

MCB 317 Genetics and Genomics Syllabus  
Generic Syllabus for Course Evaluation Purposes

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Course description

Study of genetics as a discipline, genetic analysis as a tool to understand biology and the role of genome sciences in biology. A partial list of topics includes: the brilliance of Mendel and the discovery of transmission genetics; probabilities and genetic predictions; polymorphisms; classical and molecular genotyping; genetic genealogy; linkage, recombination & mapping; three point crosses in *Drosophila*; sex-linkage; tetrad analysis in yeast; genome-wide association studies; mitotic recombination; molecular genetic & genomic understanding of transcription; epigenetics; functional RNAs: siRNAs, miRNA, piRNAs and lncRNAs; functional genomics; and the molecular basis of evolution. A partial list of techniques that are covered include: protein purification, antibodies, various blots and classic methods of genotyping, libraries, SNP arrays, di-deoxy DNA sequencing, next-generation DNA sequencing, co-immunoprecipitation; 2-hybrid analysis; mosaic analysis; DNA arrays for expression profiling; other use of DNA arrays; qPCR/RT-PCR; Chromatin IPs (ChIP); ChIP on a chip; ChIP-Seq; siRNAs; *in vitro* mutagenesis; transgenics; CRISPR (various uses); role of genomics in diagnostics; genomic analysis of protein localization; genomic analysis of protein complexes.

Pre-requisites

MCB250, MCB251, MCB252 and MCB253, or consent of the instructor.

Credit

4 credit hours. This course counts for advanced course credit in the MCB major.

Lecture meets T/R 12:30-1:50

Discussions meet 1 hour/week

Recommended text book

Genetics: From Genes to Genomes, 7<sup>th</sup> edition, Michael Goldberg and Janice Fischer and Leroy Hood and Leland Hartwell, ISBN10: 1260240878, ISBN13: 9781260240870  
Copyright: 2021 (Note: I typically refer to this textbook as "Hartwell")

Learning objectives:

1. To understand transmission genetics and be able analyze and explain patterns of inheritance.
2. To understand methods of genotyping and be able to analyze and interpret genotype data.

3. To understand the logic and methodology involved in mutant hunts (genetic screens and selections).
4. To be able to interpret classic and molecular genetic data and construct molecular models that can account such data.
5. To understand linkage, recombination and mapping and be able to analyze and interpret data derived from crosses.
6. To understand and be able to explain and interpret results from the experimental approaches that have led to our current understanding of gene expression.
7. To understand and be able interpret results from current genomic technologies and to understand the relationship between functional genomics and techniques of molecular genetics.
8. To understand the relationship between genetic, biochemical and cell biology approaches to unraveling biological processes at the molecular level and to be able to analyze and interpret data derived from these approaches.

#### Assessment

- A. Exams: two midterm exams and one final exam, each exam is worth 30% of the course grade.
- B. Homework: homework assignments are worth a total of 10% of the course grade

#### Grading scale

A+	96.00-100%
A	90.00-95.99%
B+	89.00-89.99%
B	80.00-88.99%
C+	79.00-79.99%
C	70.00-78.99%
D+	69.00-69.99%
D	60.00-68.....99%
F	<60.00%

Instructor reserves the right to alter the grading scale downward (in the students favor) if the classes overall performance merits the use of a grading curve. Typically a curve is employed if less than 25% of the class achieve a score of 90.00% or higher.

#### Topics and Readings

Topic 1 Course introduction and overview

Hartwell Chapter 1

Topic 2 The Brilliance of Mendel

Hartwell Chapter 2

Topic 3 Genotyping

Hartwell Chapter 11 sections 11.0-11.3 and 11.5, Chapter 9 section 9.3

Topic 4 Extensions to Mendel

Hartwell Chapter 3

Topic 5 Yeast and Molecular Genetics as a Tool

Posted Reading: *Saccharomyces cerevisiae*, A Genetic Portrait of Yeast, posted on course website

Topic 6 Linkage, Recombination and Mapping

Hartwell Chapter 5

Topic 7 Tetrad Analysis

Hartwell Chapter 5, section 5.5

Topic 8 Molecular Techniques

Hartwell pages: 386-388, 567-569, 654-655 including figures 19.9 and 19.10

Topic 9 Overview of Eukaryotic Gene Expression

Hartwell Chapter 11 pages 382-385 and section 11.3

Topic 10 Molecular Genetic Analysis of Transcription

No reading (beyond a single textbook), a history experiments that lead to our current understanding of transcription

Topic 11 Genomics

No reading (the material is beyond a single textbook), a overview of functional genomic approaches as extensions of classical approaches to genetics and molecular genetics

#### Attendance Policy

1. In order to receive credit for the weekly online quizzes a student must attend the discussion the week the quiz is due.
2. Face-to-face lectures are recorded live and posted online for students to view/re-view. It is strongly recommended that students attend the live lecture and rely on the recorded copies of those lectures only for study purposes. However, attendance in lecture is not mandatory.

#### Statement on Academic Integrity

According to the Student Code, 'It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.' Please know that it is my responsibility as an instructor to uphold the academic integrity policy of the University, which can be found here: [http://studentcode.illinois.edu/article1\\_part4\\_1-401.html](http://studentcode.illinois.edu/article1_part4_1-401.html)

#### Disability accommodations

To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class are asked to provide the instructor with a DRES accommodation letter as soon as possible.