COURSE DATA

Data Subject	
Code	46472
Name	Métodos en Virología
Cycle	Master's degree
ECTS Credits	4.5
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
2251 - Master¿s Degree in Virology	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
2251 - Master¿s Degree in Virology	6 - Métodos en Virología	Obligatory

Coordination

Name	Department
BRACHO LAPIEDRA, MARIA ALMA	194 - Genetics
CUEVAS TORRIJOS, JOSE MANUEL	194 - Genetics

SUMMARY

Methods in Virology is a subject included in the module "Methods and Applications". This is a mixed theoretical-practical subject, which will provide training on various methodologies used in virology laboratories, including techniques for the isolation, propagation, identification, quantification and general manipulation of viral agents, virus biotechnology, as well as bioinformatics techniques applied to the analysis of massive and quantitative data (sequencing, epidemiology, etc.). It includes classroom teaching, where the different existing methodologies will be reviewed, and practical experiments in the virology laboratories and computer rooms.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

No specific prior knowledge is required, beyond that necessary to access the Master's program.

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

2251 - Master¿s Degree in Virology

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- 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.
- To understand natural processes relevant to the field of specialization.
- To combine theoretical contents with their practical application and appreciate the importance of both fundamental and applied knowledge.
- To develop critical thinking, identifying the limits and biases of knowledge in the field of specialization.
- To explore and value the socio-economic implications of the field of specialization.
- Learn how to work in multidisciplinary teams constituted byspecialists with heterogeneous backgrounds.
- Place the specialty in the context of other fields and general knowledge.
- To apply fundamental virology concepts to practical problem solving, including antiviral therapy, prevention, public health, and the biotechnological applications of viruses.
- To master different methods in virology, their scope of application, their advantages and disadvantages and their complementarity for problem solving, both from a theoretical and practical point of view.
- To analyze scientific evidence in an objective, quantitative and rigorous way, through deductive and constructive reasoning.

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

To know the main methodologies used in the study of viruses and their control mechanisms.

To know the different techniques for virus isolation, propagation, identification, purification and quantitation.

To know the biosafety requirements associated with working with viral agents.

To experiment in the laboratory with different techniques used in the isolation, quantitation and propagation of viral agents.

To experiment in a practical way with bioinformatics tools for the analysis of viral sequences, as well as with the processing of viral sequences obtained by high-throughput techniques.

DESCRIPTION OF CONTENTS

1. Virus isolation, identification and quantitation

In vivo and environmental virus sampling. Infectivity assays for virus quantitation. Molecular techniques for virus quantitation. Serological techniques for virus identification and quantitation. Microscopic techniques for virus visualization. Flow virometry. Structural analysis.

2. Virus propagation and purification

Virus culturing techniques. Cell types for virus culture. In vivo infection systems. Virus growth dynamics. Gradient centrifugation. Filtration and flocculation.

3. Biosafety principles

Biosafety levels. GMO viruses.

4. Virus genetic handling

Reverse genetics and generation of infectious particles. Virus mutagenesis. Viral pseudotypes. Phage display. Virus-induced gene silencing (VIGS).

5. Viral bioinformatics

Virus sequencing. Genome assembly and virome inference from high-throughput sequencing data. Resequencing and variant calling. Phylogenomic analysis of viruses. Inference of evolutionary rates. Mathematical models of viral propagation and epidemiological models.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	21,00	100
Laboratory practices	16,00	100
Computer classroom practice	8,00	100
Study and independent work	45,00	0
Readings supplementary material	9,00	0
Preparation of evaluation activities	4,00	0
Preparation of practical classes and problem	9,00	0
TOTAL	**112,00**	

TEACHING METHODOLOGY

The course has a theoretical-practical nature, so the teaching methodology will be based on the use of different teaching activities that cover both aspects, as follows:

- **Lectures**, in which the teacher will explain the contents to be covered, promoting as far as possible an active participation of the students. The audiovisual materials used in the theoretical sessions will be made available in Aula Virtual prior to each session. It is especially important to provide students with complementary bibliographic material that may be useful to deepen in the contents taught. Likewise, an attempt will be made to relate the different contents, not only at the level of the subject, but in the Master's studies as a whole. In this sense, some of the contents covered in the theoretical sessions will be developed during the practical sessions.

- **Face-to-face review of contents and discussion led by the teaching staff**, which will function as group tutorials. This will serve for the follow-up and, if necessary, continuous evaluation of the students. Likewise, students will raise doubts and questions about the subject.

- **Practical classe**s, in which the student will face applied exercises related to different contents of the course. On one hand, it is intended that the student becomes familiar with work in a conventional laboratory, thanks to the use of various experimental techniques involving different virus models. For this purpose, the faculty will initially show a set of basic safety procedures used in a microbiology laboratory, after which these procedures will be applied to the handling of plant, animal, or bacterial viruses. On the other hand, practical classes will also be addressed through the use of bioinformatics procedures, which will allow the student to be introduced to the analysis of massive sequencing data for virome studies, as well as to the use of computer programs dedicated to the study of viral diversity and evolution. As supplementary material, students will be provided

with a manual detailing the different practical activities.

- **On-line tutorials**, for the resolution of doubts and specific problems, the raising of questions of interest and the debate on current scientific and social issues related to the subject.

- **Autonomous self-evaluation**, such as tests using Aula Virtual, which will allow the students to assess their own learning.

- **Autonomous study of materials and contents**, where students will review and, if necessary, expand the knowledge imparted by using the notes, presentations, relevant bibliography, etc.

- **Preparation of reports** on the practical sessions (individual or in teams).

EVALUATION

The evaluation of the theoretical contents will be carried out by means of a written test that will represent 40% of the final qualification. In order to pass the course, it will be necessary to obtain at least a score of 5 out of 10 in this exam.

Attendance to the practical sessions will be mandatory. The qualification of this section will represent 40% of the final qualification and it will be necessary to obtain at least a score of 5 out of 10 in this section to pass the course. The evaluation of the practical sessions will take into account the completion of the tasks requested by the teacher. In this sense, the active participation of the student will be valued, which includes raising doubts, proposing answers and participating in group discussions.

Continuous assessment of theoretical content, together with the completion of optional activities, will account for 20% of the final qualification. For this, different aspects that demonstrate interest in the subject will be assessed, such as attendance and participation in the development of the sessions and the completion of reports on recommended research articles.

REFERENCES

Basic

- Virology: Principles and Applications.2013. Carter J., Saunders, V. John Wiley & Sons. ISBN-10: 9781119991434

- Harnessing the Power of Viruses. 2017. Marintcheva B. Academic Press. ISBN-10: 0128105143.
- Virology Methods Manual. 1996. Edited by Brian WJ Mahy and Hillar O. https://doi.org/10.1016/B978-0-12-465330-6.X5000-3
- Virology. A laboratory manual. 1992. Florence G. Burleson, Thomas M. Chambers, Danny L. Wiedbrauk. Academic Press. ISBN: 0-12-144730-8
- Plant Virology. Methods and Protocols. 2022. Edited by Aiming Wang and Yi Li. Springer Nature. ISBN 978-1-0716-1834-9.

Additional

- Viruses: Molecular Biology, Host Interactions, and Applications to Biotechnology. 2018. Paula Tennant, Gustavo Fermin, Jerome E. Foster. ISBN: 9780128111949.
- Desk Encyclopedia of General Virology. 2010. Edited by Brian W J Mahy and Marc H. V. van Regenmortel. Elsevier Academic Press. ISBN: 978-0-12-375146-1
- Comparative plant virology. 2009. Roger Hull. Elsevier Academic Press. ISBN 13: 978-0-12-374154-7
- Diagnostic Virology Protocols. 1998. Edited by John R. Stephenson and Alan Warnes. Humana Press. ISBN 0-89603-401-1.
- Human retrovirus protocols. 2005. Edited by Humana Press. e-ISBN: 1-59259-907-9