Máster en Investigación en Inmunología

Master's Degree in Immunology Research

Facultad de Medicina/School of Medicine

Universidad Complutense de Madrid

Guía Docente:

Metabolic disorders and Immunity

Curso 2024-2025

I.- IDENTIFICACIÓN/IDENTIFICATION

NOMBRE DE LA ASIGNATURA:	Enfermedades metabólicas e Inmunidad
COURSE TITLE:	Metabolic disorders and Immunity
NÚMERO DE CRÉDITOS:	3
NUMBER OF CREDITS:	3
CARÁCTER:	Optativa
STATUS:	Optional
MATERIA:	Inmunología aplicada
SUBJECT	Applied Immunology
NIVEL:	Máster (MECES 3)
LEVEL:	Master (MECES 3)
TITULACIÓN:	Máster en Investigación en Inmunología
STUDIES:	Master in Immunology Research
SEMESTRE:	Primero
SEMESTER:	First
DEPARTAMENTO	Inmunología, Oftalmología-ORL
DEPARTMENT:	Immunology, Opht-ENT (IOO)

PROFESOR/ES RESPONSABLE/S:
PROFESSOR/RESPONSIBLE

English group	
Teoría/Theory Seminario/Seminar Tutoría/Tutorial	**Profesor/Professor: Yulia A. Nevzorova and Francisco Javier Cubero** **Departamento/Department:** Immunology (Facultad de Medicina) **Despacho/room: pl. 2/ Lab IV** **e-mails:** yulianev@ucm and fcubero@ucm.es

II.- OBJETIVOS/OBJECTIVES

■ GENERAL OBJECTIVE

- The main aim is to draw attention to a trending topic, the interplay between immunological and metabolic processes.
- Nowadays, it has become obvious that certain supposedly non-immune pathologies result in mobilization of the innate and adaptive immune systems. This promotes metabolic abnormalities (e.g. obesity) or increases disease susceptibility (e.g. Diabetes Mellitus type 2; DMT2, cardiovascular, neurological diseases). On the other hand, it also became clear that the function of all myeloid and lymphoid populations are controlled on many levels by internal metabolic properties.
- Dissection of the molecular underpinnings of the immunological–metabolic crosstalk has become a scientific priority offering a novel opportunity for therapeutic immune-based interventions.

■ SPECIFIC OBJECTIVE

Altogether, the specific course objectives are:

- to deliver basic principles and molecular mechanism of Pathoimmunology,
- to make connections between Inmunology and Metabolic disorders
- to connect immunological concepts with clinical world of diagnosis and therapy

III.- CONOCIMIENTOS PREVIOS Y /PREVIOUS KNOWLEDGE

Basic Physiology and Immunology

IV.- CONTENIDOS/CONTENTS

■ BREAF DESCRIPTION OF CONTENTS

During the course we will focus on the Immunology related to cellular and molecular mechanisms that lead to metabolic diseases and detail the potential role of adipokines and immune cells in this deleterious process. We will highlight the main regulators of immune-metabolic interactions including host genetics, nutritional status, and the intestinal microbiome as an emerging new field of interest. We will also illustrate differences among individuals and between populations, and point towards future avenues of research possibly enabling immune harnessing as means of personalized treatment for common metabolic disorders. The course will include theoretical lectures and interactive seminars.

	Topic	Academic hours (h)
theoretical lectures	1. Immune contribution to Metabolic Physiology	2
	2. Interplay between Hormones, Metabolic disorder and the Immune system	2
	3. Alterations of the homeostasis of myeloid and lymphoid cells in the adipose tissue during obesity	2
	4. Type 2 diabetes as an inflammatory disease	2
	5. Immune imbalance in Metabolic associated fatty liver disease (MAFLD)	2
	6. Immune mechanisms of hypertension	1

	7. Inflammation and Immunity in Cardiovascular metabolic diseases	**1**
	8. Stroke and the immune system: from pathophysiology to new therapeutic options	**2**
	9. Metabolism in Autoimmune Diseases	**2**
	10. Inherited Metabolic disorders: impact of Immune system	**2**
	11. Metabolic-associated changes in microbiome in the gut-liver axis. Therapeutic avenues: FMT, antibiotics, and new technology (anti-TLR, bacteriophages). Exercise.	**2**
	12. Immune-based therapies in metabolic diseases: past, present, future	**2**
interactive seminars	**1. Case studies: Educational game**	**4**
	2. Immunity in rare metabolic disorders: "Adopt-a-disease" – students team disease presentations	**4**

The triggers for adipose tissue inflammation are still poorly defined. However, obesity-induced adipose tissue expansion provides a plethora of intrinsic signals (e.g., adipocyte death, hypoxia, and mechanical stress) capable to initiate the inflammatory response. Immune dysregulation in adipose tissue of obese subjects results in a chronic low-grade inflammation characterized by increased infiltration and activation of innate and adaptive immune cells. Besides macrophages (40% of all adipose tissue cells in obesity), many other immune cells (e.g., dendritic cells, mast cells, neutrophils, B cells, and T cells) reside in adipose tissue during obesity, playing a key role in the development of adipose tissue inflammation and insulin resistance. The association of obesity, adipose tissue inflammation, and metabolic diseases makes inflammatory pathways an appealing target for the treatment of obesity-related metabolic complications.

In the setting of obesity, codependent interactions between metabolism and inflammation have been observed in the prenatal environment, infancy, early childhood, and adolescence. Many of the developmental windows that are sensitive to the patterning of metabolic physiology are also crucial in the patterning of the immune system and its responses.

We will focus on metabolic syndrome-derived MAFLD/MASH as a trigger or as a consequence of microbiome changes in the gut. Thus, we will focus on the gut-liver axis as a modulator of hyperglycemia, hyperlipidimia, hyperucemia, and therapies to prevent gut leakage and dysbiosis. Therapies will focus on fecal matter transplantation, antibiotics cocktail, exercise for MAFLD, bacteriophages and aptamers (antiTLR).

V.- COMPETENCIAS/COMPETENCES

- **GENERAL:**
  - **CG4** To demonstrate communication skills in conclusions and knowledge in immunology to specialised and non-specialised public.
  - **CG5** To demonstrate self-learning in immunology

- **SPECIFIC:**
  - **CE2** To demonstrate advanced knowledge about the methodologies in microscopy commonly used in immunology and about the molecular mechanisms mediating immune responses.

- **TRANSVERSAL:**
  - **CT1** To demonstrate the capacity of develop rigurous analysis of scientific articles.
  - **CT2** To demonstrate the capacity of writing and defending scientific and technical reports.
  - **CT5** To demonstrate the capacity of autonomous and team work.

VI. – HORAS DE TRABAJO Y DISTRIBUCIÓN POR ACTIVIDAD/HOURS OF WORK AND DISTRIBUTION OF ACTIVITIES

ACTIVITY	Academic hours (h)	Credits
Clases teóricas/theoretical lessons	**22**	**2,2**
Seminars		
• **Case studies: Educational game**	**4**	**0,4**
• **"Adopt-a-disease"**	**4**	**0,4**
Total	**30**	**3,0**

VII.- METODOLOGÍA/METHODOLOGY

Two important parts of medical education are the **theoretical knowledge** (eg, pathophysiology) and the **social skills** (human interaction, team activity). Committing and contributing of these two parts can be only reached through theoretical–practical interaction. Therefore, the course will have a hybrid methodology: **theoretical lessons and seminars**.

In **theoretical lessons,** the professor will explain the theoretical concepts of the course. The teaching will be geared toward systematic and theory-based thinking, critical appraisal, and assessment of complicated and contradictory information, students' ability to develop their own questions.

In order to make lectures more interactive - Kahoot! - a game-based learning platform will be used to review students' knowledge at the end of each theoretical class. In this learning tool, students will use their mobile phones or other electronic devices to get connected and answer the questions posed by the teacher. The game can be played individually, through the projection of questions and answers on the virtual platform. Students will obtain a better score depending on their speed of response and, of course, on the highest number of correct answers. Certain competitiveness will be generated by having a limited response time. The goal of Kahoot! is to increase engagement, motivation, enjoyment, concentration, to improve learning performance and classroom dynamics.

Additionally, the appropriate documentation concerning each topic will be available for the student in the Campus Virtual to complement theoretical lessons.

The aim of **Seminars** will be to develop exploratory learning, independent and cooperative working, training in problem solving, student's ability to present and defend reports. The seminars will include **educational games** and student's **team disease presentations.**

Games are an innovative and challenging educational method. Games provide the opportunity for learners to reinforce previously learned theoretical information and acquire new knowledge. They connect theory and practice and provide the opportunity for immediate feedback. Games encourage interaction among learners, increase learners' levels of motivation, and enhance the opportunity to learn from others.

In the course of the **Case studies** game, the participants, in accordance with the assigned roles, will mimic clinical situations. The professor - the "patient" - formulates complaints and simulates symptoms characteristic of the disease which is unknown to the rest of the participants. The students - "doctors" - must, through a dialogue, find out what worries the patient, clarify complaints, conduct an examination, study the research data, prescribe additional ones if necessary, make a diagnosis, justify it and prescribe treatment. At the end of the game professor will analyse and evaluate the work of the students. Finally, students will give an Oral presentation in **the Adopt-a-Disease seminar**. Students, in groups of 3 or 5, will be assigned a rare metabolic disease, design and give a 30-minute oral multimedia presentation. The oral presentation should follow a set format including information on etiology, pathogenesis, pathology, therapy, and disease outcomes. **To successfully complete the project, students must:**

1. - Develop a short, well organized, creative, clear presentation on the aetiology, highlight immunological aspects of the assigned metabolic disease.

2. - Work successfully with team members to produce a presentation. Balance workload and responsibility among all team members. Students are free to experiment with multimedia, art and computers to accomplish the task. After the presentation the topics will be intensively discussed and evaluated by students and professor using Doodle platform.

VIII.- BIBLIOGRAFÍA/BIBLIOGRAPHY

■ BASIC:

1. **Metabolic diseases: Foundations of Clinical Management, Genetics, and Pathology,** 2017, by Enid Gilbert-Barness, Lewis A. Barness, Philip M. Farrell
2. **The Immunology of Cardiovascular Homeostasis and Pathology**, 1st ed. 2017, by Susanne Sattler, Teresa Kennedy-Lydon
3. **Immunology of Diabetes V: From Bench to Bedside** (Annals of the New York Academy of Science, Volume 1150) by Carani B. Sanjeevi, Desmond A. Schatz, Mark A. Atkinson
4. **Encyclopedia of Cardiovascular Research and Medicine** 1st Edition - November 27, 2017, by Douglas Sawyer, Ramachandran Vasan
5. **Neuroinflammation** 2nd Edition - July 30, 2018, by Alireza Minagar
6. **Diet, Microbiome and Health** 1st Edition - January 2, 2018, by Alexandru Grumezescu, Alina Maria Holban
7. **Microbiomics Dimensions, Applications, and Translational Implications of Human and Environmental Microbiome Research** 1st Edition - February 21, 2020, by Manousos Kambouris, Aristea Velegraki
8. **Diet, Inflammation, and Health** 1st Edition - January 20, 2022 by James Hebert, Lorne Hofseth, Nitin Shivappa
9. **Immune: a journey into the mysterious system that keeps you alive,** 2021
By Philipp Dettmer

■ **COMPLEMENTARY:**

1. Roitt: "*Inmunología. Fundamentos*", 12ª edición, Ed. Médica Panamericana, 2014.
2. Regueiro, J.R. et *al*.: *"Inmunología. Biología y Patología del Sistema Inmunitario",* 4ª edición, Ed. Médica Panamericana, 2011.
3. **The Story of Basic Immunology** https://www.kyowakirin.com/story_of_basic_immunology/index.html
4. **British Society for Immunology** https://www.immunology.org/public-information
5. PDF documents of relevant publications for the topics of the course will be provided to students. In general, students will be provided with articles of scientific journals such as *Cell Metabolism, Immunity, J. Immunol, J. Hepatol etc.*

IX.- EVALUACIÓN/EVALUATION

The academic efficiency and final score of the course will be given according to three scoring sections (A, B and C) described in the tables below:

A. **Obligatory** and active participation of the student during theoretical classes. The individual knowledge of students will be obligatory evaluated after each theoretical lecture using Kahoot! platform. The student will answer 5 different multiple answer questions.

Punctuation per question	Maximal punctuation after each theoretical	Number of theoretical topics	Maximal punctuation after all theoretical classes

	class topic		
1	5	12	60

B. Active participation and team play ability of the students in educational game will be analyzed by professor based on the following criteria:

The group clearly identified the disease	6
The group's examination tactics were appropriate	4
The group clearly suggested further therapeutic strategies and tactics.	4
The group had balanced responsibility among all members	3
Students properly applied professional ethics, empathy and communication skills.	3
Maximal punctuation	20

C. "Adopt a disease" presentation will be evaluated by the students and professor using Doodle platform based following criteria's:

Clarity and coherence of the content	10
Balanced responsibility among all team members	2,5
Creativity	2,5
Design of the slides	2,5
Completion of the presentation within the allotted time frame	2,5
Maximal punctuation	20

The total maximal score of the subject A+B+C=100 points

Grading system/ Sistema de evaluación

100 points (10)	Excellent (Matricula de Honor)
90-99 point (9,0-9,9)	Very good (Sobresaliente)
70-89 points (7,0-8,9)	Good (Notable)
50-69 (5,0-6,9)	Satisfactory (Aprobado)
0-49 (0-4,9)	Fail (Suspenso)

In order to pass the subject, the total score needs to be above the 49 points. In the case of total scoring less than 49 points a written test exam with 12 multiple choice questions (one question per each theoretical topic) can be accepted as proof of knowledge on the subject. If evidence shows intent of misconduct under exam conditions, this will be treated as a severe examination behaviour and special measures will be taken.

Unattendance to class is compulsory. In case of *force majeur* a justification needs to be presented to the Coordinators.