Practical computing for biologists – a gentle introduction

Educational subject description sheet

Basic information

Field of study Biology	**Education cycle** 2024/25
Speciality -	**Subject code** UJ.WBIBIOS.250.15052.24
Organizational unit Faculty of Biology	**Lecture languages** english
Study level second cycle	**Subject related to scientific research** Yes
Study form full-time degree programme	**Disciplines** Biological sciences
Education profile General academic	**ISCED classification** 0511 Biology
Mandatory elective	**USOS code**

Subject coordinator	Wiesław Babik, Piotr Zieliński
Lecturer	Wiesław Babik, Piotr Zieliński

Periods Semester 1, Semester 3	**Examination** graded credit **Activities and hours** Classes: 45	**Number of ECTS points** 5.0

Goals

C1	To teach the students how to automate handling and processing various forms of data using standard Linux/Unix command-line tools and the R programming language

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	student knows how to format and organize data within data files and files into folders	BIO_K2_W09, BIO_K2_W10	credit with grade
W2	student understands the format and structure of text files	BIO_K2_W09, BIO_K2_W10	credit with grade
W3	student knows the Linux shell commands and command-line utilities used to automate data processing and analysis	BIO_K2_W09, BIO_K2_W10	credit with grade
W4	student knows the basic commands of R language, as well as the role of R packages in data analysis	BIO_K2_W09	credit with grade
Skills – Student can:			
U1	connect to a remote Linux machine and work in the Linux shell environment	BIO_K2_U06	credit with grade
U2	use Nano text editor	BIO_K2_U06	credit with grade
U3	automate routine tasks in data handling and analysis using the Linux shell and command-line utilities	BIO_K2_U01, BIO_K2_U06	credit with grade
U4	use R and R studio to visualize, summarise, reformat and filter data	BIO_K2_U01, BIO_K2_U06	credit with grade
Social competences – Student is ready for:			
K1	understands the central role of text files in data exchange and analysis	BIO_K2_K02, BIO_K2_K08	credit with grade
K2	the understands and appreciates the advantages of using command-line tools in the analysis of biological data	BIO_K2_K02, BIO_K2_K08	credit with grade
K3	appreciates the benefits of scripts as a permanent record of the data analysis critical for reproducible science	BIO_K2_K02, BIO_K2_K08	credit with grade

Calculation of ECTS points

Activity form	Activity hours*
Classes	45
preparation for exercises	30
preparation for final test	25
computer tasks solving	25

Student workload	Hours	ECTS
	125	5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	• Organising data in a spreadsheet or spreadsheet-like format, relations between tables • Text files, text editors and regular expressions • Connecting to a remote Linux machine, • Moving around in the Linux system • Linux command-line utilities and pipelines • Automation with shell scripts • R and RStudio • Data in R • Subsetting and working with data frames • Tidyverse • Plotting • Practical examples of handling biological data (miniprojects)	W1, W2, W3, W4, U1, U2, U3, U4, K1, K2, K3

Course advanced

Teaching methods :

discussion, practicals, consultation

Activities	Examination methods	Credit conditions
Classes	credit with grade	to pass, the student has to obtain > 50% of the maximum score at the practical test

Entry requirements

none

Literature

Obligatory

1. Instrukcje do ćwiczeń przygotowane przez prowadzących / Manuals prepared by the instructors

Optional

1. Wickham, H., & Grolemund, G. (2016). R for data science: import, tidy, transform, visualize, and model data. O'Reilly Media, Inc.
2. Shotts, W. (2019). The Linux command line: a complete introduction. No Starch Press.

Effects

Code	Content
BIO_K2_K02	Absolwent jest gotów do uczenia się przez całe życie, potrafi inspirować i organizować proces uczenia się innych osób
BIO_K2_K08	Absolwent jest gotów do konsekwentnego stosowania i upowszechniania zasady ścisłego, opartego na danych empirycznych interpretowania zjawisk i procesów biologicznych w pracy badawczej i działaniach praktycznych
BIO_K2_U01	Absolwent potrafi stosować zaawansowane techniki i narzędzia badawcze właściwe dla wybranych specjalności nauk biologicznych
BIO_K2_U06	Absolwent potrafi stosować zaawansowane narzędzia statystyczne oraz techniki numeryczne adekwatne do problemów studiowanej specjalności z zakresu nauk biologicznych
BIO_K2_W09	Absolwent zna i rozumie zna podstawowe zastosowania modelowania przebiegu zjawisk i procesów biologicznych przy użyciu algorytmów matematycznych, statystycznych oraz informatycznych,
BIO_K2_W10	Absolwent zna i rozumie zna zasady planowania badań oraz techniki i narzędzia badawcze stosowane w wybranych specjalnościach nauk biologicznych