Biophysics and structural bioinformatics I

Lecturers
Dimitri GILIS (Coordinator) and Fabrizio PUCCI

Course mnemonic
BINF-F403

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Campus
Solbosch

Course content

This course is divided into two parts.

Part I: biophysics

- Introduction to the structure of proteins, DNA and RNA.
- Introduction to the experimental determination of protein structures.
- Thermodynamics and kinetics of protein folding.
- Protein folding: identification of intermediates and transition states.
- Description of intra- and inter-molecular interactions in biomolecules.
- Structural aspects of protein-DNA interactions.

Part II: bioinformatics

- Methods of alignment / superimposition of protein structures.
- Energy functions.
- Prediction of the secondary structure of proteins
- Prediction of the 3D structure of proteins: comparative modeling, fold recognition, ab initio methods
- Structural characteristics of proteins involved in conformational diseases (Creutzfeld-Jakob disease,Alzheimer's, ...).
- Membrane proteins.

Objectives (and/or specific learning outcomes)

At the end of the course, the student will be able:

- To share a common vocabulary with experimentalists in structural biology.
- To evaluate the quality and the reliability of experimentally resolved structures of biomolecules.
- To explain the general bases in the field of structural bioinformatics.
- To demonstrate in his explanation his deep understanding of the concepts.
- To apply a scientific approach in the choice of a bioinformatics tool to find an answer to a problem.
- To demonstrate critical thinking in analyzing the results of bioinformatics tools.

Teaching method and learning activities

Theoretical courses, remote teaching through videos and practicals on computers

Contribution to the teaching profile

1.1. Acquire the concepts and fundamental knowledge of computer science and biology necessary for the development of bioinformatics or modeling projects.

1.4. Master the mathematical, statistical and computational approaches on which bioinformatics and modeling studies are based.

1.5. Be able to use existing bioinformatics resources and develop new software (algorithms, databases, analysis tools, etc.)..

3.1. Understand abstraction and its role in the development of a theory or model.

References, bibliography and recommended reading

(non exhaustive) Protein Physics, A.V. Finkelstein & O.B. Ptitsyn, Academic Press (2002); Protein Folding Mechanisms, Advances in Protein Chemistry, Vol 53, edt by C.R. Matthews, Academic Press (2000); Biophysique moléculaire, M. Daume, InterEditions, Paris, 1993.

Course notes

Podcast and Université virtuelle

Other information

Place(s) of teaching

Solbosch

Contact(s)

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Evaluation method(s)

Oral examination and Written report

Evaluation method(s) (additional information)

For the practical part, the last session corresponds to a synthesis of what has been achieved during the year. An individual report must be submitted for this session and will be used for the evaluation of the practical part. Any student who does not submit his or her report for the practicals will not be allowed to take the oral exam.

The "theory" part of the course is assessed by an oral examination, lasting 25 minutes, without preparation. Two questions will be selected at random by the student. Both questions will be discussed in relation to the whole course.

Determination of the mark (including the weighting of partial marks)

Let nE be the mark of the oral exam and nR be the mark of the report of the practicals. The final mark, nF, is calculated by the following method:

- if (nE < 7/20 AND nR < 7/20) OR (nE >= 7/20 AND nR >= 7/20), then nF = nR*0,2 + nE*0,8
- in the other cases : nF = min(nR , nE)

If nR < 10/20 and the teaching unit has not been credited at the end of the first session, a new report must be submitted in the second session. On the other hand, if nR >= 10/20, the mark is carried over from one session to the next.

If a student does not submit its report for the practicals or does not attend the examination, the final mark is a mark of absence.

Carry over of the mark obtained for the report of the practicals from one academic year to the next

If a student has not been credited for the BINF-F403 teaching unit but has obtained a mark of 10/20 or higher for the practicas, this will be carried over and the student will be exempt from the practicals, unless he/she requests otherwise.

Main language(s) of evaluation

French and English

Programmes

Programmes proposing this course at the faculty of Sciences

MA-BINF | Master in Bio-informatics and Modelling | finalité Research/unit 1