VNIVERSITAT DE VALÈNCIA

Course Guide
43467 Detection and identification of microbial populations

COURSE DATA

DATA SUBJECT

Code: 43467
Name: Detection and identification of microbial populations
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology	Facultat de Ciències Biològiques	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology	Detection and identification of microbial populations	ELECTIVES

COORDINATION

RUIZ ARAHAL DAVID

SUMMARY

Detection and Identification of Microbial Populations is a theoretical course aimed at presenting to the student the importance of the study of microbial populations and the different methodological approaches that are feasible depending on the objectives set. The aim is to give an updated view of the wide range of techniques for the detection, identification and quantification of microorganisms, highlighting their advantages over other conventional techniques, without overlooking their limitations.
Its applications will also be presented in different fields of Applied Biology and professional orientations, without forgetting the necessary reinforcement in questions of taxonomy and classification, combining practical sense and scientific authority.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

COMPETENCES / LEARNING OUTCOMES

2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology

Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.

Be able to access to information tools in other areas of knowledge and use them properly.

Be able to make quick and effective decisions in professional or research practice.

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.

To acquire basic skills to develop laboratory work in biomedical research.

To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.

DESCRIPTION OF CONTENTS

1. Introduction

Concept of microbial identification, typing and detection. Cultivation-dependant and cultivation-independant methods: advantages and limitations.

2. Quantification of microorganisms

Advanced methods in microscopy: epifluorescence, FISH, viability kits. Methods based on growth and activity: bioluminiscence, electric impedance, metabolites and turbidity. Automatic inoculators. Automated systems to estimate microbial concentration (Bactometer, Malthus). Aplications.

3. PCR methods for detection of microorganisms

Conventional PCR. Specificity. Sensitivity and detection limit. Sample preparation for detection by PCR: removal of inhibitors. Automated amplification detection systems: DEIA, spectroscopy, capillary electrophoresis. Real-time PCR. Multiple-PCR.

4. Detection of microorganisms in natural populations

Detection of microorganisms in natural populations. Detection strategies. Methods for separation and concentration of microorganisms from samples. Cultivation methods. Immunological methods.

5. Genetic-molecular techniques for the study of populations in their natural habitat

Electrophoretic profiles. FISH, FISH coupled to flow cytometry. High-throughput sequencing.

6. Rapid methods for microbial identification

Miniaturized automated systems (API, Vitek, Cultek). Rapid moleculatr methods (PCR, DEIA, ELISA, FISH, FAME-GC, MALDI-TOF).

7. Genetic analysis methods for the identification of microorganisms

PCR, sequence analyses of rRNA genes and housekeeping genes. Restriction analysis. Automated identification systems.

8. Intraspecific differentiation of microorganisms

Molecular methods based on electrophioretic profiles: RAPD, AFLP, Restriction of PCR amplified fragments (Sau-PCR), Polimorfism of amplified repetitive elements (REP, ERIC, BOX, Microsatelites), Macrorestriction, Multiplex-PCR, Multilocus Sequence Typing (MLST)

9. Computer analysis of data. Databasing and on-line resources.

Bioinformatic analysis to study population dinamics, epidemiologic studies, taxonomic studyies. Databases. On-line resources.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	26,00
Other activities	4,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	15,00
Preparation of lessons	10,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**45,00**

TEACHING METHODOLOGY

Lectures: Based on expository teaching/lectures and case-study analysis to develop the course contents.

Computer laboratory sessions: Four hours of computer-based practical training are included to provide experience in the use of bioinformatics tools and resources for molecular identification.

Individual tutorials: Intended to support and guide students in addressing any difficulties that may arise during non-contact learning activities and independent study.

EVALUATION

The knowledge acquired from the theoretical syllabus will be assessed through a written examination, which will account for 70% of the final grade. The remaining 30% will be based on continuous assessment, primarily considering the student's performance during the computer laboratory session, participation in tutorials, and engagement in theoretical classes.

To pass the course, students must obtain an overall score of at least 5 out of 10. In addition, a minimum score of 4 out of 10 in the written examination is required for the continuous assessment mark to be included in the final grade calculation.

REFERENCES

Colwell, R. R.; Grimes, D. J. (2012). *Nonculturable Microorganisms in the Environment*. Chapman & Hall.

Goodfellow, M.; Sutcliffe, I.; Chun, J. (2014). *New Approaches to Prokarytic Systematics.* Elsevier.

Jiao, J.-Y.; Narsing Rao, M. P.; Salam N., Li W.-J. (2024). *Modern Taxonomy of Bacteria and Archaea: New Methods, Technology and Advances*. Springer Nature Singapore.

Liu, D. (2011). *Molecular Detection of Human Bacterial Pathogens*. CRC Press.

Luna Fontalvo, J. (2020). *Métodos analîticos de microbiologîa general y aplicada*. Universidad del Magdalena.

Luna Pabello, V. M. (2023). *Manual de Prácticas Avanzadas para el Estudio de la Microbiología Ambiental de Agua y Suelo*. (1st ed.). Universidad Nacional Autónoma de Mexico, Instituto de Investigaciones sobre la Universidad y la Educación.

Munn, C. (2011). *Marine Microbiology*. Taylor & Francis Group.

Ogwu, M. C.; Izah, S. C. (2025). *Detection, Identification, and Monitoring of Food Contaminants*. IGI Global Scientific Publishing.

Rainey, F.; Oren, A. (2011). *Taxonomy of Prokaryotes*. Elsevier Science.

Suar, M.; Singh P. K.; Misra, N. (2024). *Evolving Landscape of Molecular Diagnostics. Applications and Techniques*. Elsevier

Thompson, K. C.; D'Agostino, M.; Cook, N. (2015). *Molecular Microbial Diagnostic Methods: Pathways to Implementation for the Food and Water Industries*. Elsevier Science.

Towner, K. J.; Cockayne, A. (2013). *Molecular Methods for Microbial Identification and Typing*. Springer Science & Business Media.
:12.0pt;line-height:200%;">Springer Science & Business Media.