Course plan

2015-2016 Academic Year
Qualification Master's Degree

1. Description of the subject

- Subject name: Principles in Genome Bioinformatics (PGB) Code: 30167
- Total credits: 5 ECTS Workload: 125
- Year: 1st Term: 1st
- Type of subject: optional
- Centre: UPF
- Teaching language(s): English
- Teaching team/Teaching staff:
  - Subject Coordinator M.Mar Albà
  - Teaching staff M.Mar Albà, Cedric Notredame, Toni Gabaldón, Roderic Guigó

2. Teaching guide (Campus Global)

- **Associated competences**

  General competences

  1. Using scientific English.
  2. Ability to work in a team.
  3. Ability to solve by yourself a given problem.
  4. Ability to use programming in Perl to perform simple sequence analyses
  5. Ability to search and manage information from different sources.

  Specific competences

  1. To understand the dynamic programming algorithm for pairwise sequence alignment.
  2. To understand multiple sequence alignments, and how to compute sequence distance matrices.
  3. To understand basic concepts of sequence evolution, natural selection and substitution rates.
  4. To understand the most commonly used algorithms to identify similar sequences in databases.
  5. To know how to use genome databases to extract sequence and functional information.
  6. To understand the basic procedures involved in genome assembly and annotation.
  7. Ability to work with next generation sequencing data for transcript assembly and gene expression quantification.
  8. Ability to understand and communicate research in the area of computational genomics.

- **Contents**

  Section 1: Protein and DNA sequence analysis

  Homology: orthology and paralogy. Mechanisms of sequence evolution. Algorithms for pairwise and multiple sequence alignment.

Amino acid substitution matrices. Estimation of genetic distance and evolutionary rate on sequence alignments. Database sequence similarity searches. Representation and search of sequence motifs.

Section 2: Genome and transcriptome analysis

Sequence repositories. Genome projects. Transcriptomics and high - throughput sequencing technologies. Comparative genomics and genome evolution. Comparison of large sequence datasets.

- ## Teaching methodology

Approach and general organization of the subject

Combining theory and hands-on. The subject coordinator gives most lectures and exercises, participation of other experts as well. Final project is presented in class, team work and communication skills also evaluated.

Training activities*

Solving problems in class using programming (Perl) and statistical packages (R). Making questions and promoting discussions in the class.

- ## Assessment

Assessment system

Written exam, final project, participation in class.

Grading system

On a system where 10 is the maximum mark, exam gives a maximum of 7 points, final project 3 points, attitude/participation in class may add 0.5 points.

3. Programme of activities (Aula Global)*

- Description of the subject: Principles in Genome Bioinformatics
- Total credits: 5 ECTS Total number of hours: 30
- Estimated time spent on the subject: 125

  - In the classroom: 30
  - Outside the classroom: 95

Weekly timetable of learning and assessment activities

Week (dates)	Work in the classroom (plenary, seminar, practical, etc.)	Estimated time	Activities outside the classroom (time studying, preparing activities, etc.)	Estimated time
1st week	Plenary - Introduction, Pairwise sequence alignment	2	*studying*	2
	Plenary - Evolution of biological sequences	2	studying	2
2nd week	Plenary - Multiple sequence alignment	2	studying	2
	Plenary - Phylogenetic trees	2	studying	2
3rd week	Plenary - Database sequence similarity searches, Sequence motifs	2	studying	2
	Practical - Exercises	2	exercises	5
4th week	Plenary - Genome assembly and annotation	2	studying	2
	Practical - Exercises	2	exercises	5
5th week	Plenary – Next generation	2	studying	2

	sequencing			
	Practical - Exercises	2	exercises	5
6th week	Seminar- Transcriptome analysis	2	Literature reviewing	2
	Practical - Exercises	2	exercises	6
7th week	Project preparation	2	Exercises	
	Project execution			6
8th week	Project execution			10
	Studying for the exam			10
9th week	Project execution			10
	Studying for the exam			10
10th week	Project presentation	2		
	Project presentation	2		
	Studying for the exam			12
Other	Final assessment activities – Written exam	2		