



# NEUROGENETICS 4050

3 credit hours

Fall 2015

1187 Graves Hall

Tuesday & Thursday, 10:20-11:40 AM

## Course Director:

John Oberdick, Associate Professor, Department of Neuroscience  
4073 Graves Hall  
P: 292-8714  
e-mail: [oberdick.1@osu.edu](mailto:oberdick.1@osu.edu)

Office hours: by appointment please

## Course Objectives

The course will provide a deep understanding of gene discovery in the nervous system. We will consider classic studies of simple invertebrate systems in which the genes for motor, sensory, and cognitive function were mapped and cloned, and move on to classic studies of mouse neurological mutants, to a consideration of human genetics and neurological disorders. The main focus will be on the mapping and identification of genes affecting brain function, behavior, and human neurological disease. There will also be a strong focus on contemporary state-of-the-art knowledge about chromatin activation, gene expression, gene networks, and the relevance of these control mechanisms in brain function and disease. The course is designed to complement existing undergraduate courses in the neuroscience major.

## Textbook and Website

The textbook *Concepts of Genetics* by Klug, Cummings, Spencer and Palladino, 11<sup>th</sup> edition is highly recommended to cover the foundational material of classic as well as contemporary genetics. An older edition is suitable, or any basic genetics text should suffice if you already have another. The text (bound, or a cheaper loose-leaf version) or e-text is available through the Barnes & Noble bookstore for purchase or rent. We will use Carmen for the course website, and we will use the Socrative website for in-class interactive learning.

## Student Evaluation

One exam at the end of each module for a total of three exams, taken in class (85% of grade), and exams are not cumulative; two at-home "laboratory" exercise, plus a short essay on a topic of your choice (3 pages) (lab + essay = 15% of grade). Generally we will follow standard university percentile ranges for grading, however this will be adjusted based on the actual range of scores across the class.

**NEUROGENETICS 4050**  
**Fall 2015**

**A. Developmental Genetics and Gene Structure & Function in the Nervous System  
(Genotype to Phenotype)**

1. Aug. 25 Overview and history of genetics and neuroscience
2. Aug. 27 Review: cell nucleus, chromatin structure and gene expression
3. Sept. 1. Chromatin structure and modulation in the nervous system I
4. Sept. 3. Chromatin structure and modulation in the nervous system II: drug addiction, learning and memory, cognitive disorders and therapeutics
5. Sept. 8. Developmental genetics of the nervous system I: neural induction and patterning
6. Sept. 10. Developmental genetics of the nervous system II: genetic switches controlling nervous system development and function; ES and iPS cells
7. Sept. 15. Translational control, miRNAs, and protein/RNA trafficking in the nervous system
8. Sept. 17. Web tools for gene and gene expression analysis (Take-home 1)
9. Sept. 22. Reverse genetics: transgenic and knock-out animal strategies and their use in neuroscience
10. Sept. 24. Exam 1

**B. Transmission Genetics and Gene Discovery in the Nervous System**

11. Sept. 29. Review: meiosis, mitosis and mendelian genetics
12. Oct. 1. Linkage and recombination
13. Oct. 6. Sydney Brenner: mapping motor behavior genes in C elegans
14. Oct. 8. Getting at the genes: a gene network controlling mechanosensation in C elegans
15. Oct. 13. Mechanosensation and touch: beyond C. elegans
16. Oct. 20. Seymour Benzer and the genetic mapping (and cloning) of learning & memory genes in Drosophila; optogenetics in learning and memory

17. Oct. 22. The genetics of mice and dogs: mouse neurological mutants of Sidman and Rakic; canine narcolepsy and cloning of the Hypocretin receptor 2 (HCRTR2) gene
18. Oct. 27. Mapping and molecular cloning of the human Huntington's Disease gene
19. Oct. 29. Animal models of Huntington's Disease
20. Nov. 3 Exam 2

### **C. Multifactorial Traits and Diseases of the Nervous System, and Gene-Environment Interactions**

21. Nov. 5. Causative genes and molecular mechanisms underlying autism I
22. Nov. 10. Causative genes and molecular mechanisms underlying autism II
23. Nov. 12. Animal models of autism
24. Nov. 17. Causative genes and molecular mechanisms underlying schizophrenia
25. Nov. 19. Epigenetics and the effects of environment: Was Lamarck correct?
26. Nov. 24. Epigenetics and maternal effects: The Dutch Hunger Winter Study and obesity
27. Dec. 1. Paternal- and maternal-directed inheritance patterns: genomic imprinting and the brain
28. Dec. 3. Transposable DNA elements in the brain
29. Dec. 8. Exam 3

#### ***ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)***

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct." The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct. If I suspect that a student has committed academic

misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include suspension or dismissal from the University and a failing grade in this course. If you have any questions about the above policy, please contact me. Other sources of information on academic misconduct (integrity) include: COAM's web page (<<http://oaa.osu.edu/coam/home.html>>) "Eight Cardinal Rules of Academic Integrity" (<<http://www.northwestern.edu/uacc/8cards.html>>).