

**COURSE DATA****Data Subject**

|                      |   |
|----------------------|---|
| <b>Code</b>          | 43096                                       |
| <b>Name</b>          | Stem Cells: Biology, study and applications |
| <b>Cycle</b>         | Master's degree                             |
| <b>ECTS Credits</b>  | 3.0   |
| <b>Academic year</b> | 2021 - 2022                                 |

**Study (s)**

| <b>Degree</b>   | <b>Center</b>                  | <b>Acad. Period</b> |
|---|--------------------------------|---------------------|
| 2142 - Master's Degree in Molecular Approaches in Health Sciences | Faculty of Biological Sciences | 1 First term        |

**Subject-matter**

| <b>Degree</b>   | <b>Subject-matter</b>                                      | <b>Character</b> |
|---|--|------------------|
| 2142 - Master's Degree in Molecular Approaches in Health Sciences | 1 - Molecular technologies for research in health sciences | Obligatory       |

**Coordination**

| <b>Name</b>                   | <b>Department</b>                       |
|-------------------------------|---|
| GALAN ALBIÑANA, AMPARO        | 30 - Biochemistry and Molecular Biology |
| O'CONNOR BLASCO, JOSE ENRIQUE | 30 - Biochemistry and Molecular Biology |

**SUMMARY**

In the course “Stem Cells: Biology and Applications Study”, students will become familiar with the concepts and techniques of biological research on stem cells and the likely applications of human stem cells in research and therapy of cancer and in the new area of Regenerative Medicine.

The lessons address the molecular mechanisms that regulate the cell cycle, proliferation, differentiation and apoptosis of embryonic and adult stem cell populations, in normal and pathological conditions. It will describe the biology of embryonic stem cells, adult stem cells and tumor stem cells and review current techniques and animal models in research on stem cells.

The new concept of Regenerative Medicine will be addressed by describing failing organs and tissue that benefit from stem cell replacement, as well as basic and applied aspects of the Tissue Engineering and Biomaterials.



Through laboratory sessions, students will face in vitro experimental studies of our own research on cancer stem cells and Regenerative Medicine.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

None.

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 2142 - Master's Degree in Molecular Approaches in Health Sciences

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Conocer en profundidad y comprender la organización a nivel molecular de células, sistemas y procesos de relevancia en las Ciencias de la Salud.
- Conocer en profundidad y comprender las bases moleculares de la enfermedad.
- Conocer en profundidad y comprender las metodologías de investigación básica aplicables a las Ciencias de la Salud.
- Tener capacidad de analizar y sintetizar un problema.
- Tener capacidad de comunicación oral y escrita en una segunda lengua científica.
- Tener capacidad de localizar información.
- Tener capacidad de desarrollar un trabajo interdisciplinar.
- Conocer y comprender los conceptos básicos y las aplicaciones en investigación básica y clínica de las células madre.



- Conocer, comprender y manejar en la práctica métodos de estudio de las células madre.
- Aprender a identificar, manejar y presentar adecuadamente en informes y exposiciones públicas, conocimientos existentes sobre células madre, usando como vehículo la lengua inglesa.

## **LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)**

1. To know and to understand the basic concepts and applications in basic and clinical research of stem cells.
2. To know, to understand and to manage in practice methods of studying stem cells.
3. To learn to identify, manage and present properly in public reports and statements existing knowledge on stem cells, using the English language as a vehicle.

## **DESCRIPTION OF CONTENTS**

### **1. Bloque 1. Introducción a las Células Troncales y la Medicina Regenerativa**

Tema 0. Introducción a la Asignatura.

Tema 1. Introducción a las Células Troncales y la Medicina Regenerativa

### **2. Bloque 2. Fallo orgánico y origen de las enfermedades crónicas humanas:**

Tema 2. Autoinmunidad y Diabetes Mellitus

Tema 3. Fallo Hepático Agudo y Crónico

Tema 4. Enfermedades Neurodegenerativas

Tema 5. Enfermedad Cardiovascular

### **3. Bloque 3. Características y fuentes de las Células Troncales humanas:**

Tema 6. Células Madre Embrionarias

Tema 7. Células Pluripotentes inducidas (iPSC)

Tema 8. Diferenciación de las Células Troncales: Células Madre del Adulto

### **4. Bloque 4. Tecnologías Ómicas en la investigación de Células Troncales:**

Tema 9. Genómica, Proteómica y Citómica en Medicina Regenerativa



### **5. Bloque 5. Aplicaciones de las Células Troncales en Medicina Regenerativa:**

- Tema 10. Medicina Regenerativa en Diabetes Mellitus
- Tema 11. Medicina Regenerativa en Reproducción
- Tema 12. Medicina Regenerativa en Enfermedades Hepáticas
- Tema 13. Medicina Regenerativa en Enfermedades Neurodegenerativas
- Tema 14. Medicina Regenerativa en Terapia Cardiovascular
- Tema 15. Medicina Regenerativa y Envejecimiento

### **6. Bloque 6. Células Troncales y Cáncer:**

- Tema 16. La Célula Madre tumoral y su papel en el cancer y su terapia.

### **7. Bloque 7. Aspectos prácticos del trabajo con Células Troncales:**

- Tema 17. Ética y Legislación en el uso de Células Troncales humanas
- Tema 18. Ensayos clínicos con Células Troncales humanas

### **8. Bloque 8. PRÁCTICAS DE LABORATORIO**

1. Caracterización fenotípica por Citometría de flujo de Células Troncales
2. Caracterización funcional por Citometría de flujo de Células Troncales
3. Visita guiada a un Centro de Investigación en Medicina Regenerativa

### **9. Bloque 9. TRABAJO PRÁCTICO**

Los estudiantes se organizarán en grupo de 4-5 estudiantes, para preparar una presentación en grupo sobre un aspecto a determinar en relación con la Señalización Celular en el ámbito de las Células Madre.

Este trabajo será evaluado de forma compartida con la asignatura "Análisis Molecular y Celular de la Señalización Celular".

**WORKLOAD**

| ACTIVITY                       | Hours        | % To be attended |
|--------------------------------|--------------|------------------|
| Group work                     | 10,00        | 100              |
| Theory classes                 | 10,00        | 100              |
| Seminars                       | 10,00        | 100              |
| Development of individual work | 25,00        | 0                |
| Study and independent work     | 20,00        | 0                |
| <b>TOTAL</b>                   | <b>75,00</b> |                  |

**TEACHING METHODOLOGY**

The subject is designed to be developed in the form of face-to-face and non-face-to-face work.

The face-to-face teaching of this subject will be carried out through theoretical lectures and practical seminar sessions and attendance at tutorials. Some of the theoretical lectures and practical seminars will be taught in English.

In theory classes, a global vision of the topic to be discussed, with special emphasis on key concepts. In the same session, the most appropriate resources will be indicated for an in-depth study of the subject, so that the student may complete his training in it.

**EVALUATION**

The evaluation of student learning will be carried out by assessing the following sections:

1. Continuous evaluation of the theoretical and practical contents of each of the blocks of the subject, with questions of different formats, to be carried out in the classroom. This test will be worth up to 30% of the final grade and will be done through an online test at the end of teaching in each block.
2. Final exam of the theoretical and practical contents, with questions of different formats, to be held in the classroom. This test will be worth up to 30% of the final grade and will take place at the end of the first semester.
3. Practical written work on a basic or applied aspect of the Stem Cells, which will have a value of up to 30% of the final grade.
4. Student interest in the subject, expressed as their participation in organized discussions, answers to questions asked by the teacher during face-to-face sessions, attendance at personal tutoring and / or any other type of activity carried out by the student in relation to the subject. Up to 10% of the final grade for the course can be obtained from the evaluation of these concepts.



**REFERENCES****Basic**

- Lanza, R. Essentials of Stem Cell Biology. Academic Press (2009)
- Stem Cell Biology in Normal Life and Diseases  
<https://www.intechopen.com/books/stem-cell-biology-in-normal-life-and-diseases>
- Stem Cells in Clinic and Research  
<https://www.intechopen.com/books/stem-cells-in-clinic-and-research>
- Regenerative Medicine and Tissue Engineering  
<https://www.intechopen.com/books/regenerative-medicine-and-tissue-engineering>
- Cells and Biomaterials in Regenerative Medicine  
<https://www.intechopen.com/books/cells-and-biomaterials-in-regenerative-medicine>

**Additional**

- The Stem Book. <http://www.stembook.org>
- Euro Stem Cell. <http://www.eurostemcell.org/>
- Tissue Regeneration - From Basic Biology to Clinical Application  
<https://www.intechopen.com/books/tissue-regeneration-from-basic-biology-to-clinical-application>
- Autoimmune Diseases - Contributing Factors, Specific Cases of Autoimmune Diseases, and Stem Cell and Other Therapies  
<https://www.intechopen.com/books/autoimmune-diseases-contributing-factors-specific-cases-of-autoimmune-diseases-and-stem-cell-and-other-therapies>
- Diabetes Mellitus - Insights and Perspectives  
<https://www.intechopen.com/books/diabetes-mellitus-insights-and-perspectives>
- Cardiomyopathies - Types and Treatments  
<https://www.intechopen.com/books/cardiomyopathies-types-and-treatments>
- Liver Regeneration  
<https://www.intechopen.com/books/liver-regeneration>
- Advanced Understanding of Neurodegenerative Diseases  
<https://www.intechopen.com/books/advanced-understanding-of-neurodegenerative-diseases>
- Células Madre y Terapia regenerativa. F de Pablo y M Cascales, eds., Monografías de la Real Academia Nacional de Farmacia, Monografía XXVII (2009)  
<https://www.analesranf.com/index.php/mono/issue/view/360>



## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

In the event that the health situation so requires:

- A) Face-to-face teaching will be replaced by online teaching, through synchronous or asynchronous presentations by teachers of the teaching materials, using the tools made available to teachers and students in the Virtual Classroom.
- B) The tutorials will be carried out exclusively telematically.
- C) The final evaluation of the subject will be done through an online test.