GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2023-2024

Integrative Biology (C004000)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 80 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 2)	English	Gent	lecture
			seminar

Lecturers in academic year 2023-2024

Marchal, Kathleen	WE09	lecturer-in-charge

Offered in the following programmes in 2023-2024	crdts	offering
Bridging Programme Master of Science in Bioinformatics(main subject Engineering)	3	A
Master of Science in Bioinformatics(main subject Bioscience Engineering)	3	A
Master of Science in Bioinformatics(main subject Engineering)	3	A
Master of Science in Bioinformatics(main subject Systems Biology)	3	A
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology	3	A
Exchange Programme in Bioinformatics (master's level)	3	A

Teaching languages

English

Keywords

Network-based data analysis, systems biology, data-integration

Position of the course

This is an advanced course in the master of bioinformatics and systems biology which aims at introducing the importance of data-integration in systems biology. The course is tailored towards students that pursue a master in bioinformatics or any other advanced master that aims at the analysis of cellular, molecular data. The course aims at showing how in systems biology specific biological questions are solved through data-integration. The course will highlight some state-of-the-art research questions and show how they can be approached using bioinformatics tools of which the underlying methods are taught in the theoretical courses. The main emphasis is by means of examples showing that the choice of the analysis method can severely influence the outcome of the results and that therefore in bioinformatics both understanding the intricacies of the biological problem and the underlying assumptions of the tool used to solve the problem are essential to critically evaluate the results. It also shows how different tools solve slightly different research questions and how users need to be aware of the intricacies of the tool to select to most optimal tool for a given research question. By giving examples of applications of integrative data analysis in real world (in plant breeding, synthetic biology, personalized medicine) students will be informed on the ethical aspects that go hand in hand with this novel domain of data-(re) analysis.

Contents

The course integrates tools and techniques discussed in the other courses to solve specific 'biological problems' in bioinformatics.
Part II (semester II)
Top down network inference
- Expression based methods
- Integrative methods

Network-based data-interpretation
• Overview of techniques to visualize data on a network (Pathfinding approaches, Graph based clustering, diffusion techniques)
• Application: eQTL analysis, gene prioritization, biomarker identification
Genotype phenotyping mapping
• GWAS/QTL (population stratification, linear models)
• Network-aided GWAS
• Integrative genotype-phenotype mapping (cancer systems genetics)
Applications in the domain of medical, microbial and Biotechnology (plant breeding, GWAS for trait selection, personalized medicine)

Initial competences

identical to those of the Master in Bioinformatics

Final competences

1 Understanding the concepts of network inference, motif detection, data integration.
2 Recognize analysis techniques underlying bioinformatics tools.
3 Being able to independently read and analyse a systems biology paper that combines biological results with advanced data-analysis.
4 Being able to apply a tool given the available documentation and literature.
5 Being able to implement a tool given the description in a paper.
6 Being able to construct a model to understand a complex biological problem.
7 Critical reading attitude towards the domain.
8 Understanding bioinformatics is a fastly evolving discipline.
9 Functioning as a member of a multidisciplinaire environment.
10 Communication in an interdisciplinary context.
11 Being aware of ethical and confidentionality aspects of some bioinformatics applications.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Learning materials and price

prerecorded presentations/course notes on Ufora

References

recent research articles

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

not applicable

Calculation of the examination mark

Students will be evaluated based on the written end exam (open book) for their understanding, analytical and synthesizing skills (18/20). Student will have to write a report (review of a paper, permanente evaluatie). THis will contribute 2/20 marks.