Universidad de Navarra

General Microbiology (F. Ciencias)

Guía docente 2024-25

PRESENTATION

Welcome to the exciting world of microbiology! This course will provide you with a comprehensive understanding of the fundamental principles and concepts of microbiology. We will explore the origins and development of microbiology, delve into the microscopic world, and investigate the structure, genetics, physiology, and diversity of non-eukaryotic microorganisms. Additionally, we will explore microbial ecology, pathogenesis, and applications in various industries.

Join us on this journey to explore the fascinating world of microbiology and its applications in various fields. Get ready to unlock the secrets of the microbial world!

- **Degrees:** Biochemistry, Biology and Environmental Sciences
- **ECTS**: 6
- **Year**: Third
- **Semester**: First
- **Type of course**: Mandatory (all Degrees)
- **Lecture sessions:**
  - Instructor: Prof. Tomás Maira-Litrán (tmairalitra@unav.es)
  - Language: English
  - Room: 35
- **Laboratory sessions:**
  - Instructors:
    - Prof. Tomas Maira-Litrán
    - Prof. Ignacio López (ilgoni@unav.es
    - Prof. Maite Iriarte (miriart@unav.es)
    - Prof. David Gonzalez (dgonzalez@unav.es)
  - Language: Spanish
  - Room: -1 floor of the Science library building
- **Lecture schedule**
  - September 2nd 2024-November 28th 2024
  - Monday 10-11 am, Tuesday 10-11 am, Thursday 8-9 am

LEARNING OUTCOMES (COMPETENCIES)

Degree in Biology:

Specific competences

- CE2: To plan, to develop and to discuss critically experiments and to use techniques and instruments of experimentation in biology.
- CE6: To permanently update knowledge and integrate new discoveries in context
- CE13: To know the origin of life and the foundations of biological evolution. To know the genetic basis of biodiversity. To understand the structural and functional characteristics of major groups of organisms and the principles and techniques of taxonomy

General and basic competences

- CG2. Think and approach problems in an integrated manner, from different perspectives. To develop a critical thinking. To provide solutions to problems in science.
- CG3: To develop team-working capacities, to be able to select and to choose the appropriate methodologies and distribution of functions. To listen and to speak with positive and constructive interventions.
- CB2: To apply knowledge to their work or ability in a professional manner and to have competences typically demonstrated through the development and explanation of points of view and solving problems within their field of study.
- CB3: To have the ability to collect and interpret relevant data (usually within their field of study) to make judgments that include consideration on relevant social, scientific or ethical.

Degree in Biochemistry:

Specific competences

- CE1: To formulate and to solve qualitative and quantitative problems in Biochemistry through scientific hypotheses based on knowledge and theories available that can be demonstrated empirically.
- CE2: Safely apply experimental techniques and instruments in Biochemistry, Biology and Molecular Biology
- CE5: To understand, critically analyze, discuss, write and present scientific arguments, both in “Castellano” and English as the language of reference in science.
- CE7: To understand the differences between the major types of living organisms, from microorganisms to higher organism. To understand the structure and function of prokaryotic and eukaryotic and cells, tissues, and organs in animals and humans. To understand the organization, dynamics and expression of genes and genomes, the laws of inheritance and the sources of genetic variation

General and basic competences

- CG1: To plan and to organize time, to manage continuous training updating the knowledge in the last scientific discoveries and technological innovations and to analyze future trends.
- CG3: To develop team-working capacities, to be able to select and to choose the appropriate methodologies and distribution of functions. To listen and to speak with positive and constructive interventions.
- CG6: To know how to work properly and safely in a laboratory with chemical and biological material, including the proper handling and disposal of waste, annotation of activities and interpretation of results
- CB1: To demonstrate knowledge and understanding in a particular field of study whose starting point is the general secondary education and includes aspects in the frontiers of knowledge, with the support of advanced textbooks.
- CB2: To apply knowledge to their work or ability in a professional manner and to have competences typically demonstrated through the development and explanation of points of view and solving problems within their field of study.
- CB4: To be able to communicate information, ideas and answer questions to specialist and non-specialist audiences.

Degreee in Environmental Sciences:

Specific competences

- CE17:To know the molecular and cellular structure of living beings.

General and basic competences

- CB2**:**To apply knowledge to their work or ability in a professional manner and to have competences typically demonstrated through the development and explanation of points of view and solving problems within their field of study.

PROGRAM

I. Classroom Sessions

Introduction to Microbiology

Class 1-The origin and development of microbiology

General methods in Microbiology

Class 2-Microscopy

Class 3-Microbial nutrition and culture

Class 4-Physical and chemical control of microorganisms

Structure and Genetics of Non-eukaryotic Microorganisms

Class 5-Prokariotic cell structure and function

Class 6-Archea and endospores

Class 7-Inside the cell

Class 8-Outside the cell

Class 9-Basic virology-I

Class 10-Basic virology-II

Class 11-Basic virology-III

Class 12-Microbial genetics-I

Class 13-Microbial genetics-II

Physiology and Metabolism of Non-eukaryotic Microorganisms

Class 14-Introduction to microbial metabolism-I

Class 15-Introduction to microbial metabolism-II

Class 16-Chemoorganotrophs-respiration and fermentation-I

Class 17-Chemoorganotrophs-respiration and fermentation-II

Class 18-Chemolithotrophs

Class 19-Phototrophs

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Class 20-Microbial growth-I

Class 21-Microbial growth-II

Class 22-Antibiotics and chemotherapeutic agents-I

Class 23-Antibiotics and chemotherapeutic agents-II

Microbial Diversity

Class 24-The Archaea

Class 25-Chemotrophic Gram-negative Bacteria

Class 26-Chemotrophic Gram-positive Bacteria

Class 27-Phototrophic Bacteria

Class 28-An overview of eukaryotic microorganisms

Microbial Ecology and Human Microbiota

Class 29-Microbial interactions

Class 30-Human microbiota

Microbial Pathogenesis and Infectious Diseases

Class 31-Host immunity to microbes

Class 32-Microbial pathogenesis-I

Class 33-Microbial pathogenesis-II

Class 34-Microbial pathogenesis III

Applied Microbiology

Class 35-Food microbiology

Class 36-Epidemiology diagnosis and immunoprophylaxis

Class 37-Industrial microbiology

II. Laboratory sessions

General instructions

- Safety: general rules; fires; personal protection; biosafety cabinets
- Equipment: microscope; autoclave & oven; incubators and water-baths
- Waste disposal

Culture media

- Preparation: main components
- Solid (agar) and liquid (broth) media
- General, enrichment, selective and differential media

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The manipulation of microorganisms

- Basic aseptic methods for sampling and handling microorganisms
- Growth of bacteria in agar and broth
- Pure culture: the streak plate and the serial dilution techniques

Ubiquity of microorganisms

Observing microorganisms under the light microscope

- Review of use of the light microscope
  - Magnification, contrast, light intensity and condenser
  - Oil-immersion lenses
- Wet mounts
  - Preparation of smears
- Staining
  - Simple staining
  - Gram-staining
  - Endospore staining
  - Negative staining
- Size, shape and cell arrangements
  - Bacteria
  - Yeasts and other eukaryotic microorganisms

Bacterial counting by serial dilutions

- Serial dilution technique
- Colony forming units counting (calculation of CFU/ml).

Physical factors and bacterial control

- Observing the bactericidal effect of ultraviolet light

Fundamentals of bacterial identification

- Isolation and growth of enteric bacteria and Gram-positive cocci on differential and selective media (blood agar, mannitol-agar, MacConkey agar (MAC))
- Biochemical tests: analytical profile index (API) test strip, catalase and cytochrome-c oxidase tests

Antibiotic susceptibility

• Performing an antibiogram and understanding how to interpret it

EDUCATIONAL ACTIVITIES

The course will consist of :

I. Lecture sessions-Classroom lectures (Room 35; Science library building)

II. Laboratory sessions. (Microbiology laboratory, -1 floor of the Science library building)

I. Classroom Activities: Lectures

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Classes start on **MONDAY, September 2, 2024**.

Lectures are conducted by the professor and cover topics outlined in the syllabus. These lectures make use of various teaching aids, including the blackboard, PowerPoint presentations, and videos.

The professor will upload the presentations for each topic on ADI.

For each chapter, specific learning objectives will be provided, along with questions, exercises, or activities for students to complete independently.

During the classroom activities, the most significant aspects of each topic will be explained, and any questions or doubts will be addressed.

The lectures are organized into modules based on the concepts being discussed.

Please note that lectures will not be recorded.

In cases where students are unable to attend classroom lectures due to justified and exceptional reasons they should promptly contact the coordinator and the professor via email. These students will be provided with personal tutorials to ensure they receive the necessary support.

II: Laboratory work

The practical sessions will be conducted according to the schedule detailed below.

Students will also have access to laboratory protocols outlining the main objectives and activities for each session. Prior to each lab session, students are required to review and understand the lab videos available on ADI. These videos provide clear instructions for what students should do once they are in the laboratory, enabling them to begin work promptly upon arrival.

During the experiments, students will be supervised by laboratory instructors. They will record their results and draw conclusions, documenting their work in a laboratory manual.

Students will be assessed throughout the various laboratory sessions. Additionally, there will be a lab session exam on Tuesday, November 5th, during class hours (10-11 a.m.), which accounts for 20% of the final course grade. If a student scores below 5, they are not required to retake the lab session exam.

Attendance at laboratory sessions is mandatory. If a student cannot attend, they must promptly inform the instructor of the situation.

There will be three practice groups that will coordinate with the rest of the subjects. The laboratory session will be in the afternoon from 4:00 pm to 7:00 pm.

Group 1: September 24, 26, 27 and 30 and October 1, 2, 3 and 4.

Group 2: October 8, 9, 10, 14, 15, 16, 17 and 18.

Group 3: October 21, 22, 23, 24, 25, 29, 30 and 31.

ASSESSMENT

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The final grade will be calculated as follows:

Final exam: 80% of the final grade

Laboratory sessions evaluation: 20% of the final grade

Exam questions will be drawn from lectures, class discussions, and laboratory exercises.

The final exam will consist of multiple-choice questions (MCQs), each with four potential answer options, of which only one is correct. Correct answers will be scored as +1, while incorrect answers will incur a deduction of -0.25 points

Important: in order to pass the course, a minimum grade of 4 points is required in the final exam.

Make-up exams

Students not passing the examination are granted a second opportunity after the second semester.

The final grade of the exam will be calculated as follows: make-up exam (80%) + lab sessions exam (20%)

Students with special learning needs

Accommodation will be provided for students with special learning needs, either regarding the methodology and/or evaluation of the course, but they will be expected to fulfill all course objectives.

Grades will be assigned as follows:

10-9.0: SB

8.9-7.0: NT

5.0-6.9: AP

0-4.9: SS

Students who achieve a final grade of 9 or above and provide strong answers to the questions on both the final exam and the lab sessions exam will be eligible for honors.

Students who do not take the final exam or the lab session exam will not pass the course and will be graded as “absent”.

After the grades are published, students will have the opportunity to review their exams during a scheduled session with the professor. The date and location for this review will be announced in advance.

OFFICE HOURS

To be scheduled via email with Prof. Tomas Maira-Litrán: tmairalitra@unav.es

BIBLIOGRAPHY AND RESOURCES

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CLASSROOM SESSIONS

1. Madigan, M. T., Martinko, J. M., Dunlap, P. V. y Clark, D. P. Brock Biology of Microorganisms. 16ª edición. 2022 Find it in the Library (e-book) and Find it in the Library (2019)

2. Willey, Sherwood, Woolverton. Prescott's Microbiology. 10º edition 2017. McGraw-Hill International Edition. Find it in the Library (2017), Find it in the Library (2014), Find it in the Library (2011)

3. Patrick R. Murray, Ken Rosenthal, Michael A. Pfaller. Medical Microbiology 9th Edition, 2020. Find it in the Library (e-book)

In both cases you can access without a key name ("acceso sin registro").

LABORATORY SESSIONS

1. Gamazo, C., López-Goñi, I. y Díaz, R. Manual práctico de Microbiología. 3ª edición. Elsevier-Masson, S.A.. Barcelona, 2005. Find it in the Library

Complementary

P. de Kruiff. Los cazadores de microbios. 5ª edición. Aguilar, Madrid, 2010. Find it in the Library