27123 - Bioinformatics

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	446 - Degree in Biotechnology
ECTS	6.0
Course	3
Period	Second semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

For students enrolled in the subject, places, times and dates of lectures and practical sessions will be public via Bulletin Board advertisements of the grade on the platform Moodle at the University of Zaragoza , https://moodle2.unizar.es/add/, and in the moodle page for the course. These routes will be also used to communicate enrolled students their distribution by groups of practical sessions, which will be organized by the coordination of degree. Provisional dates will be available on the website of the Faculty of Sciences in the corresponding section of the Degree in Biotechnology : https://ciencias.unizar.es/grado-en-biotecnologia .

In this web there will be also available the dates of exams.

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

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5.1.General methodological presentation

The learning process is designed so that on the basis of an intensification of the theoretical knowledge the students will be able to acquire an orientation in the management of bioinformatic tools that is eminently practical and applied in the computing room.

As far as possible students will be able to choose the bioinformatic tools to apply for particular needs on the basis of theoretical and practical knowledge. In this strategy the realization of general practical cases allows the student to become familiar with the tools, to subsequently move to the resolution of a real biochemical problem that, ultimately, is the applied section and a way to approach the students to day-to-day work situations.

Thus, the subject has an applied orientation, the proposed activities are focused in the application of a series of principles first to concrete cases, through the analysis and results interpretation of cases provided by Professor, and them by the individual preparation of a supervised but real case requiring the application of one or more of the methodologies treated in the course.

5.2.Learning activities

MASTER CLASSES

Face-to-face. 20 hr. Basic theoretical knowledge of the subject is presented. Computer screen projections, including animations, videos and navigations online will be used. The basic material will be provided by the professors to the students through the MOODLE UNIZAR learning platform.

PRACTICAL CASE STUDIES

Face-to-face and mandatory. 20 hours. Computer room. The professor will distribute practical cases through the online learning platform, and he will instruct the students in how to design their searches, simulations and interpret the results. These activities will help the student to acquire the capacity and skills to later analyze and solve particular problems by hisowm/herowm. The student will be able to independently design searches, data analysis and simulations and to critically evaluate the results obtained.

INDIVIDUAL PROJECT

Face-to-face and mandatory. 20 h. 5 sessions of 4 hours in the computer classroom were the professor will assist the students to prepare an individual project. The students will develop a concrete case on an individual basis and then generate a report, for evaluation, according to the extension and regulations indicated in the directions provided by the professor. The analysis of the information should lead to the preparation of a structured presentation that must contain results, discussion, conclusions, and bibliography sections. This activity will encourage students to use various software applications and servers, which have been explained in the theoretical classes and used in the sessions of practical cases, to resolve a particular problem. This activity stimulates the use by students of online scientific material as well as its interpretation, communication and discussion.

5.3.Program

MASTER CLASSES

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1. Introduction.
2. Sequence Databases: genes and proteins. Data introduction and recovery.
3. Sequence alignment.
4. Analysis and comparison of genomes. Metagenomes. Transcriptomics data bases.
5. Metabolic pathways databases.
6. Phylogenetics.
7. Proteomics and interactomics databases.
8. Protein and nucleic acid structure databases. Introduction of data, and applications for visualization.
9. Cheminformatics: small molecule databases.
10. Tools for drug design. QSAR, ADMET.
11. Web servers: how they are made and how they work?
12. Thematic databases and servers.
13. Methods for Molecular Simulation.
14. Molecular Dynamics and Monte Carlo.
15. Protein and nucleic acid structure prediction methods.
16. Molecular docking.
17. Hybrid Quantum Mechanics/Molecular mechanics (QM/MM) Methods. Simulation of enzyme reactions.

PRACTICAL CASE STUDIES

Case of study (20 hours), Computer room.

- Case 1: Recovery of sequences, sequence alignment and phylogenetic tree construction.
- Case 2: *In silico* gene amplification and cloning.
- Case 3: Structural analysis: enzyme structure-function relationships.
- Case 4: Protein-ligand docking.

- Case 5. Preparation of an analysis script.

INDIVIDUAL PROJECT

Project (20 hours), Computer room.

Individual project applying learned methods. Each student will present a report of his/her project following the guidelines given in the corresponding protocol.

5.4.Planning and scheduling

Schedules of lectures and problems will coincide with the officially established and will be available at: https://ciencias.unizar.es/grado-en-biotecnologia .

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of maters at beginning of course. The Coordinator will produce the groups of students for these activities at beginning of course to avoid overlaps with other subjects.

The course will begin with the 20 hours of lectures session (February-March).

Then there will be a week of practical cases with 5 cases in the computer room in 5 sessions of 4 hours each (February-April).

Finally students will benefit from another week of 5 sessions of 4 hours in the computer room for the preparation of the individual project assisted by the teacher, and then of an additional week for completion by their owns (April-May).

5.5.Bibliography and recomended resources

BB	Fuxreiter, M.. Computational Approaches to Protein Dynamics. From Quantum to Coarse-Grained Methods. CRC Press, 2015
BB	Lesk, Arthur M.. Introduction to bioinformatics / Arthur M. Lesk . 4th. ed. Oxford : Oxford University Press, cop.2014
BB	Marketa Zvelebil, J.. Understanding Bioinformatics. Garland Science. 2008
BB	Structural bioinformatics / edited by Jenny Gu, Philip E. Bourne . 2nd ed. Hoboken, New Jersey : Wiley-Blackwell, cop. 2009
BC	Attwood, T.K.. Introduction to Bioinformatics. - 1999 Prentice Hall
BC	Baxevanis, A. D. (Ed). Bioinformatics: a practical guide to the analysis of genes and proteins . 2001 Wiley-Interscience
BC	Campbell, A. Malcolm. Discovering genomics, proteomics, and bioinformatics /

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	A. Malcolm Campbell, Laurie J. Heyer . - 2nd ed. San Francisco [etc.] : Pearson Benjamin Cummings, cop. 2007
BC	Des Higgins and Willie Taylor eds. Bioinformatics: sequence, structure and databanks. Oxford University Press, 2000
BC	Mount, D. W.. Bioinformatics: sequence and Genome Analysis. - 2ª Cold Spring Harbor Laboratory Press
BC	Orengo, C (Ed.). Bioinformatics: Genes, Proteins and Computers. Taylor & Francis Group
BC	Schlick, Tamar. Molecular modeling and simulation : an interdisciplinary guide / Tamar Schlick New York [etc.] : Springer, cop. 2002
BC	The phylogenetic handbook : a practical approach to DNA and protein phylogeny / edited by Marco Salemi and Anne- Mieke Vandamme. Cambridge [etc.] : Cambridge University Press, 2003.
BC	Tramontano, Anna. The ten most wanted solutions in protein bioinformatics / Anna Tramontano Boca Raton : Chapman & Hall/CRC, 2005
BC	Westhead, D.R.. Bioinformatics Twyman Bios: Instant Ntes
BC	Zhow, R.. Molecular Modeling at the Atomic Scale. Methods and Applications in Quantitative Biology. CRC Press, 2015