

EPI 249: Molecular Biology for Epidemiologists

Fall 1 2023, 2.5 credits

Dates: August 30, 2023 - October 20, 2023

Time: Wednesdays and Fridays, 11:30AM to 1:00PM

Location: Kresge G2

Primary Instructor: Immaculata De Vivo

Email: devivo@channing.harvard.edu

OH: by appointment

Guest Lecturers: Marta Crous-Bou

martacrousbou@gmail.com

Kathryn Lee Penney

kpenney@hsph.harvard.edu

OH: by appointment

TA: Ruitong Li

Email: ruitongli@g.harvard.edu

OH: TBD

Reading List

Recommended text (on reserve at Countway Library):

Strachan T, Read AP. (2011). Human Molecular Genetics (4th ed.). London; New York: Garland Science.

Supplementary materials:

- Supplementary movies at <https://www.labxchange.org>
- Supplementary reading list posted on course website (articles accessible through provided links)
- Watson JD, et al. (2007). Molecular Biology of the Gene (6th ed.). San Francisco: Pearson/Benjamin Cummings.
- Krebs JE, et al. (2009). Lewin's Genes X (10th ed.). Upper Saddle River, NJ: Jones and Bartlett Publishers.
- Fletcher H, et al. (2006). Instant Notes in Genetics (3rd ed.). Taylor & Francis, Inc.
- Watson JD, et al. (2006). Recombinant DNA (3rd ed.). New York: W.H. Freeman.
- Isaacson W (2021). The Code Breaker: Jennifer Doudna, Gene Editing, and the Future of the Human Race. Simon & Schuster.

Objectives

By the end of this course, students should be able to:

- Understand the mechanisms and regulatory processes involved in different steps of the central dogma of molecular biology
- Understand how cellular mechanisms go awry and how cells can repair these
- Gain a basic understanding of Mendelian and non-Mendelian genetics, meiosis, and mitosis
- Be familiar with the advantages and disadvantages of various molecular tools and study designs commonly used in molecular epidemiology research

Outcome Measures

Problem sets (distributed and submitted on paper in class)

- Problem set #1 (due 9/27/2023) = 30%
- Problem set #2 (due 10/25/2023) = 30%

Quizzes (in class)

- Quiz #1 (9/20/2023) = 20%
- Quiz #2 (10/20/2023) = 20%

For problem sets, students are welcome to reference texts or class notes, use the internet, or discuss with classmates, but the final submission must be the student's own work.

Default grading for this course is ordinal grading.

Please talk to the TA (Ruitong Li, ruitongli@g.harvard.edu) if you have any questions.

Course Schedule

- W: 8/30 Course outline / Molecular Biology: DNA structure (Ch. 1)
F: 9/1 DNA structure (cont'd) / DNA replication and telomeres / DNA transcription (Ch. 1)
- W: 9/6 DNA transcription / translation (Ch. 1)
F: 9/8 Translation (cont'd) (Ch. 1)
- W: 9/13 Gene regulation (Ch. 1)
Problem set #1 distributed
- F: 9/15 Gene regulation (cont'd) (Ch. 1, 11)
- W: 9/20 **Quiz #1** (covers material through 9/15)
F: 9/22 Gene structure (Ch. 1, 2, 9) (Kathryn Lee Penney)
Mitosis / Meiosis / Mendelian genetics (Ch. 2, 3)
- W: 9/27 Non-Mendelian Genetics (Ch. 3, 14, 15)
Problem set #1 DUE
- F: 9/29 DNA mutation and DNA repair (Ch. 13)
- W: 10/4 Epigenetics (methylation, imprinting) (Marta Crous-Bou) (Ch. 11)
F: 10/6 Classic molecular biology tools (Sanger, PCR)
- W: 10/11 Classic molecular biology tools (cont'd: cloning, blotting, microarrays, CRISPR)
F: 10/13 Modern molecular tools in population studies (Ch. 7, 8, 18)
(Taqman, Illumina, Next-generation sequencing / Copy number variations / How to choose a tool?)
Problem set #2 distributed
- W: 10/18 The genome and beyond + Path to Darwin
F: 10/20 **Quiz #2** (covers material from 9/22 to 10/18)
(10/25 **Problem set #2 DUE**)