

## **Biology 3422: Genes, Brains, and Behavior**

### **Description:**

Genetic studies of physiological systems underlying animal behavior, including the genetic basis for normal and abnormal behaviors in animals and humans. Topics include: history of behavioral genetics; the ongoing debate about “nature vs. nurture”; contributions of genetic model systems including the nematode *Caenorhabditis elegans*, the fruit fly *Drosophila melanogaster*, zebrafish, the mouse *Mus musculus*, and other animal models; molecular mechanisms underlying the evolution of behavioral phenotypes; the emerging role of epigenetics in regulating nervous-system functions and behavior; the use of genetic and genomic analyses in studies of human behavior and psychiatric disorders.

**Prerequisites:** Bio 2970.

**Class goals:** This course is designed to help upper level students who are interested in neuroscience and genetics understanding the role of the genome and the function of genes in regulating behavioral phenotypes. Students who take this course are expected to participate in informal discussions, and to read and comprehend primary research papers. By using behavior as a phenotype, a student should be able to master advanced concepts in modern genetics and molecular analyses of complex phenotypes. They should also achieve better understanding of how the nervous system functions at the cellular and molecular levels to produce behaviors. Furthermore, understanding how studies of behavior in simple organisms can affect our understanding of human behavior is important for realizing that behavior is a trait that is sensitive to selection and other evolutionary forces.

### **Reading materials:**

No formal textbook is required. Primary scientific articles as well as chapters from the **Handbook of Behavior Genetics**, ed. Yong-Kyu Kim (<http://www.springerlink.com/content/978-0-387-76726-0>) will be assigned as readings for specific lectures. Other textbooks that you might find useful are **Behavioral Genetics** by Robert Plomin, John C. DeFries, Gerald E. McClearn, and Peter McGuffin; and **An introduction to behavior genetics** by Terence J. Bazzett. Russel’s iGenetics textbook will be referred to for general genetic concepts.

### **Meeting Times:**

Tue and Thu; 10:00-11:30. McDonnell Hall 362

### **Instructor:**

Instructor: Yehuda Ben-Shahar: 935-3484; benschahary@wustl.edu  
Monsanto Hall 411 (office hours by appointment)

### **Class Website:**

<http://www.nslc.wustl.edu/courses/Bio3422/bio3422.html>

### **Grading:**

***Exams and paper reports***

There will be two in-term exams (each represents 20% of the total grade). Each exam will emphasize materials introduced since the last exam but will also require synthesis of previous lectures. Final exam will include all covered materials (50% of total grade). Lectures will often include discussions of primary scientific articles that are relevant to specific lectures. Students will be required to write a short report on discussed articles (10% of total grade). Instructions for writing the report will be given in class.

**Syllabus** (readings in blue are those that will require a report)

Lecture	Date	Subject	Readings
1	08/27/09 Thu	Introduction; Historical origins of Behavioral and Neural Genetics	History; Hirsch; Holden; Plomin
2	09/01/09 Tue	Behaving without a “brain”	Preer; Kung
3	09/03/09 Thu	The nematode	Brenner; Hodgkin; Kaletta
4	09/08/09 Tue	The fruit fly I: Biology, genetic principles and screens	Anderson; Sokolowski; Thomas; de Bono
5	09/10/09 Thu	The fruit fly II	
6	09/15/09 Tue	Complex behavior in a simple organism - fruit fly courtship behavior	Dickson; Baker; Casci; Toma
7	09/17/09 Thu	The fruit fly III: Natural variations and quantitative genetics of behavior.	Mackay; Reaume
8	09/22/09 Tue	Simple models: The honey bee	Smith
9	09/24/09 Thu	The mouse; <b>Q &amp; A for exam I</b>	Crabbe; Bucan
	09/29/09 Tue	<b>Exam I (Lectures 1-8)</b>	
	10/01/09 Thu	<b>No class</b>	
10	10/06/09 Tue	The genetics of mammalian social behaviors	Robinson; Donaldson
11	10/08/09 Thu	The genetics of social behaviors - pheromone sensing in rodents ( <b>Tim Holy</b> )	Dulac; Firestein
12	10/13/09 Tue	The sense of touch and the genetics of pain ( <b>Gina Story</b> )	Perl; Patapoutian
13	10/15/09 Thu	Behavioral epigenetics and imprinting	Murrell; Meaney; Theodoridou
14	10/20/09 Tue	Learning and memory I	Kandel
15	10/22/09 Thu	Learning and memory II	Tully; Waddell; Lehrer
16	10/27/09 Tue	Eugenics – race and misuse of “genetics” ( <b>Gar Allan</b> )	Breeding; DNA & Criminal Justice System; Ideology of Elimination
17	10/29/09 Thu	Bird song – genetics of communications	Bolhuis; Stefanko
18	11/03/09 Tue	Biological Clocks ( <b>Christian Beaulé</b> )	Kuhlman; Siepka
19	11/05/09 Thu	Sleep ( <b>Paul Shaw</b> )	Tononi; Donlea
20	11/10/09 Tue	Anxiety and depression; <b>Q &amp; A for exam II</b>	Burmeister

	11/12/09 Thu	<b>Exam II (lectures 9-19)</b>	
21	11/17/09 Tue	Alcoholism and drug abuse ( <b>Sarah Hartz</b> )	Hartz
22	11/19/09 Thu	Aggression and anti-social behaviors	Popova
23	11/24/09 Tue	Sensory biology – emphasis on chemosensation	Yarmolinski, Stocker
	11/26/09 Thu	<b>Thanksgiving Break</b>	
24	12/01/09 Tue	Genetic tools for studying and manipulating the brain and behavior	
25	12/03/09 Thu	Open discussion; <b>Q &amp; A for final exam</b>	

Final exam: Wed 12/16/09. 6:00 - 8:00pm. McDonnell Hall 362.