

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

Code	43096
Name	Stem Cells: Biology, study and applications
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2	1 - Molecular technologies for research in health sciences	Obligatory

Coordination

Name	Department
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.

OUTCOMES

2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2

- 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

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. Overview of Regenerative Medicine

This unit provides an overview of Regenerative Medicine, as interdisciplinary specialty that applies the principles and methods of engineering and life sciences to manufacturing biological substitutes that maintain, improve or restore the function of organs and tissues in the human body

2. Organ Failure and Origin of Chronic Human Disease (I) Autoimmunity and Diabetes

This unit reviews the different types of organ failure resulting in chronic human diseases, referring in particular to autoimmunity and Diabetes Mellitus.

3. Organ Failure and Origin of Chronic Human Disease (II) Liver Failure

This unit reviews the different types of organ failure resulting in chronic human diseases, referring in particular to liver failure.

4. Organ Failure and Origin of Chronic Human Disease (III) Neurodegenerative Diseases

This unit reviews the different types of organ failure resulting in chronic human diseases, referring in particular to neurodegenerative diseases.

5. Organ Failure and Origin of Chronic Human Disease (IV) Cardiovascular Disease



This unit reviews the different types of organ failure resulting in chronic human diseases, referring in particular to cardiovascular diseases.

6. Human Embryonic Stem Cells (hESC) (I) Basic biology of hESC.

This unit introduces the basic concepts of phenotype and function of human embryonic stem cells.

7. Human Embryonic Stem Cells (II): Derivation, culture and differentiation

This unit reviews the methodological and experimental aspects most relevant to the derivation, culture and differentiation of human embryonic stem cells.

8. Human Embryonic Stem Cells (III): Alternatives to Conventional hESC lines

This unit will address the technical, legal and ethical use of human embryonic stem cells and shows the current alternatives to the lines of human embryonic stem cells.

9. Human Adult Stem Cells (hASC) and Therapy (I): Basic biology of hASC

This unit introduces the basic concepts of phenotype and function of human adult stem cells.

10. Human Adult Stem Cells (hASC) and Therapy (II): Mechanisms of Action

This unit presents the mechanisms of action of human adult stem cells in their use for experimental and therapeutic uses.

11. Human Adult Stem Cells (hASC) and Therapy (III): Neural Stem Cells

This unit reviews the applicability of neural stem cells from adult human for therapeutic use in regenerative medicine.

12. Human Adult Stem Cells (hASC) and Therapy (IV) Application in neurodegenerative diseases

This unit reviews the applicability of human adult stem cells for therapeutic use in the treatment of neurodegenerative diseases.

13. Human Adult Stem Cells (hASC) and Therapy (V) Application in cardiovascular therapy

This unit reviews the applicability of human adult stem cells for therapeutic use in the treatment of cardiovascular diseases.



14. Induced Pluripotent Stem Cells (iPSC)

This unit introduces the basic concepts of phenotype and function of induced pluripotent cells (IPSC) and their potential applications in cell therapy and regenerative medicine.

15. Stem Cells in Developmental Biology

This unit introduces the basic concepts related to the multiple roles of stem cells in Developmental Biology.

16. Cancer Stem Cells (I): Concept and implications

This unit introduces the basics of phenotype and function of cancer stem cells and revises the hypotheses of their participation in the processes of tumorigenesis and metastasis.

17. Cancer Stem Cells (II) Cancer Stem Cells in hematopoietic tumors

This unit examines the involvement of cancer stem cells in hematopoietic tumors.

18. Genomics, Proteomics and Cytomics in Stem Cell Investigation

This unit presents the technical basis and applications of new methodologies omics (genomics, proteomics and Cytomics) in stem cell research.

19. Large group seminars

Seminario 1: Working in GMP conditions for Cellular Therapy.

Seminario 2: Practical approach to Ethics and Legislation in Human Stem Cell use.

20. Practical work

Each student will write a practical work on a biomedical application of the Stem Cells, to choose from the list that will be proposed by the teacher at the beginning of the course, with the specific instructions for its preparation. The work will be delivered before the end of the first semester of the academic year.

**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
TOTAL	75,00	

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.