UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Animal Genome Evolution

2627-1-F0602Q079

Aims

The genome is the information center of a living beings, both viruses and cells. But where does it come from? The main aim of the course is to study the genome architecture to understand their evolution and the derived functions. In particular:

1) Knowledge and understanding

At the end of the lessons, the student will have acquired knowledge regarding the evoution of animal genomes from prokaryotic ones.

2) Applying knowledge and understanding

At the end of the lessons, the student will be able to apply the knowledge acquired to other courses involving genomics or thesis programs.

3) Making judgements

The student will be able to critically adopt the acquired knowledge and choose the most reliable approach to describe genome evolution.

4) Communication skills

At the end of the lessons, the student will be able to describe clearly, and with an adequate language the animal genome evolution.

5) Learning skills

At the end of the lessons, the student will have the necessary knowledge to deal with the next studies that will require knowledge of genomics, also using an integrative approach.

Contents

In the course we will follow the principal steps during evolution leading to the appearance of life and the first informative system up to the proper genomes.
For the actual genomes we will observe the regulative mechanisms and the selective pressures forging they structure.

Detailed program

1) Origin of life and of the first informative contents.
2) Genome definition and architecture.
3) Definition of biological complexity
4) Genomes of viruses, bacteria, archaea and eukaryotes. The *Tree of Life*.
5) Genome organisation: eukaryogenesys.
6) *C-value* and repetitive nature of genomes.
7) non-genic DNA and introns evolution.
8) Gene and genomic duplication in genome evolution. Multigene families.
9) dN/dS and codon bias.
10) Molecular clocks.
11) Genome regulation: RNAi, epigenetics, Evo-Devo.
12) Evolutionary novelties and evolvability.

Prerequisites

Genetics; Molecular Biology; basics in Biological Evolution.

Teaching form

There are 21 lessons of 2 hours each.
Roughly, 17 of them are frontal lessons.
I foresee to have 4 lessons in interactive way, having guests exposing their researches or asking students to assume a central role in the activities (for example, through a flipped classroom approach).

Textbook and teaching resource

Slides showed at lessons are available on the e-learning platform.
Many scientific papers are cited in the diapos. They have to be used to study.

There is not a textbook, but specific arguments are available on:

- Evoluzione. Modelli e Processi, a cura di Marco Ferraguti e Carla Castellacci, Pearson.

- Evolution. Nicholas H. Barton, Derek E.G. Briggs, Jonathan A. Eisen, David B. Goldstein, Nipam H. Patel. Cold Spring Harbor Laboratory Press.

- From DNA to diversity: molecular genetics and the evolution of animal design. S.B. Carrol, J.K. Grenier, S.D. Weatherbee. Blackwell, 2003.

Useful links:

Pikaia, the evolution portal:

GOLD, Genome Online Database:

TimeTree, the timescale of life:

Semester

First semester

Assessment method

Oral examination.
The exam consists generally in 5 questions. The first two are relative to general concepts of animal genome evolution and their origin. The following two questions are relative to specific topics of the animal genome evolution as observed in the second part of the lessons. In the last question the student has to elaborate and defend a research project based on the genome evolution.
There are not partial essays.

Office hours

On appointment; mail to: maurizio.casiraghi@unimib.it

Sustainable Development Goals