COURSE DATA

Data Subject	
Code	33156
Name	Molecular health parasitology
Cycle	Grade
ECTS Credits	4.5
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	14 - Materia de asignaturas optativas	Optional

Coordination

Name	Department
MARCILLA DIAZ, ANTONIO	21 - Cellular Biology and Parasitology

SUMMARY

Parasitic diseases affect a third of the total world population, causing many deaths and serious damage, especially in children, where are related with delays in physical and mental development. Of the 11 diseases considered as priorities by the Division of Tropical Medicine from the World Health Organization (WHO), 7 are of parasitic origin. Most of them are associated with poverty. Thus, action on these conditions should allow for improved health, welfare and livelihood of these people and encourage their development. Nowadays with genomic studies, including the availability of parasites genomes, as well as advanced technologies, it is reasonable to think about their applicability to neglected diseases, such parasitic diseases.
In this matter we will study the biological processes where parasites are involved, delving into the development of new approaches to control them and the diseases they cause. This will analyze the mechanisms that could enable the developing of new control strategies, including new faster and effective diagnostic tools, the identification of new targets for specific treatment as well as new candidates for vaccine development.
The course focuses on the molecular aspects of parasitic diseases and will appeal to those who wish to broaden their education before embarking on a research career in areas such as parasitology, molecular

biology and immunology, and for those seeking specialized training on parasitic diseases.
The course objectives are:
1) Provide a realistic vision of the biology of parasitic diseases, their transmission and control.
2) Understand current research on immunological and molecular aspects of parasites with greater public health significance.
3) Training in research and modern techniques used in the study of parasites and their relationship with the host.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1101 - Degree in Biochemistry and Biomedical Sciences

- Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.
- Desarrollo de habilidades para la aplicación de los conocimientos adquiridos al mundo profesional.
- Capacidad para el trabajo multidisciplinar en equipo y la cooperación.
- Be able to use new information and communication technologies.
- Know how to use the different bibliographic sources and biological databases and be able to use bioinformatic tools.
- Know the usual procedures used by scientists in the area of molecular biosciences and biomedicine to generate, transmit and disseminate scientific information.
- Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.
- Know how to design multidisciplinary experimental strategies in the field of molecular biosciences to solve complex biological problems, especially those related to human health.
- Know how to apply the knowledge gained in the diagnosis, prevention and treatment of human diseases.
- Tener una visión integrada de las técnicas y métodos utilizados por las ciencias Biomédicas.
- Utilización de terminología específica de la biomedicina.
- Conocer los principales métodos y técnicas experimentales aplicadas al estudio de la salud y enfermedad humanas, su etiología y la efectividad de los tratamientos.

- Conocer los organismos patógenos de humanos, las patologías que provocan y conocer los fundamentos de las principales estrategias terapéuticas.
- Conocer los mecanismos de interacción hospedador-patógeno para entender factores de virulencia en enfermedades infecciosas y parasitarias.
- Saber diseñar y preparar nuevas vacunas.
- Entender la genómica de patógenos y sus implicaciones para el diseño de fármacos y vacunas.
- Interpretar de modo crítico el papel de los datos de bioquímica clínica en el diagnóstico, pronóstico, control y monitorización de medidas terapéuticas.

LEARNING OUTCOMES

Acquisition and understanding of the basics of molecular parasitology applied in health
Knowledge of methods and instrumental techniques and basic concepts that allow professional development in molecular parasitology
Solve theoretical and practical parasitological exercises
Interpret data and present and discuss results of studies of molecular parasitology
Design of experiments to solve problems related to parasitic diseases

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO MOLECULAR PARASITOLOGY

Lesson 1. INTRODUCTION TO MOLECULAR PARASITOLOGY. Definitions and objectives in molecular parasitology. Brief historical notions of Parasitology and Tropical Medicine. Molecular parasitology and parasitic diseases.
Lesson 2. PARASITIC LIFE AND BIOLOGICAL CYCLES. Parasitism. Types of parasitism. Parasitic diseases: clinical and economic importance. Brief description of parasites biological cycles.

2. BASIC TOOLS IN MOLECULAR PARASITOLOGY

Lesson 3. OBTAINING PARASITES AND THEIR MOLECULES. Isolation and cultivation of parasites. Methodology for the isolation and analysis of nucleic acids and proteins from protozoa and helminthes.

Lesson 4. MOLECULAR TECHNIQUES FOR PARASITE DIFFERENTIATION. Molecular techniques: Analysis of electrophoretic enzyme variants (isoenzymes). Using antibodies to isotype. Analysis of nuclear and mitochondrial genes of parasites and vectors. Applications. Examples.

3. MOLECULAR STUDIES ON HOST-PARASITE RELATIONSHIPS

Lesson 5. HOST-PARASITE MOLECULAR INTERACTIONS. Analysis of host-parasite relationships at the molecular level: examples. Phylogenetic studies.

Lesson 6. PARASITES AND THE IMMUNE SYSTEM. Immune response to parasites. Mechanisms of evasion of the immune response. Antigenic variation.

Lesson 7. ANTIPARASITIC VACCINES. Types of vaccines. Malaria vaccines: principles and current status. Vaccines against other parasites. Factors affecting the generation of vaccines.

4. DIAGNOSIS AND MOLECULAR EPIDEMIOLOGY OF PARASITES

Lesson 8. MOLECULAR DIAGNOSIS OF PARASITES. Summary of the main diagnostic techniques applied to molecular parasites.
Lesson 9. MOLECULAR EPIDEMIOLOGY OF PARASITES. Studies on characterization of strains of parasites and vectors.

5. PARASITIC PROTOZOANS

Lesson 10. INTESTINAL PROTOZOANS. Study of Entamoeba histolytica, Giardia intestinalis, Cryptosporidium spp. Molecular aspects and applications to diagnosis and treatment.
Lesson 11. TOXOPLASMOSIS. Morphological forms and life cycle of Toxoplasma gondii. Host cell invasion and gliding movement.
Lesson 12. LEISHMANIOSIS. Study of kinetoplast DNA: DNA minicircles. Analysis of nuclear DNA. Canine leishmaniasis.
Lesson 13. SLEEPING SICKNESS. Mechanisms of survival of Trypanosoma brucei. Antigenic variation of the surface glycoproteins. Genetic mechanisms of antigenic variation. Coating antigen of the parasite.
Lesson 14. AMERICAN TRYPANOSOMOSIS. Schyzotrypanum cruzi group heterogeneity based on analysis of DNA. Using PCR. Chromosomal analysis. Triatominae vectors and evolutionary relationships.
Lesson 15. MALARIA. Molecular approaches to knowledge of Plasmodium spp. Genome. Studies of anophelinae vectors.

6. PARASITIC HELMINTHES

Lesson 16. TREMATODES I: FOODBORNE TREMATODES. Molecular studies on the genus Fasciola, Echinostoma, Clonorchis, Opistorchis, Paragonimus. Transcriptomics and proteomics studies.

Lesson 17. SCHISTOSOMOSIS. Molecular studies of Schistosoma spp. Genome, transcriptome and proteome.

Lesson 18. CESTODES I: TAENIA AND CYSTICERCOSIS. Differentiation of Taenia species by molecular techniques: PCR and DNA probes. Libraries screaning and tracing and obtaining new antigens using recombinant DNA techniques.

Lesson 19. NEMATODES I: INTESTINAL NEMATODES. Molecular studies on Trichinella spiralis and Strongyloides stercoralis.

Lesson 20. NEMATODES II: FILARIAE. Molecular studies of major filariae that affect humans.

7. ANTIPARASITIC TREATMENT

Lesson 21. MOLECULAR TECHNIQUES ON THE RATIONAL TREATMENT OF PARASITIC DISEASES. Antiparasitic treatments used today and biochemical routes where they operate. Analysis of protein structure and applications of genetic techniques.

Lesson 22. ANTIPARASITIC DRUG RESISTANCE. Clinical and economic importance of the emergence of resistance. Description of cases of resistance and molecular origin. Identification of strains and isolation of genes involved. Recommended therapeutic guidelines.

Lesson 23. DESIGN OF NEW ANTIPARASITIC DRUGS. Role of molecular parasitology in the design of new antiparasitic drugs. Generation of new drugs. Implications.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	41,00	100
Tutorials	4,00	100
Attendance at events and external activities	2,00	0
Development of group work	10,00	0
Study and independent work	30,00	0
Readings supplementary material	4,00	0
Preparation of evaluation activities	6,50	0
Preparing lectures	10,00	0
Resolution of case studies	2,00	0
Resolution of online questionnaires	3,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The course is based on lectures where the teacher will present the most relevant content for each group of lessons supported by different resources. Support materials will be available to the Aula Virtual in advance. The course is complemented by seminars where critical discussion of recent scientific publications is achieved and presented. They will be complemented with lectures from renowned professionals in the field of molecular parasitology.

EVALUATION

Evaluation combines continuous assessment (taking into account assistance, attention, participation and involvement, and students skills acquired) with objective written tests (one final exam with theoretical issues, and online tests throughout the year), which should reflect the progress made by students. Participation in class, exhibitions, seminars (10%), written tests (90%).

REFERENCES

Basic

- J. J. MARR, R. W. KOMUNIECKI & T.W. NILSEN (2003). Molecular Medical Parasitology. Elsevier, UK. (http://www.sciencedirect.com/science/book/9780124733466)
  D.F. SMITH & M. PARSONS (1996). Molecular Biology of parasitic protozoa. IRL Press, Oxford University Press, Oxford, UK.
  J. J. MARR & MIKLOS MULLER (eds.) (1995). Biochemistry and Molecular Biology of Parasites. Academic Press Inc., New York.

Additional

- J. C. BOOTHROYD & R. KOMUNIECKI (eds.) (1995). Molecular approaches to Parasitology: Modern approaches. Mbl lectures in Biology, Vol. 12. John Wiley & Sons, UK.
  M. WAHLGREN & P. PERLMANN (eds.) (1999). Malaria: molecular and clinical aspects. Harwood Academic Publishers, Amsterdam, The Netherlands.
  M.L. BLAXTER, M.E. SELKIRK, R. M. MAIZELS, B. D. ROBERTSON (1992). Parasite antigens, parasite genes: a laboratory manual for Molecular Parasitology. Cambridge University Press.
  CDC: http://www.dpd.cdc.gov/dpdx
  Genomas de parásitos: http://www.ebi.ac.uk/parasites/paratable.html

ADDENDUM COVID-19

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

English version is not available