UAB
Universitat Autònoma de Barcelona

Genomics, Proteomics and Interactomics

Code: 100893
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500252 Biochemistry	OB	3

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although no previous formal requirements have been set, basic knowledge is expected on Biochemistry and Molecular biology, Genetics, Microbiology, Cell biology, Methods on recombinant DNA and Statistics.

For certain activities a basic level of understanding for reading english is required.

Objectives and Contextualisation

Genomics is the science dealing with the structure, content and evolution of genomes. Is a relatively novel science (we can say that it was born in 1995 with the sequencing of the first bacterial genomes) that developed explosively in the last years. The development of methods for automatic sequencing of nucleic acids has been a key factor about. In 2001 the first draft of the sequence of the human genome was presented, a historic milestone that opened the doors for the studies on comparative genomics and the evolution of the human species, on the biological clues of the human nature, on the genotype-phenotype association studies to find genes or regions of DNA related with diseases, etc.

After the sequencing of genomes appeared the so called "postgenomic" period. Among its tasks are the analyses of genes and genomes expression in a massive way (Transcriptomics and Functional Genomics), the identification and structural-functional analysis of proteins (Proteomics), and of their interactions (and with the other biomolecules) and formation of complexes (interactomics). Together with the identification and quantitation of all the metabolites present in a sample of an organism (Metabolomics), such knowledge provides the basis to try the integration of the whole conjoint and reach a global description of the biology of the cell (Systems biology).

The main formative goals of the subject are : the understanding of the diversity and complexity of genomes and proteomes; the study of the historic and evolutionary character of the genetic information as well as its nature, the meaning and consequences of the intraspecific and interspecific variability; and finally the potentiality of the applications that come from the genomic, transcriptomic and proteomic information. It is also part of the subject to know the experimental and computational methods that are used in the so-called "omic" sciences.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Collaborate with other work colleagues.
- Design experiments and understand the limitations of experimental approaches.
- Interpret experimental results and identify consistent and inconsistent elements.
- Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
- Make an oral, written and visual presentation of one's work to a professional or non-professional audience in English and understand the language and proposals of other specialists.
- Manage bibliographies and interpret the information in the main biological databases, and also know how to use basic ICT tools.
- Manage information and the organisation and planning of work.
- Read specialised texts both in English and one's own language.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take responsibility for one's own learning after receiving general instructions.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.
- Use the basics of mathematics, physics and chemistry that are required to understand, develop and evaluate the chemical procedures of living matter.

Learning Outcomes

1. "interpret use information existing databases biological, patents;, market, etc."
2. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
3. Collaborate with other work colleagues.
4. Design experiments and understand the limitations of experimental approaches.
5. Establish structural, functional and evolutionary relations based on information in existing biological databases .
6. Explain the physical and chemical principles behind the methodology and the tools used in genomic, transcriptomic, proteomic, interactomic, metabolomic and metabonomic analysis.
7. Interpret and use the information obtained from experiments in genomics, transcriptomics, proteomics, interactomics, metabolomics, metabonomics, etc.
8. Interpret experimental results and identify consistent and inconsistent elements.
9. Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
10. Make an oral, written and visual presentation of one's work to a professional or non-professional audience in English and understand the language and proposals of other specialists.
11. Manage information and the organisation and planning of work.
12. Model and quantitatively represent a biological system or process.
13. Read specialised texts both in English and one's own language.

14. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
15. Take responsibility for one's own learning after receiving general instructions.
16. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
17. Think in an integrated manner and approach problems from different perspectives.
18. Use ICT for communication, information searching, data processing and calculations.

Content

GENOMICS

- Introduction to genomes

- Sequencing, assembly and annotation of genomes

- Study of gene expression: Transcriptomics

- Comparative genomics

- Nucleotide and structural variation

PROTEOMICS AND INTERACTOMICS

- Introduction and Basic Concepts
- Diversity of the Proteome
- Basic Proteomics Techniques
- Quantitative Proteomics
- Structural and Functional Proteomics
- Interactomics

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Recommended readings and solving problems	40	1.6	18, 3, 4, 5, 6, 11, 8, 13, 12, 1, 7, 17, 10, 15
Seminars and problems	16	0.64	18, 3, 4, 5, 6, 11, 8, 13, 12, 1, 7, 17, 10, 15
Theory classes	29	1.16	18, 4, 5, 6, 11, 8, 13, 12, 1, 7, 17, 15
Type: Supervised			
Individual tutorials	3	0.12	4, 5, 11, 8, 1, 7, 17, 10, 15
Type: Autonomous			

Study	41	1.64	18, 3, 4, 5, 11, 8, 13, 12, 1, 7, 17, 15	

The subject consists of theory classes, seminars for the resolution of practical cases and problems and tutorials. The following describes the organization and teaching methodology that will be followed in these three types of training activities.

Theory classes:

The contents of the theory program will be taught mainly by the teacher in the form of masterclasses with audiovisual support. Presentations used in class by the teacher will be previously available on the Virtual Campus of the subject. It is recommended that students print this material and take it to class, to use it as support when taking notes. It is advised that students regularly consult the recommended books in the Bibliography section of this teaching guide to consolidate and clarify, if necessary, the contents explained in class.

Seminars and problem classes:

The mission of seminars and problem classes is to bridge between masterclasses and practical work, promoting active learning to develop the ability to analyze and synthesize, critical reasoning, and problem-solving ability. Seminars and problem classes are sessions with a small number of students (maximum 30 students). Its mission is to deepen or complete the knowledge presented in the masterclasses by solving problems and discussing case studies. Students will receive periodic readings recommended, problems and cases to solve, web addresses to consult, etc.

15 minutes of a class will be dedicated to answer the institutional surveys of the UAB

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	80	9	0.36	18, 4, 5, 6, 11, 8, 12, 7, 17
Seminars and problems	20	12	0.48	2, 16, 14, 18, 3, 4, 5, 6, 11, 8, 9, 13, 12, 1, 7, 17, 10, 15

Continued evaluation:

The evaluation of the subject will be carried out through a series of continued evaluation activities, a partial exam, and a retake exam, corresponding to each of the two parts of the subject: Genomics and Proteomics/Interactomics. The weight of each part of the subject will be 50% of the final grade. The following details the weight of the different tests and activities corresponding to each of the two parts of the subject:
Genomics 50%: 80% exam + 20% problems-seminars (over the overall mark: 40% exam + 10% problems and seminars)
Proteomics 50%: 80% exam + 20% problems-seminars (over the overall mark: 40% exam + 10% problems and seminars)
The partial exams will consist of multiple-choice or short-answer questions or problems. These tests will be eliminatory of matter.

Only those grades that are >=4.0 will be averaged. Students who have obtained a mark of less than 4.0 (out of 10) in the previous exam of one or both of the partials will have to take the recovery exam for the corresponding partial(s) (first partial, second partial, or both).
- To participate in the retake exam, students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two-thirds of the total grade for the subject or module. Therefore, the student will obtain the qualification of "Not Evaluable" when the evaluation activities carried out have a weighting of less than 67% in the final qualification.
- The students who fail the continued evaluation of the part corresponding to problems and seminars will have the opportunity to make the recovery on the day of the final test.
The final test will also be open to any student who, having passed the partial tests, wishes to improve the mark obtained in one or both partial tests. In this case, the student must notify the corresponding teachers of her interest in taking the final grade improvement test and will renounce the previous grade.
Students who cannot attend an individual evaluation test for justified reasons (such as illness, death of a first-degree relative, or accident) and provide the corresponding official documentation, will have the right to take the test in question on another date.
The course is considered passed if the overall final grade is >=5.0.
At the beginning of the classes of each part of the subject, the corresponding professor will detail how the problems-seminars and the integrating exercise (in the case of the Genomics part) will be evaluated.

Unique evaluation:
There will be an Exam that will include multiple choice or short answer questions or problems from both the genomics and proteomics parts. The grade obtained in this test will account for 80% of the final grade for the subject, with 40% corresponding to the genomics part and the remaining 40% corresponding to the proteomics part.
The delivery of the activities carried out during the course will follow the same procedure and calendar as in the continued evaluation. Depending on the teacher, they can be individual or group work to be delivered in print, through the virtual campus, or through presentations in the classroom. The delivery will follow the same procedure and calendar as in the continued evaluation. The grade corresponding to this part of classroom practices will mean a final 20%, 10% corresponding to the genomics part, and the other 10% to the proteomics part.

Bibliography

Books:

- Gibson, G. & S. V. Muse, 2009 (3rd edition). A Primer of Genome Science. Sinauer, Massachusetts. USA.

- Brown, T. A., 2017 (4th edition). Genomes 4. Garland Science, UK.

- Lesk, A.M. 2017. Introduction to genomics (3rd edition). Oxford University Press, Oxford, UK.

- Twyman R. M., 2014 (2n edition). Principles of Proteomics. Garland Science, New York & London.

- Lovric J., 2011. Introducing Proteomics. Ed. John Wiley & Sons, Oxford, UK.

Links:

- Campus Virtual de la UAB: https://cv2008.uab.cat/

- Entrez Genome Database: http://www.ncbi.nlm.nih.gov/sites/genome

- Expasy Proteomics Server: http://expasy.org/sprot

Software

None

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	331	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	332	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	33	Catalan/Spanish	second semester	morning-mixed