MCB188 Chromosomes
Spring, 2024
Class will meet on Tuesday and Thursday from 3:00-4:15 pm. Room 169

Chromosomes are the repositories of our genetic material. Their evolution, dynamics, transmission and management (and the ways in which these aspects go awry) is fundamental to life. The goal of this course is to provide a broad understanding of these issues from diverse perspectives and length scales, ranging from molecules to whole chromosomes, and from genetics to biochemistry to physical and mechanical aspects, with implications for evolution and disease.

Overall organization: Nancy Kleckner (contact: kleckner@fas.harvard.edu)
Course website: https://canvas.harvard.edu/courses/127769

Class will usually meet in person. However, if we need to meet in zoom, here is the link:
https://harvard.zoom.us/j/99331956565?pwd=MC9kQzFqNjdlcUVGQTJ0VURwcDlzdz09

Class Format
The course will be evenly divided into lectures and classes devoted to student presentations of papers, likely collaborative in nature. There will be no final exam. Instead, at the end of the course, students will identify an interesting unsolved question in the chromosomes field, think of an experiment to address that question, write a 3 page double spaced paper that introduces and explains this experiment and its limitations, and give a 10min presentation on their idea (below).

End of Semester Exercise

Each student will identify an interesting question (in any subject area relevant to Chrmosomes, covered specifically by the course or not) and think of an experiment to address this question. A priority should be placed on sensible but elegant approaches.

Each student will prepare a 3-page double-spaced paper that (a) provides background, (b) poses the question, and (c) describes the idea of the experiment and the critical components needed for it to work. A few days after the paper is due, there will be a "mini-meeting" at which each student gives a 10-minute oral presentation of his or her question and proposed experiment; five minutes of questions will also be permitted per talk. In advance of this mini-meeting, copies of all papers will be distributed to all class members. (Dates below)

Grades
50% Class Participation
50% End-of-Semester Exercise
25% written paper
25% oral presentation

I. Classics
II. DNA
III. Mitotic chromosomes
IV. Meiosis and evolution

Schedule

Part I. Basics

1,2	Jan 23/25	Week 1.	Introduction, Mendel and Sturtevant
3,4	Jan 30/Feb1	Week 2.	Mutations and chromosome catastrophes
5,6	Feb 6/8	Week 3.	DNA and supercoiling
7,8	Feb 13/15	Week 4.	Topoisomerases and supercoiling *in vivo*

Part II. Mitotic Chromosomes

9,10	Feb 20/22	Week 5.	Chromosome program via HiC and cytology
11,12	Feb 27/Mar 1	Week 6.	Sister chromatids and Loops
13,14	Mar5/7	Week 7.	Chromatin dynamics and phase separation

Spring Break Mar9-17

15,16	Mar 19/21	Week 8.	Mechanical effects

short paragraph about possible papers due **Tuesday;**
discuss paragraphs together in class on **Thursday**

Part III. Meiotic Chromosomes (and Evolution)

17,18	Mar 26/28	Week 9.	Reversing the central dogma (David Haig)
19,20	Apr 2/4	Week 10.	Meiosis - Recombination
21,22	Apr9/11	Week 11.	Meiosis - Crossover interference
23,24	Apr 16/18	Week 12.	Meiosis - Homologous pairing

Week 13	**25. Tuesday April 23**	**Papers due for End of Semester Exercise**
	26. Thursday April 25	**Mini-meeting for presentation of papers**