocaine) on brain and behavior using rats as experimental subjects. The procedures in routine use in the laboratory include behavioral testing under a variety of experimental conditions (including intravenous drug self-administration), stereotaxic surgery for implantation of cannulae in brain, in situ hybridization histochemistry to examine how drugs alter gene expression in the brain, anatomical studies of how drugs change neuronal structure, and routine histological procedures on brain tissue. Students will assist in one of a number of ongoing projects, and are encouraged to take Psychology 436 (Drugs of Abuse, Brain and Behavior) either before or concurrently with 331.

**Section 138 - A.G. Rosati**

**(****rosati@umich.edu****, 4063 East Hall, phone)**

*Description*: The Cognitive Evolutionary Group examines the origins of cognition in humans and other primates. How do other animals think about the world, and do they use cognitive abilities that are similar to or different from our own? We conduct research with human participants on campus, and a variety of primate species including chimpanzees, macaque monkeys, and lemurs at off-campus sites. Our current research focuses on the evolutionary origins of human-like decision-making, self-control, and social cognition. Students will work with a graduate student or postdoctoral researcher, and responsibilities may include coding primate behavior from video, assisting in human cognitive experiments, and conducting literature reviews. For more on our work, visit: <https://sites.lsa.umich.edu/cognitive-evolution/>

**Section 230 – G. Rothschild**

**(****gid@umich.edu****, 4075 East Hall, 647-3114)**

*Description:* Sensation and memory are tightly linked in our everyday lives. Meaningful sensory experiences can transform to become long-term memories, and memories of past experiences influence how we process and perceive incoming sensory input. Our lab aims to understand the neural circuit mechanisms that underlie the bidirectional interaction between sensation and memory in health and disease. To this end, we use a wide range of neurophysiological and optical techniques to record and perturb neural activity in the neocortex and hippocampus of rodents, as they learn to perform sensory- and memory- guided tasks.

**Section 071 – M. Sarter**

(**msarter@umich.edu, 4032 East Hall, 764-6392)**

*Description:* Our research focuses generally on brain mechanisms mediating attentional mechanisms and capacities. Specifically, we are studying the regulation and function of the cortical cholinergic input system. Abnormalities in the regulation and integrity of this system contribute to the development of the cognitive symptoms of dementia and schizophrenia. Our present experiments are designed to measure the release of the transmitter acetylcholine in animals performing attention-demanding tasks. Furthermore, we are developing new methods in order to assess the capacity of choline transporters in vivo. Research involves animal models of schizophrenia and dementia to examine the role of dysregulated cortical cholinergic inputs in the manifestation of the cognitive impairments that are characteristic for these disorders. Students will be involved in experiments which employ combinations of sophisticated behavioral, neurochemical, electrophysiological and molecular methods to manipulate or measure cholinergic transmission in the cortex.

**Section 514 – P. Shah**

**(priti@umich.edu, 2204 East Hall, 615-3745)**

*Description:* The human brain is a sophisticated machine capable of impressive feats such as storing millions of memories, effortlessly processing complex visual scenes, and seamlessly integrating perception, thought, and action.  At the same, performance on many complex cognitive activities is highly limited. Individuals make well-known errors in scientific reasoning and decision making, have trouble comprehending difficult texts and diagrams, and can only store about 3-4 simple items in short-term memory. In the basic and applied cognition laboratory, our primary goal is to understand the nature of limitations in the performance of complex cognitive tasks and ultimately how these limitations may be overcome. I focus primarily on tasks relevant to school and other everyday contexts.  Our research has two foci. In one line of research, we study scientific reasoning, and, primarily, the interpretation and critical evaluation of scientific data. Other research focuses on understanding working memory and executive functions, basic mechanisms that support complex cognition, and the degree to which they can be improved, especially in populations that may have difficulty with these skills (e.g., older adults and individuals with ADHD). Students in the laboratory will learn some or all of the following: designing studies, developing stimuli, scheduling and testing research participants, entering and organizing data, conducting simple data analysis, and possibly presenting research. The students will also be given background information about this research and attend lab meetings in which we will discuss the research and relevant literature.

**Section 036 – N. Tronson**

**(****ntronson@umich.edu****, 4032 East Hall, 936-1495)**

*Description:* The goal of our research is to determine how memory processes are altered by other events, leading to either impaired or abnormally strong memories. To do this, our research focuses on behavioral and molecular studies of memory and emotion. In particular, we examine the modulation of memory by stress, illness and inflammation, or memory retrieval, and the intracellular mechanisms that cause these alterations in memory. Our laboratory primarily uses fear conditioning in mice, together with genetic and pharmacological manipulations, and subsequent molecular analysis of brain tissue. In this section, students will work on one of the ongoing projects in the lab, and will gain experience in analysis of behavioral tasks (e.g., fear conditioning, tests of depression-like behavior; anxiety tests), and biochemical assays of protein level in the brain (e.g., western blot, immunohistochemistry). Students are encouraged to take Psych 434 (Biopsychology of Learning and Memory) or another memory-related course either before or concurrently with 331.

1. *Name:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Student Number (middle eight digits on front of MCard):* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *Uniqname:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

 2. Year: Sophomore \_\_\_\_\_; Junior \_\_\_\_\_; Senior \_\_\_\_\_

3. *Phone number* where you can be reached: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*E-Mail Address:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. *Section requested* (give instructor’s name): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Are you applying to one other section? \_\_\_\_\_\_\_\_\_\_\_ IMPORTANT: Rank your choices for lab section if more than one. \_\_\_\_\_\_\_\_\_\_

5. *Area of concentration:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. *Overall GPA:* \_\_\_\_\_\_\_\_\_\_\_

7. *Relevant course background:* (Check the courses you have taken, and note any courses in which you will be enrolled concurrently with 331).

Psych 230 Intro to Biopsychology \_\_\_ Psych 240 Cognitive Psychology \_\_\_

Psych 332 Biopsychology of Rhythms

and Behavior \_\_\_

Psych 333 Affective Neuroscience \_\_\_

Psych 335 Intro to Animal Behavior

Psych 336 Drugs of Abuse \_\_\_ Psych 337 Hormones & Behavior \_\_\_ Psych 338 Primate Social Behavior \_\_\_ Psych 345 Human Neuropsychology \_\_\_ Psych 347 Perception \_\_\_

List any other Biopsychology and/or Cognition and Perception courses you have taken in the space below. List the courses you have taken in the following disciplines. *Biology:*  *Chemistry:*  *Mathematics and/or Statistics:*  *Other sciences:*  Answer the next five questions on a separate piece of paper. 8. Briefly describe why you want to take 331, and why you want this particular section. 9. Briefly describe your future plans (e.g., career, medical school, graduate school, or other goals), and how you think this course will be important in achieving these goals. 10. Do you have any objections to the use of animals in basic research, or do you personally object to working with animals? 11. Briefly describe your experience with computers and your knowledge of computer software packages and computer programming. 12. What special skills and abilities (e.g., hobbies, personal interests, or experience) do you have that may make you a special asset to the laboratory? Signature Date **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**