| 科目ナンバリング | U-LAS14 20050 LE68 | | | | | | |
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| 授業科目名<br><英訳> | Practical Computing for Biologists-E2<br>Practical Computing for Biologists-E2 | | | 担当者所属<br>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・<br>開講期 | 2025・後期 | 曜時限 | 火5 | 配当学年 | 主として1・2回生 | 対象学生 | 理系向 |

**[授業の概要・目的]**

This class will introduce students to basic but powerful computational tools that are increasingly becoming an essential part of biological research. We will learn how to navigate a command line environment in a UNIX computer system, explore some useful open source software for DNA and protein analysis, and learn the basics of Python programming for analyzing biological sequence and images.

Each class will start with a background lecture and proceed to hands-on guidance. The ultimate aim of the class is to provide an introduction that will facilitate your further exploration of computational biology.

**[到達目標]**

-To discover current bioinformatics and biological image analysis software
-To be able to design analyze DNA sequences using open online software
-To learn general principles of programming using the Python language
-To develop a foundation for further exploration of the exciting world of bioinformatics

**[授業計画と内容]**

1. Overview of the course. How are computers used in biology, and introduction to the "Shell" (terminal)

2. Beginning programming with Python, a general computer language that can be adapted for biology

3. Introduction to manipulating text files and how DNA sequences are stored as text files

4. Extending Python with modules for mathematics (Numpy), biological sequences (Biopython), and data tables (Pandas)

5. The EMBOSS molecular biology suite: Searching protein and DNA sequences for features.

6. Plotting data with Python using the 'plotly' framework

7. Searching and visualizing DNA sequence distribution with Python

8. Small-group coding exercise #1

9. Protein structure analysis using AlphaFold, ChimeraX, and Python

10. Using Generative AI for programming assistance: strategies, misconceptions, potential

11. Approaching statistics: developing an intuitive understanding of statistical significance. p-values, t tests, Fisher's exact test.

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12. Imaging for biologists: Image fundamentals (pixels, intensity, scaling) using Fiji

13. Measuring 2D and 3D objects in images

14. Small-group coding exercise #2

15. Final exam

16. Feedback (test review and Q&A session)

**[履修要件]**

A laptop computer with a wireless internet connection is highly recommended for this class.

Windows users should install the program "Cygwin" (from http://www.cygwin.com) to provide a shell environment; Mac and UNIX users can use the built-in terminal program.

All students should also install Python to provide a Python environment.

Provisions can be made for students who do not have their own laptop.

**[成績評価の方法・観点]**

Grading will be based on three areas: active participation, in-class quizzes and exercises, 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.

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]**

Haddock and Dunn 『Practical Computing for Biologists』（Sinauer Associates）ISBN:978-0-87893-391-4（Textbook purchase is suggested but optional. See also the companion website at http://practicalcomputing.org）

**[授業外学修（予習・復習）等]**

Students will have to understand technical vocabulary in English. This may require studying and research outside of class hours.

**[その他（オフィスアワー等）]**

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

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**[主要授業科目（学部・学科名）]**