Universitat Autònoma de Barcelona

2020/2021

Genomics, Proteomics and Interactomics

Code: 100893
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OB	3	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Barbara Negre de Bofarull

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

- Collaborate with other work colleagues.
- Design experiments and understand the limitations of experimental approaches.
- Interpret experimental results and identify consistent and inconsistent elements.
- Make an oral, written and visual presentation of ones 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 ones own language.
- Take responsibility for one's own learning after receiving general instructions.
- 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. Collaborate with other work colleagues.
3. Design experiments and understand the limitations of experimental approaches.
4. Establish structural, functional and evolutionary relations based on information in existing biological databases .
5. Explain the physical and chemical principles behind the methodology and the tools used in genomic, transcriptomic, proteomic, interactomic, metabolomic and metabonomic analysis.
6. Interpret and use the information obtained from experiments in genomics, transcriptomics, proteomics, interactomics, metabolomics, metabonomics, etc.
7. Interpret experimental results and identify consistent and inconsistent elements.
8. Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English and understand the language and proposals of other specialists.
9. Manage information and the organisation and planning of work.
10. Model and quantitatively represent a biological system or process.
11. Read specialised texts both in English and ones own language.
12. Take responsibility for one's own learning after receiving general instructions.
13. Think in an integrated manner and approach problems from different perspectives.
14. Use ICT for communication, information searching, data processing and calculations.

Content

GENOMICS

- Introduction to genomes

- Genetic and physical maps

- Sequencing, assembly and annotation of genomes

- Transcriptomics

- The human genome

- Comparative genomics

- Nucleotide and structural variation

PROTEOMICS AND INTERACTOMICS

- Proteomics: Basic introduction

- Experimental and bioinformatic methods in proteomics

- Proteomics of identification, functional proteomics and structural proteomics

- Interactomics

- Applications of proteomics and interactomics

- (Metabolomics, Systems biology and other "omics")

"*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents."

Methodology

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.

"*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities."

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Recommended readings and solving problems	40	1.6	14, 2, 3, 4, 5, 9, 7, 11, 10, 1, 6, 13, 8, 12
Seminars and problems	16	0.64	14, 2, 3, 4, 5, 9, 7, 11, 10, 1, 6, 13, 8, 12
Theory classes	29	1.16	14, 3, 4, 5, 9, 7, 11, 10, 1, 6, 13, 12
Type: Supervised			

Individual tutorials	3	0.12	3, 4, 9, 7, 1, 6, 13, 8, 12
Type: Autonomous			
Study	41	1.64	14, 2, 3, 4, 9, 7, 11, 10, 1, 6, 13, 12

Assessment

The evaluation of the subject will be carried out through a series of activities of continuous evaluation, 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 is 50% on the final grade. The weight of the different tests and activities corresponding to each of the two parts of the subject is detailed below:

50% genomics: 60% exam + 20% integrating exercise + 20% problems-seminars (over the overall grade: 30% exam + 10% integrating exercise + 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 type test questions or short answer or problems. These tests will be eliminatory of matter.

Average will be done only with those grades that are > = 4.0. Students who have obtained a mark less than 4.0 (out of 10) in the previous examination of one or both partials must carry out the examination of recovery of the corresponding partial (s) (first partial, second partial or both).

- To participate in the retake exam, the students must have been previously evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, the students will obtain the "Not Evaluable" rating when the evaluation activities carried out have a weighting of less than 67% in the final grade.

- Students who suspend the continuous evaluation of the part corresponding to problems and seminars will be able to do the retake exam 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 grade obtained in one or both partial tests. In this case, the student must notify the corresponding professors of their interest in presenting themselves to the final exam. The second mark obtained in the final exam will always be considered.

Students who can not attend an individual exam for a justified cause (such as illness, death of a first-degree relative or accident) and provide the corresponding official documentation, will be entitled to take the exam in question on another date.

The subject is considered approved if the 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 will be evaluated (in the case of the Genomics part).

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Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	70	9	0.36	14, 3, 4, 5, 9, 7, 10, 13

Integrating Exercise	10	3	0.12	14, 2, 4, 9, 7, 11, 10, 1, 6, 13, 8, 12
Seminars and problems	20	9	0.36	14, 2, 3, 4, 5, 9, 7, 11, 10, 1, 6, 13, 8, 12

Bibliography

Books:

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

- Brown, T. A., 2006 (3rd edition). Genomes. Garland Science, 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