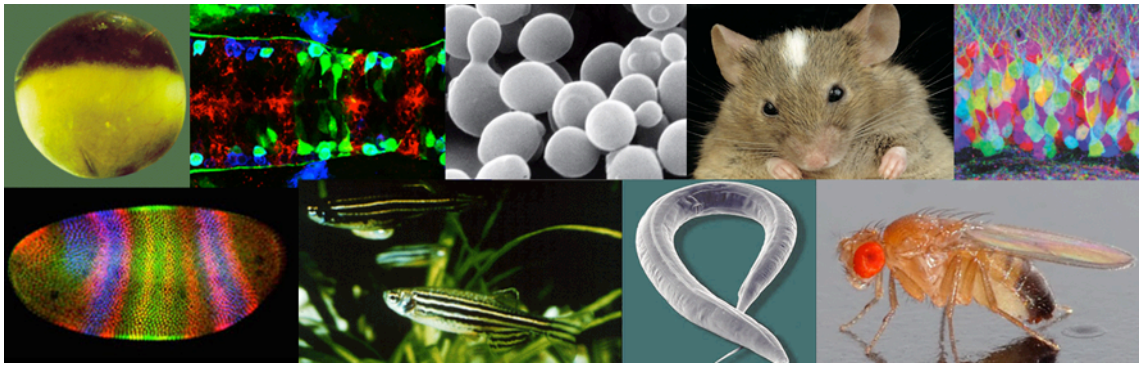

MODEL ORGANISMS IN BIOMEDICAL RESEARCH, DCEXS-UPF

Descriptive details concerning the subject

Name of the subject: Model Organisms in Biomedical Research
Code: MOBR
Type of subject: Optional
ECTS: 5
Total hours: 125h with a maximum of 60% of attendance hours. The program will consist in lectures, seminars of invited speakers and oral presentations by the students.
Lecturing period: The course comprises 5 weeks, with classes starting the 3rd of November and ending December 3rd.
Classes are from 8.40-9.30 and 9.30-10.30, Monday to Thursday. However, classes or talks from invited speakers can be exceptionally on Friday (see final schedule).
The exam will be in December 2014.
Place: Campus del Mar
Coordination: Cristina Pujades
Department: Ciències Experimentals i de la Salut, UPF

Teaching details

Language: English
Lecturers: Berta Alsina, Jose Ayté, Laia de Nadal, Andrés Ozaita, Paco Real, Patricia Robledo, and Cristina Pujades from the DCEXS (Barcelona)
Invited speakers will be from institutions within the PRBB and others.
Room: 61.129

Presentation

In ways that were not predictable ten years ago, model organisms have changed the study of human biology. A great number of developmental regulators discovered in *Drosophila* and *C. elegans* are important factors in human genetic disease, and with complete genome sequences available in many organisms, we have the dictionary to translate among organisms. Because of the evolutionary conservation of developmental regulators, we have learned about the molecular basis of a number of human birth defects.

The scope of this course is to analyze in depth the applicability of different model systems to biomedical research. Applications of genetic recombination and modified organisms to biotechnology and biomedicine will be discussed as well as emergent developments in gene therapy and regenerative medicine.

Requisites

Language

The course will be entirely in English, as well as the articles and class materials. Students are expected to have an English level sufficient to understand scientific articles, and basic conversational and writing skills to discuss and do oral and written presentations of scientific literature.

Background

Classes will be at an advanced level, with an emphasis on the analysis of biological processes from a molecular, biochemical, and cellular basis. Students are expected to have knowledge on Cell Biology, Molecular Genetics and Biochemistry equivalent to the level achieved in a University degree in Biology, Biochemistry, Biotechnology, Genetics.

Competences to be attained in the subject

General competences

1. To develop skills for critical analyses and synthesis of acquired information.
2. To acquire abilities for communication of scientific information.
3. To acquire basic abilities to outline and design experimental approaches to solve specific questions.

Specific competences

1. Basic concepts in embryonic development.
2. Basic concepts on yeast, fly, fish and mice genetics. Knowledge of mutant collections.
3. Knowledge of the development of new powerful tools and techniques to dissect the molecular processes that regulate development.
4. Knowledge of complete genome sequences now available, *in vivo* techniques and the ability to express any gene at any time or place in whole organisms.
5. Knowledge of the different organisms used nowadays in biomedical research: advantages and disadvantages.

Learning aims

1. To understand the concept of model organism and how developmental biology brought them into the scene.
2. To get basic user knowledge of some of the most popular tools for forward and reverse genetics.
3. To know basic concepts on genetic and molecular biology experimental techniques.
4. Knowledge on behavioural studies in mice.

5. To understand the importance of the choice of *in vivo* models in biomedical research.
6. To know the basics of model organisms as useful systems for biomedical research.

Evaluation: General Assessment Criteria

There will be a final exam in December. The evaluation will consist in four parts, with percentages of the total grade indicated in the following list:
1. Oral presentations of students (20% of the total grade).
2. Multiple choice exam (35% of the total grade).
3. Written exam (short questions) (40% of the total grade).
4. Attendance to the course is mandatory (5% of the total grade).
5. Capacity in answering questions during the theoretical sessions, degree of participation in the classes and in scientific discussions will be taken into account.

To pass the course, you have to score in the multiple choice AND the short questions exams at least 4.5/10. **There will not be a second exam or opportunity to pass the course**.

Format and methodology

The course will be divided into five blocks attending to the main model organisms used in biomedical research, starting with the less complex systems and ending with mammals.

The format and distribution of the classes will be: i) lectures will be used to present an overview of current topics; ii) presentation and discussion of articles (this work will be carried out by the students); and iii) seminars by invited speakers.

PROGRAM

Block 1: The transformation of the model organism: model organisms in developmental biology. *Lecturer:* C. Pujades

The transfiguration of the model organism.
Visualizing cells and tissue polarity (*C. elegans* and *D. melanogaster* as invertebrate models).
From worms and flies to vertebrates: triumphs of reverse genetics (the mice model).
Forward with genetics: from flies to fish ... and mice.
What's left? The classicals in experimental embryology (*Xenopus* and chick*).*

Invited speaker Nov 4th

Block 2: Model organisms in biomedical research: the advantage of unicellular eukaryotes. *Lecturers:* L. de Nadal and J. Ayté

The importance of the intact genome structure.
The use of a unicellular eukaryote (yeast) in: DNA repair and genome stability, telomers and aging, cell cycle control (*S. cerevisiae* vs *S. pombe*).
Parallel in higher eukaryotes: genome instability in human cancers.

Invited speaker Nov 10th
Student paper analysis

Block 3: From unicellular eukaryotes to multicellular ones. The use of invertebrate models. *Lecturer:* C. Pujades and B. Alsina

The elegant worm *(C. elegans)* in the study of immunity and aging. The knowledge from the microRNAs and developmental timing genes in life-span regulation.
What we can learn about us knowing more about *Drosophila*? Lessons in age-related memory impairment, cancer and tumor growth (epithelial polarity and proliferation control: links from the *Drosophila* neoplastic tumor suppressors).

Invited speaker Nov 13th
Invited speaker Nov 17th
Student paper analysis

Block 4: Let's fish! Why fish are so useful in biomedical research? *Lecturer:* C. Pujades

Introduction to fish models: *fugu* as a good system for genomic studies, and *zebrafish* for genetic analysis.
Tissue regeneration and stem cell research in zebrafish.

New avenues using zebrafish as a biomedical research model: compound screening for vascular biology (development of high throughput small molecule screens); genetic and molecular basis of aging and longevity.

Invited speaker Nov 24th
Student paper analysis

Block 5: Heading to an anthropocentric view: the use of the mouse as a model.
Lecturers: C. Pujades, A. Ozaita, P. Robledo, P. Real

The mice embryos as a model for genetic cell tracing and lineage.
Mouse models for developmental disorders (congenital diseases).
Using mice to model cancer.
The mouse as a useful tool to investigate the molecular adaptive responses developed during addiction.

Invited speaker Dec 2nd
Student paper analysis