

## 68453 - Bioactive molecules: identification, design & development

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 68453 - Bioactive molecules: identification, design & development

**Faculty / School:** 100 - Facultad de Ciencias

**Degree:** 626 - Máster Universitario en Biofísica y Biotecnología Cuantitativa / Master in Biophysics and Quantitative Biotechnology

**ECTS:** 6.0

**Year:** 01

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

**The objectives of this course are related to:**

- 1 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a context of research
- 2 - Students should be able to apply acquired knowledge and problem-solving skills in environments new or little known within broader (or multidisciplinary) contexts related to their area of study
- 3 - Students are able to integrate knowledge and confront the complexity of making judgments from information that, incomplete or limited, includes reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments
- 4 - That the students know how to communicate their conclusions and the latest knowledge and reasons that support them to specialized public and non-specialized services in a clear and unambiguous manner
- 5 - Students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>), so that the acquisition of the learning outcomes of the subject provides training and competence to contribute to some extent to their achievement: GOAL 3: GOOD HEALTH AND WELL-BEING. GOAL 4: QUALITY EDUCATION. GOAL 8: DECENT WORK AND ECONOMIC GROWTH

### 2. Learning results

**Students will achieve the following results:**

- 1 - Order, analyze critically, interpret and synthesize information
- 2 - Obtain information from different types of sources and evaluate their reliability
- 3 - Learn efficiently through autonomous study and acquire a significant degree of independence
- 4 - Apply acquired knowledge and solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
- 5 - Formulate, analyze, evaluate and compare new or alternative solutions to different problems
- 6 - Be able to work in multidisciplinary and international teams
- 7 - Develop capacity for criticism and self-criticism
- 8 - Make decisions taking into account social, ethical and legal responsibilities
- 9 - Be able to develop a project, participating in the stages of bibliographic search, experiment planning, obtaining results, interpreting, and disseminating them

### 3. Syllabus

The course will address the following topics:

**Theory sessions (20 hours of theoretical lessons):**

#### **SECTION 1: Biomolecular Engineering for medicine and biotechnology**

- 1.1- Gen cloning/expression systems and protein purification process
- 1.2- Site directed and random protein mutagenesis
- 1.3- Protein modeling applications for rational design of protein mutations
- 1.4- Protein improvement: Thermostability Protein Solubility and Protein Affinity
- 1.5- Development of new enzymes
- 1.6- New commercial biological products as bioactive compounds

#### **SECTION 2: Strategies for new drug candidates' identification**

- 2.1- Drug discovery and optimization
- 2.2- Protein folding and protein/ligand binding equilibria
- 2.3- Molecular, cellular and in vivo assays during the identification of bioactive compounds
- 2.4- Experimental screening of chemical libraries
- 2.5- Computational screening of chemical libraries

2.6- QSAR models: structure/function relationships. Synthetic chemistry and medicinal chemistry. Development and validation of QSAR models.

### **SECTION 3: From “in vitro” bioactive molecules identification to “in vivo” testing**

- 3.1- Bioavailability testing (ADME): Pharmacodynamics and pharmacokinetics
- 3.2- Drug toxicity tests in cells and animals
- 3.3- Drug targeting
- 3.4- Developing new drugs: Examples of small molecules identification

#### **Practical sessions (30 hours of practical sessions):**

Students will be guided through practical exercises to deeper understand and apply the content previously showed in the theory sessions.

#### **Seminar sessions (10 hours of student's presentations):**

Students will explain a research project related to the subject topic.

## **4. Academic activities**

**The activities offered to the student to help him/her achieve the expected results are:**

The course includes 6 ECTS organized according to:

- Interactive lecture sessions: (0.8 ECTS): 20 hours.
- Practical workshops in the computer lab room (0.6 ECTS): 15 hours.
- Practical individual assessments with computer (0.6 ECTS): 15 hours.
- Assignments: Presentation and work exposition or seminar (0.4 ECTS): 10 hours.
- Autonomous work (3.6 ECTS): 90 hours.

**Theory sessions:** 2-hour sessions take place. Lecture notes and a series of problems (and its solutions) will be available for the students. At the end of each topic, some of the problems will be solved in class by the professor and the rest will be done individually. The professor will also assign some unsolved problems to be submitted later.

**Practical sessions:** 3-hour sessions take place. Students are provided in advance with task guidelines for each session.

## **5. Assessment system**

**Student must demonstrate that he/she has achieved the expected learning outcomes by means of the following assessment activities:**

**Homework (35/100):** Preparing a report about a topic related to the course. The report will be prepared individually or in groups of two students. It will evaluate considering how the student describes in a clear way the problem statement, describes properly the methodology, and the results in a logic and sequential way, give original ideas in the description, provide conclusions justified by the job and reports the appropriate the references in literature.

**Written Test (50/100):** It will comprise of questions that requires short or long answers. Short ones will allow performing a comprehensive sampling of the student knowledge and long ones will allow students to exhibit their expression capabilities in presentation and sustain argumentations, and critical judgments. This written test will be based on the learning activity program.

**Seminars (15/100):** Report preparation and public presentation and defense about a topic related to the course. This report will be individual or in two group students. The presentation sessions will have seminar format. 10-15 minutes for presentation and defense. The work will be evaluated according to its structure (coherent) and appropriate literature reference contained; clarity and tidiness during the presentation; maturity during debate.