

Biology 540/CAMB541: Genetic Analysis

T-Th, 10:30-12, Goddard 101

Instructor: Scott Poethig

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This course describes the logic and practice of genetic analysis, i.e., the use of mutations for the analysis of gene function. The course is divided in two parts. The first part provides a general overview of the logic and methodology of genetic analysis. The second part introduces four widely used experimental systems--*Arabidopsis thaliana* (plant), *Drosophila* (fruit fly), *Caenorhabditis elegans* (nematode), *Mus musculus* (mouse)--and how genetic analysis has been used to study various processes in these organisms. The course ends by considering the special challenges of human genetics. The course is appropriate for graduate students and advanced undergraduates and who have had an introductory course in genetics and molecular biology.

Grading is based on a midterm (30%) and a final (40%) exam, and a 10 page term paper (30%).

Reading

Meneely, P., (2009), Advanced Genetic Analysis, Oxford University Press, New York.

BB: PDFs available on Blackboard

Date	Topic	Lecturer	Reading
Jan. 13	Principles of genetic analysis	Poethig	Chap. 1; BB
18	Genes and genomes	Poethig	Chap. 1
20	Cytogenetics	Poethig	BB
25	Mutagenesis	Poethig	Chap. 3
27	Types of mutations; complementation test	Poethig	Chap. 4
Feb. 1	Mapping mutations: markers, methods	Poethig	Chap. 5
3	Positional cloning	Poethig	Chap. 5
8	Reverse genetics	Poethig	Chap. 6
10	RNAi, whole genome screens	Poethig	Chap. 7
15	Conditional mutations	Poethig	Chap. 8; 9.1-9.3
17	Mosaic analysis	Poethig	Chap. 9.4
22	Pathway analysis: gene interactions	Poethig	Chap. 10
24	Pathway analysis: epistasis	Poethig	Chap. 11
March 1	Genetic analysis of natural variation	Poethig	BB
3	Midterm		
8	Break		
10	Break		

15	<u>Arabidopsis</u> : Life history, genetics, genomics	Poethig	Chap. 2, BB
17	-genetic analysis of a stem cell niche	Poethig	BB
22	-genetic analysis of an epigenetic trait: FLC	Poethig	BB
24	<u>Drosophila</u> : Life history, genetics, genomics	Schottenfeld	Chap. 2, BB
29	-saturation screen; segmentation mutants	Schottenfeld	Case study 3.1, BB
31	-signal transduction; the <i>sevenless</i> pathway	Poethig	BB
April 5	<u>C. elegans</u> : Life history, genetics, genomics	Sundaram	Chap. 2, BB
7	-heterochronic pathway; epistasis	Poethig	BB
12	-discovery of miRNAs	Poethig	BB
14	<u>Mus musculus</u> : Life history, genetics, genomics	Bucan	Chap. 2, BB
19	-behavioral genetics	Bucan	BB
21	-cancer genetics; the Mom1 story	Poethig	BB
26	<u>Homo sapiens</u> : complex diseases	Rader	BB

The genetic basis for organismal diversity is receiving increasing attention, aided by the development of new model systems. Choose one of the model organisms mentioned in Abzhanov et al (2008), and a trait of interest to you. In a 10 page paper, describe how you would go about determining the genetic basis for this trait. The paper should have three parts: 1) an introduction; 2) a description of the experimental system, and 3) the experimental approach. In the introduction, describe the problem of interest, and why it is important. The second section should provide a brief description of the life cycle of the organism of interest, with special attention to features important for genetic analysis. In the final section, describe how you would go about studying the problem of interest. This part should include a detailed description of the experiments, and how you would perform them. These experiments must be primarily genetic in nature. Papers that describe only molecular approaches (i.e. making transgenic plants/animals, gene expression studies) will receive lower grades.

Abzhanov, A., C. G. Extavour, A. Groover, S. A. Hodges, H. E. Hoekstra, E. M. Kramer, A. Monteiro. (2008) Are we there yet? Tracking the development of new model systems. Trends in Genetics 24: 353-360.