Bioinformatics

Code: 101909
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biomedical Sciences	OB	3

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

There are no prerequisites.

Objectives and Contextualisation

This course introduces the student to the field of Bioinformatics, an area of research that uses computer databases to store, retrieve and assist in the understanding of biological information. The large genome sequencing projects as well as significant progresses in the determination of three-dimensional protein structures have led to an explosion of genetic sequences and structural data available for automated analysis. The student will learn how genomic analysis and protein structures can lead to a better understanding of the biological processes. Students will be introduced to basic tools of Boinformatics and Computational Biology. The practical sessions will complement this knowledge, allowing students to become familiar with the details and the use of the most used tools and online resources of the field.

Objectives:

- General introduction to the field of Bioinformatics.
- Introduction to the types of data analyzed in Bioinformatics and their databases.
- Introduction to the use of tools and algorithms commonly used in the field.

- Develop skills in the research, retrieval, and analysis of protein sequences and structures.
- Understand the most relevant aspects of Chemoinformatics, with special emphasis on drug discovery.
- Understand the concepts of Medical Informatics and the integration of genetic and clinical databases.

Competences

- Apply knowledge acquired to the planning and implementation of research, development and innovation projects in a biomedical research laboratory, a clinical department laboratory or the biomedical industry.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Identify and apply suitable functional study methodologies for the development of research projects.
2. Use procedures for analysing the structure, properties and function of cellular molecules and organelles.
3. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

1. Introduction. Databases in Bioinformatics

- NCBI - Entrez
- Bibliographic data bases
- Protein sequences. UniProt
- Nucleotide sequences. GenBank

2. Genomics

- Genome annotations
- Search for genes
- Genome project
- Genomic browsers
- Encode project
- HapMap project
- Catalog of human genes and genetic disorders: OMIM
- Databases of SNPs
- Genome association studies (GWAS)

3. Alignment of sequences

- Sequence comparison methods
- Substitution matrices
- Dynamic programming
- Local and global alignment
- Search by similarity (BLAST)
- Multiple sequence alignment
- Representation of LOGOS of Sequences
- Progressive alignment. ClustalW

4. Phylogenetic analysis

5. Structural bioinformatics

- Protein secondary structure
- Protein tertiary structure. Molecular interactions
- Experimental methods for the determination of the tertiary structure of proteins: X-ray and NMR
- The PDB format
- Protein quaternary structure
- Structural alignment of proteins, molecular cavities, molecular electrostatic potential
- Cell membrane, membrane proteins, prediction of secondary structure of transmembrane segments
- Structural classification of proteins: motifs, domains
- Homology modeling

6. Modes of drug action

- G protein-coupled receptors
- Kinases
- Growth factors

7. Chemoinformatics

- Representation of chemical entities. SMILES and Tanimoto coefficient
- Structure-Activity Relationships. Pharmacophore models
- Protein-ligand molecular docking
- ADME / Tox

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	24	0.96	
Research project presentation	5.5	0.22	
Theoretical classes	24	0.96	
Type: Supervised			
Consolidation practices and tutorials	10	0.4	
Type: Autonomous			
Research project	10	0.4	
Study	71	2.84	

The orientation of the course is eminently practical with the use of software.

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
Attendance to practices and presentation of the corresponding reports	15%	4	0.16	1, 2
Drafting and presentation of a project	20%	1	0.04	1, 3, 2
Practical and theoretical exams	65%	0.5	0.02	1, 3, 2

- 2 partial exams of theoretical-practical knowledge and conceptual questions [Tests T1 (32.5%) and T2 (32.5%)]
- Attendance to practical classes and presentation of correspondent reports [AI (15%)]
- Preparation and presentation of a project [PJ (20%)]

Single assessment is not an option in this course

Bibliography

- Attwood, T.K., Parry-Smith, D.J., Introducción a la Bioinformática, Pearson Education, 2002.
- Baldi, P., Brunak, S., Bioinformatics, MITPress, 1998.
- Baxebanis, A.D., Oullette, F., Bioinformatics, John Wiley & Sons, 1998.
- Lesk, A. Introduction to Bioinformatics. Oxford University Press, 2005.
- Waterman, M.S., Introduction to computational biology maps, sequences and genomes,Chapman & Hall/CRC, 2000.

http://www.nih.gov/

http://www.ncbi.nlm.nih.gov/

http://www.pdb.org/

http://www.ebi.ac.uk

http://www.uniprot.org/

http://www.rcsb.org/

http://www.genomesonline.org/index

http://www.ncbi.nlm.nih.gov/projects/mapview/

http://genome.ucsc.edu/ENCODE/

http://www.genome.gov/Encode/

http://www.nature.com/encode/#/threads

http://hapmap.ncbi.nlm.nih.gov

http://www.ncbi.nlm.nih.gov/snp

http://www.ncbi.nlm.nih.gov/SNP/

http://omim.org

http://www.1000genomes.org/home

http://www.genome.gov/

http://www.genome.gov/GWAStudies/

http://www.embl.de/

http://genes.mit.edu/GENSCAN.html

http://expasy.org/prosite/

http://prodom.prabi.fr/

http://pfam.sanger.ac.uk/

http://www.cbs.dtu.dk/services/TMHMM/

http://scop.mrc-lmb.cam.ac.uk/scop/

http://www.cathdb.info/

http://ekhidna.biocenter.helsinki.fi/dali_server/

http://www.vcclab.org/lab/edragon/

http://matisse.ucsd.edu/itp-bioinfo/links.html

http://sites.univ-provence.fr/~wabim/english/logligne.html

Software

No

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	531	Catalan	second semester	afternoon
(PLAB) Practical laboratories	532	Catalan	second semester	afternoon
(PLAB) Practical laboratories	533	Catalan	second semester	afternoon
(SEM) Seminars	531	Catalan	second semester	morning-mixed
(SEM) Seminars	532	Catalan	second semester	morning-mixed

(TE) Theory	53	Catalan	second semester	morning-mixed