Universitat Autònoma de Barcelona

2023/2024

Microbial Genomics

Code: 101949
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	OT	4	2

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Prerequisites

It is recommended to have coursed or are coursing Molecular Biology of Prokaryotes, Bioinformatics and Genetic Engineering of Microorganisms.

Objectives and Contextualisation

The main objective of this course is to broaden the vision of microbial genomics and the molecular and bioinformatics techniques used as well as their current and future applications.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply knowledge of theory to practice.
- Apply scientific method to problem solving.
- Be able to analyse and synthesise.
- Be able to communicate effectively, orally and in writing.
- Describe and identify the structural and functional characteristics of nucleic acids and proteins including their different organisational levels.
- Design experiments and interpret the results.
- Develop self-directed learning.
- Know and apply the omic' tools of genomics, transcriptomics and proteomics.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.

- Perceive the strategic, industrial and economic importance of genetics and genomics to life sciences, health and society.
- Reason critically.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Use and manage bibliographic information or computer or Internet resources in the field of study, in one's own languages and in English.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Apply knowledge of theory to practice.
3. Apply scientific method to problem solving.
4. Be able to analyse and synthesise.
5. Be able to communicate effectively, orally and in writing.
6. Defend the relevance of progress in the generation and interpretation of data on a genomic scale for our understanding and technological manipulation of organisms.
7. Describe and apply the methods for the analysis of proteomes, of genomics and of functional proteomics.
8. Design experiments and interpret the results.
9. Develop self-directed learning.
10. Explain and apply the methods for the analysis and annotation of genomes.
11. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
12. Reason critically.
13. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
14. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
15. Use and manage bibliographic information or computer or Internet resources in the field of study, in one's own languages and in English.
16. Use the techniques, tools and methodologies used to describe, analyse and interpret the enormous amounts of data produced by high performance technologies.

Content

The student will work on the following contents:

- Methods for the study of genomics
- Genomic analysis
- Prokaryotic species concept and taxogenomics
- Structural genomics and evolution of genomes
- Comparative genomics. Core and accessory genome and pangenome
- Functional genomics: from genome to function
- Population genomics of microorganisms
- Genomic structure of microbial communities
- Pathogenomics and other omics
- Current challenges of microbial genomics and case studies

Methodology

This course will be taught mostly following the problem-based learning method (PBL). The class group will be divided into small groups that will independently work three problems. For the last case the teams could choose between different types of problems. Each of the problems will last approximately 12 classroom sessions, including the evaluation tests.

The student's role will be to actively participate in the working group, to assign group moderator roles, spokesperson and activities coordinator to the group members. They should also work individually to research, select and manage the information to share, discuss and re-elaborate the new knowledge with their work group. Finally, the group will prepare reports, present and/or discuss with the rest of the class the knowledge acquired, its application in the context of the problem and in other contexts. The groups could also present scientific articles relevant to each problem as seminars.

The role of teachers will be to facilitate the learning process, stimulate group discussions and critical thinking, provide the necessary tools for students to build knowledge and guide them. If necessary, some participatory master classes can be performed. As supervised activities and to support the learning activities indicated above, individual and collective mentoring will be possible. At the beginning of the course, teachers will explain to the students the organization of the subject and will give the working guidelines.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	6	0.24	14, 6, 7, 10, 16
Problem-based learning	34	1.36	1, 14, 13, 3, 2, 6, 7, 9, 8, 10, 11, 12, 5, 4, 15, 16
Type: Supervised			
Tutorship	3	0.12	6, 7, 8, 10, 12, 4, 16
Type: Autonomous			
Integrate information and generate hypotheses	20	0.8	3, 2, 6, 7, 9, 8, 10, 12, 5, 4, 15, 16
Preparation of the work plan, reports and oral presentations	21	0.84	2, 6, 7, 9, 8, 10, 12, 5, 4, 15, 16
Reading specialized texts	40	1.6	9, 12, 4, 15
Search and management of information	20	0.8	4, 15

Assessment

The evaluation of the subject consists of three units associated with each of the proposed problems. The evaluation of each unit will be made according to the following distribution:

1. Exams associated with each problem. Consistent in a specific written test or oral presentation where the course-specific competencies, concepts and methodologies worked on each problem is assessed. Weigh 15% each.

2. Deliveries and/or reports associated with the problem. The report may consist of a written assignment and/or an oral presentation. In some cases, co-evaluations of other students' submissions and/or reports will be carried out. The number and specific weight of each delivery, report, and/ or co-evaluation activity, as well as their format, will be indicated in the problem presentation session. Global weight 45%.

3. Self-assessment of individual and teamwork. Each member of the group should evaluate himself/herself and the functioning of the team in solving the problem. The maximum mark is 1.0 points out of 10 (10%).

Optional seminars and active and creative participation in class/forum may add up to 1 point on the final grade of the subject.

To pass each unit the student must obtain at least a score of 4.5 points out of 10 in the individual exams. If the student does not pass any of the individual written tests, he/she will perform a retake examination. 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 or module.

To pass the subject, it is mandatory to attend a minimum of 20 classroom sessions, including attendance at the working sessions of the class group, whose date of celebration will be established during the course development. The absence without justification or non-profit of the classroom sessions may subtract up to 1 point from the final grade of the subject.

The students pass the course when the average mark of the evaluation activities is equal to or greater than 5.

The student will be graded as "Non-evaluable" if the weight of all conducted evaluation activities is less than 67% of t final score.

For those students who choose the single assessment system, this assessment will consist of a single written test in which the contents of the entire program of the subject will be evaluated. The test will consist of multiple choice questions, other types of short questions and topics to be developed. The grade obtained in this test will account for 45% of the final grade. In addition, students will deliver all the reports related to the different problems addressed during the course (50% of the final mark) and will do a self-assessment of their achievement (5%). The format and content of these reports will be indicated at the beginning of the course and could be different from the problems developed during the regular course. These students will be able to participate in classroom sessions and be part of group work without affecting the functioning of the teams. The single assessment test and the deadline for deliveries will coincide with the date of the last assessment activity. The same system for the retake examination and revision of the final qualification and the same criteria for passing will be applied as for the continuous evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of deliveries and/or oral presentations	45%	0	0	1, 14, 13, 3, 2, 6, 7, 9, 8, 10, 11, 12, 5, 4, 15, 16
Case 1 individual written exam	15%	1.5	0.06	3, 2, 6, 7, 8, 10, 12, 5, 4, 15, 16
Case 2 individual written exam	15%	1.5	0.06	3, 2, 6, 7, 9, 8, 10, 12, 5, 4, 15, 16
Case 3 exam	15%	1.5	0.06	14, 3, 2, 6, 7, 9, 8, 10, 11, 12, 5, 4, 15, 16

Individual self-assessment	5%	0.5	0.02	3, 2, 6, 7, 9, 8, 10, 12, 5, 4, 15, 16
Teamwork self-assessment	5%	1	0.04	3, 2, 6, 7, 9, 8, 10, 12, 5, 4, 15, 16

Bibliography

It is the responsibility of the student to seek the bibliography necessary for the resolution of the problems raised. To do this he/ she can be advised by the teachers. Still the following textbooks are recommended for basic concepts on genomics concepts and case studies.

- Genome and Genomics: From Archaea to Eukaryotes. Chaitanya, K. V. 2019. Singapore: Springer Singapore Pte. Limited.
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1c3utr0/cdi_askewsholts_vlebooks_9789811507021

- The Pangenome Diversity, Dynamics and Evolution of Genomes / Edited by Hervé Tettelin, Duccio Medini. Ed. Hervé. Tettelin and Duccio. Medini. 1st ed. 2020. Cham: Springer International Publishing.
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010360498206709

- Population Genomics: Microorganisms Edited by Martin F. Polz, Om P. Rajora. Ed. Martin F. Polz and Om P. Rajora. 1st ed. 2019. Cham: Springer International Publishing.
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010404004706709

- Bacterial Pathogenomics. Editor(s):Mark J. Pallen Editor-in-chief, Karen E. Nelson, Gail M. John Wiley & Sons, Inc., 2014. https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010350952606709

- Microbial Functional Genomics. Zhou, Jizhong, Dorothea K Thompson, and James M Tiedje. 2004. Hoboken: John Wiley & Sons, Incorporated.
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1c3utr0/cdi_proquest_ebookcentral_EBC3056645

Software

There is no specific software for this subject. Each team will prepare its own list of software throughout the course according to the needs that arise from each problem.