Universitat Autònoma de Barcelona

2018/2019

Genomics, Proteomics and Interactomics

Code: 100792
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OT	4	0

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

Alicia Roque Cordova

Prerequisites

Although there are no oficial requirements students are assumed knowledge of Biochemestry and Molecular Biology, Genetics, Microbiology, Cellular Biology, Methods of recombinent DNA and Statistics.

For some activities a basic level of english is necessary.

Objectives and Contextualisation

Genomics is the science that studies the structure, content and evolution of genomes. It is a relatively new science (born in 1995 with the sequencing of the first bacterial genomes) and has developed explosively during the recent years. The development of automatic methods for genome sequencing has been key. In 2001 the first draft of the Human genome was presented. It represented a historic landmark which opened the doors to studies in comparative genomics and evolution of humans, the biological components of human kind, genotype-phenotype association studies for the discovery of gens or genetic regions related with illnesses, etc.

After the sequencing of whole genomes appears the "postgenomic" era. The aim is to conduct a massive analysis of the expression of genes and genomes (Transcriptomics and Functional Genomics), the identification and structural and functional analysis of proteins (Proteomics) and their interactions (and with other biomolecules) and the formation of complexes (Interactomics). In conjunction with the identification and quantification of all the metabolites present in a sample of the organism (Metabolomics), this knowledge gives rise to the bases to integrate all the data and reach a global description of the biology of the cell (Systems Biology).

The main objectives of this course are: the understanding of the diversity and complexity of genomes and proteomes; the study of the historic and evolutive characteristics of genetic information and the nature, meaning and consequences of intra-specific and inter-specific variability; and finally the potential applications of genomics, transcriptomics and proteomics data. It is also an objective to learn the experimental and computational methods used in the so-called "omics" sciences.

Skills

- Analyse and interpret the origin, evolution, diversity and behaviour of living beings.
- Apply statistical and computer resources to the interpretation of data.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning strategies.
- Obtain information, design experiments and interpret biological results.
- Work in teams.

Learning outcomes

1. Apply statistical and computer resources to the interpretation of data.
2. Apply the tools of genomics, transcriptomics and proteomics.
3. Be able to analyse and synthesise.
4. Be able to organise and plan.
5. Describe the diversity of genomes and the basic mechanisms of their evolution.
6. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
7. Develop independent learning strategies.
8. Work in teams.

Content

PART I. GENOMICS

Topic 1. Introduction to genomes

Topic 2. Genetic and physical maps

Topic 3. Sequencing, assembly and annotation of genomes

Topic 4. Transcriptomics and epigenomics

Topic 5. The human genome

Topic 6. Comparative genomics

Topic 7. Genomic variation and paleogenomics

PART II. PROTEOMICS AND INTERACTOMICS

Topic 8. Introduction and basic concepts.

Topic 9. Proteome diversity.

Topic 10. Basic techniques of proteomics.

Topic 11. Quantitative proteomics.

Topic 12. Structural and functional proteomics.

Topic 13. Interactomics.

Methodology

The subject consists of theoretical classes, seminars for the resolution of practical cases and problems, and tutoring sessions. Here we describe the organization and the teaching methodology that will be followed in these three types of training activities.

Theory classes:

The content of the theory program will be taught mainly by the teacher in the form of master classes with audiovisual support. Presentations used in class by the teacher will be previously available on the Moodle classroom of the subject. It is recommended that students print this material and take it to class, to use it as a support when taking notes. It is recommended that students regularly consult the books recommended in the bibliography section of this teaching guide, as well as the readings proposed in the Moodle classroom, in order to consolidate and clarify, if necessary, the contents explained in class.

Seminars and problem solving classes:

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

Tutoring sessions:

There will be up to 3 tutoring sessions with the teacher. In these sessions, the doubts that the students raise about the theoretical program topics will be resolved to facilitate the understanding of specific aspects of the subject.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Seminars and problem solving classes	15	0.6	2, 1, 5, 7, 6, 3, 4, 8
Theory	30	1.2	2, 1, 5, 7, 6, 3, 4, 8
Type: Supervised			
Tutoring	3	0.12	2, 1, 5, 7, 6, 3, 4, 8
Type: Autonomous			
Problem solving, activities and recommended readings	44	1.76	2, 1, 5, 7, 6, 3, 4, 8
Study	48	1.92	2, 1, 7, 6, 3, 4, 8

Evaluation

The evaluation system is organized in **six main activities**. There will also be a **recuperation exam** and an **optional activity to improve the final grade**. The details of the activities are:

Main evaluation activities

(A) Partial exams. Overall weight **65%**

- **Partial exam 1 (Genomics).** Weight **30%**
- **Partial exam 2 (Proteomics/Interactomics).** Weight **35%**

Partial exams are combined tests that can consist of multiple-choice questions or short answer questions or problems. These tests willbe eliminatory of contents.

There will be a first partial exam corresponding to the part of **Genomics** with a weight of **30%** on the final grade of the subject, and a second partial exam corresponding to the part of **Proteomics/Interactomics** with a weight of **35%** on the final grade of the subject.

To pass these two evaluations you have to reach a **minimum score of 4.0 in each of them**.

(B) Continuous assessment. Overall Weight **35%**

Throughout the course, professors will present problems or seminars related to the taught subject that the students must solve in the form of evaluations, deliveries or active participation in the seminars. There will be four different typologies:

- **Weekly Problems of Genomics.** Weight **10%**

The continued nature of this evaluation means that the subject can not be evaluated unless there is a **minimum participation in 50% of the activities proposed**.

- **Integrative work of Genomics.** Weight **10%**

The work will contain issues related to the different topics of the Genomics part. It will be done in groups of 3-5 students. Professors will supervise the work and evaluate progress on a weekly basis and at the end of the subject.

Students will deliver the works following the guidelines for content, presentation and deadlines.

This activity is **mandatory** and non-participation will entail **non-evaluation of the subject**.

- **Seminars of Proteomics/Interactomics.** Weight **10%**

The continued nature of this evaluation means that the subject can not be evaluated unless there is a **minimum participation in 50% of the activities proposed**.

- **Integrative problem of Proteomics/Interactomics.** Weight **5%**

The problem will contain issues related to the different topics of the Proteomics part.

Students will deliver the problem following the guidelines for content, presentation and deadlines.

This activity is **mandatory** and non-participation will entail **non-evaluation of the subject**.

Retake exam

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling **at least two thirds of the final score** of the course.

The **evaluations 1 and/or 2** can be retaken individually and the grade, if **>=4**, will make an average with those passed in the partial exams. In the event that the grade of the retake exam does not reach a **minimum of 4.0**, it cannot make an average and the student does not pass the subject.

Continuous assessment (weekly problems of genomics, integrative work of genomics, seminars of proteomics/interactomics and integrative problem of proteomics/interactomics), due to its continued nature, **cannot be retaken**.

Improvement of the final qualification

Students who have passed the evaluations 1 and 2 want to **improve their final qualification**, may opt for a final test. This test will include **all the subject contents**. It is not possible to improve the grade through works or other types of activities.

The **degree of difficulty** of this test will correspond to the objective of the test and, therefore, **may be higher than the partial evaluations**.

The student presented in this test **waives the qualifications of the partial evaluations 1 and 2**. Therefore, the grade of this improvement test will be the one that will prevail in the final grade even though it is lower than that obtained in the partial evaluations.

Formula of weighting of the final grade

Final grade = [(Partial exam 1 x 0.3) + (Partial exam 2 x 0.35) + (Weekly Problems of Genomics x 0.1) + (Integrative work of Genomics x 0.1) + (Seminars of Proteomics/Interactomics x 0.1) + (Integrative problem of Proteomics/Interactomics x 0.05)]

Passed

The subject is considered passed if the **final grade is >=5**.

Not evaluable

The student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Integrative problem of Proteomics/Interactomics	5%	0.5	0.02	2, 1, 5, 7, 6, 3, 4, 8
Integrative work of Genomics	10%	1	0.04	2, 1, 5, 7, 6, 3, 4, 8
Partial exam 1	30%	3	0.12	2, 1, 5, 7, 6, 3, 4, 8
Partial exam 2	35%	3.5	0.14	2, 1, 5, 7, 6, 3, 4, 8
Seminars of Proteomics/Interactomics	10%	1	0.04	2, 1, 5, 7, 6, 3, 4, 8
Weekly problems of Genomics	10%	1	0.04	2, 1, 5, 7, 6, 3, 4, 8

Bibliography

Textbooks:

- Gibson, G. i S. V. Muse, 2009. A Primer of Genome Science. Sinauer, Massachusetts. USA. Third edition.
- Brown, T. A. 2006. Genomes. Garland Science, UK. Third edition.
- Twyman R. M. 2014. Principles of Proteomics. Garland Science, UK. Second Edition.
- Mishra N. C. 2010. Introduction to Proteomics: Principles and Applications. Wiley, Hoboken (New Jersey).

Useful links:

- Aula Moodle de la UAB: https://cv.uab.cat/
- Entrez Genome Database: http://www.ncbi.nlm.nih.gov/sites/genome

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