科目ナンバリング	U-LAS14 20049 LE68						
授業科目名 <英訳>	Chromosome Biology-E2 Chromosome Biology-E2			担当者所属 職名・氏名	生命科学研究科 准教授 CARLTON, Peter		
群	自然科学科目群		分野(分類)	生物学(各論)		使用言語	英語
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）
開講年度・開講期	2025・前期	曜時限	火5	配当学年	主として1・2回生	対象学生	全学向

[授業の概要・目的]

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.

[到達目標]

-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

[授業計画と内容]

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, and how it associates with proteins called histones.

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

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partitioned between daughter cells.

5. Chromosomes and the cell nucleus: what then 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 methods called "HiC" and "DamID" 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)

[履修要件]

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.

[成績評価の方法・観点]

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.

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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.

[教科書]

使用しない

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

[授業外学修（予習・復習）等]

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.

[その他（オフィスアワー等）]

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

[主要授業科目（学部・学科名）]