

Course number		U-LAS14 20049 LE68					
Course title (and course title in English)		Chromosome Biology-E2 Chromosome Biology-E2		Instructor's name, job title, and department of affiliation		Graduate School of Biostudies Associate Professor,CARLTON, Peter	
Group		Natural Sciences		Field(Classification)		Biology(Issues)	
Language of instruction		English		Old group		Group B	
				Number of credits		2	
Number of weekly time blocks		1		Class style		Lecture (Face-to-face course)	
				Year/semesters		2025 • First semester	
Days and periods		Tue.5		Target year		Mainly 1st & 2nd year students	
				Eligible students		For all majors	
[Overview and purpose of the course]							
DNA contains all the information needed to build complex organisms from a single cell. Inside cells, DNA is packaged into discrete bodies called chromosomes. Since chromosomes hold information, but are also large structures that must interact with the cell, they create connections between many diverse biological fields. Among other areas, students will gain an understanding of: - what chromosomes are - how DNA is packaged inside them - how chromosomes replicate and divide - how problems with chromosomes can lead to disease. This introductory class is also intended to give students a foundation for further studies of bioinformatics. Additionally, this class will be taught in English, providing students a chance to master English reading comprehension of common biological concepts.							
[Course objectives]							
-To understand the central importance of chromosomes in biology -To explain the levels of chromosome organization, from the structure of DNA to large-scale folding of chromosomes -To understand how chromosomes are transmitted from one generation to the next, i.e., the fundamentals of genetics and heredity -To understand how problems with chromosome maintenance can lead to disease -To understand how researchers can visualize, isolate, and study chromosomes							
[Course schedule and contents)]							
1. Overview of the course; human chromosomes and chromosome disorders, how many chromosomes humans typically have, and what kind of disorders occur from having a different number of chromosomes. 2. Small-scale structure of chromosomes: DNA and nucleosomes, the physical properties of the DNA double helix, how DNA replicates, and how it associates with proteins called histones.							
Continue to Chromosome Biology-E2(2) ↓ ↓ ↓							

Chromosome Biology-E2(2)

3. Large-scale structure of chromosomes, chromosome condensation and cohesion: how DNA is packaged inside the nucleus by active reorganization of higher-order structure, and how chromosomes condense in preparation for division.
4. How chromosomes behave during cell division
: cell division from the chromosome perspective, and understand how chromosomes are accurately partitioned between daughter cells.
5. Chromosomes and the cell nucleus: what the nucleus is, the structure of the nuclear envelope and nuclear pores, how DNA is organized inside the nucleus during interphase.
6. Sex chromosomes: how chromosomes can determine sexual development, problems presented by having different types of chromosomes among members of the same species, and how these problems are solved.
7. Meiosis introduction: the special cell division called meiosis, which creates haploid gametes (sperm, eggs, pollen, spores, etc) from diploid germ cells.
8. Meiosis part 2: The problem of homologous chromosome pairing during meiosis, and some molecular mechanisms that organisms use to make the problem easier.
9. Meiosis part 3: Meiotic recombination: how DNA molecules are cut and re-joined to create new chromosomes from the original parent chromosomes, and why this is essential to the meiotic cell divisions.
10. Chromosome evolution: we will study examples of how chromosomes have changed over time, in both the human lineage as well as in nematode worms, and understand the importance of chromosome number for speciation
11. Chromosomes and genome sequence: we will examine the genome sequence of several organisms and see directly the relationship between DNA sequence and chromosomes
12. Chromosome structure from sequence data: we will examine the method called "HiC" to understand how sequencing of large numbers of DNA molecules from cells can help us understand the structure of chromosomes
13. Chromosome diversity: a diverse sampling of organisms will show how many different ways there are of packaging DNA into chromosomes
14. The current frontier of chromosome biology: we will look at recent advances in our understanding of chromosomes from results that have appeared in the literature over the past 6 months
15. Feedback (review of the final exam, Q&A session)

[Course requirements]

The course is open to all students, but a background in biology is essential, so non-biology students must have taken biology courses in high school.

Continue to Chromosome Biology-E2(3) ↓ ↓ ↓

Chromosome Biology-E2(3)

[Evaluation methods and policy]

Grading will be based on three areas: active participation, quizzes, and a final exam.

"Active participation" will be measured by: class attendance, asking questions/giving comments on Panda (as a rule, each student should ask at least 1 question/give one comment on Panda for each class), and answering questions during in-person classes.

Quizzes: short homework assignments. 3 will be given in total, at week 4, 8, and 12 of the class.

The final exam will be a 3-page exam with short answers, multiple choice questions, and a short English writing assignment.

Each area will contribute 1/3rd of the total grade.

[Textbooks]

Not used

No textbook will be used, but handouts will be provided of the lecture material as well as additional reading in English and Japanese.

[Study outside of class (preparation and review)]

For some students, the material will be familiar, but the English vocabulary will be new. For other students, both the content and the vocabulary will be new; for these students, this class may require extensive out-of-class study.

[Other information (office hours, etc.)]

Office hours will be 1 hour once per week on Fridays. Schedule to be announced on the first day of class.