COASTAL AND MARINE BIOLOGY AND ECOLOGY (LM51R)

(Lecce - Università degli Studi)

Teaching ENVIRONMENTAL MICROBIOLOGY

GenCod A002336

Owner professor Pietro ALIFANO

Teaching in italian ENVIRONMENTAL MICROBIOLOGY

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SSD code BIO/19

Reference course COASTAL AND MARINE BIOLOGY AND ECOLOGY

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 48.0

For enrolled in 2025/2026

Taught in 2025/2026

Course year 1

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

Microbial evolution and systematics.
Prokaryotic diversity: the Bacteria.
Prokaryotic diversity: the Archaea.
Metabolic diversity.
Methods in microbial ecology.
Microbial ecology.

REQUIREMENTS

No formal propedeuticity is required with respect to other courses. However basic knowledge of general microbiology is strongly recommended.

COURSE AIMS

Course outline and aims

This course aims at providing students with an in-depth knowledge of the current view of microbial evolution and systematic, and the continuing roles played by microbes in the environment. Major methodological approaches to environmental microbiology including their powers and limitations will be also discussed.

Learning outcomes

Knowledge to be attained:

- Current views on the origin of life and the evolution of the major microbial taxa
- Current views on metabolic diversity in microbial world
- Special bacteriology: major Bacteria and Archaea taxa
- Microbial ecology: Key roles played by microbes in the aquatic and terrestrial environment including soil structure, element cycles, genesis and breakdown of fossil fuels and contribution to geological processes
- Microbial ecology: Detrimental roles played by microbes in pollution and the beneficial roles played by microbes in wastewater treatment and bioremediation
- Microbial ecology: interactions of microorganisms with other organisms.
- Methods in microbial ecology

Abilities to be attained:

- Culture-based and culture-independent methods in microbial systematic and ecology
- Methods to study microbial phylogeny
- Construction of phylogenetic trees

TEACHING METHODOLOGY

Learning methods consist of formal lectures and integrative lectures making use of slides and hypertext links to specific Web sites. Outside these activities, the students are expected to read assigned papers from the scientific literature.

ASSESSMENT TYPE

Oral examination. It is aimed at ascertaining, in proportion:

- The level of theoretical knowledge through the presentation of the program topics (50%)
- The level of practical abilities through description of methods and methodologies (25%)
- The ability to apply theoretical knowledge and practical skills to solve simple problems (25%)

FULL SYLLABUS

Program of Lectures

Microbial evolution and systematics. Early Earth and the origin and diversification of life; formation and early history of Earth; origin of cellular life; microbial diversification; endosymbiotic origin of eukaryotes. Microbial evolution; the evolutionary process; evolutionary analysis: theoretical aspects and analytical methods.; microbial phylogeny; applications of SSU rRNA phylogenetic methods. Microbial systematics; phenotypic analysis; genotypic analysis; phylogenetic analysis; the species concept in microbiology; classification and nomenclature.

Prokaryotic diversity: the Bacteria. Bacterial phylogenesis. Phylum 1: Proteobacteria; Phylum 2 and 3: Gram-positive bacteria and Actinobacteria. Phylum 4: Cyanobacteria and Prochlorophytes; Phylum 5: Chlamydia; Phylum 6: Planctomyces/Pirellula; Phylum 7: Verrucomicrobia; Phylum 8: Flavobacteria; Phylum 9: the Cytophaga group; Phylum 10: Green-sulphur bacteria; Phylum 11: Spirochetes; Phylum 12: Deinococci; Phylum 13: Green non-sulphur bacteria; Phylum 14-16: deeply branching hypertermophilic bacteria; Phylum 17 and 18: Nitrospira and Deferribacter.

Prokaryotic diversity: the Archaea. Phylogeny and general metabolism. Phylum euryarchaeota; Phylum Crenarchaeota; Phylum Nanoarchaeota; Evolution and life at high temperature.

Metabolic diversity. The phototrophic way of life; chemolithotrophy: energy from the oxidation of inorganic electron donors; the anaerobic way of life: anaerobic respirations; the anaerobic way of life: fermentations and syntrophy; hydrocarbon oxidation and the role of O2 in the catabolism of organic compounds; nitrogen fixation.

Methods in microbial ecology. Culture-dependent analyses of microbial communities; molecular (culture-independent) analyses of microbial communities; measuring microbial activities in Nature.

Microbial ecology. Microbial ecosystems; soil and freshwater microbial habitats; marine microbiology; the carbon and oxygen cycles; other key nutrient cycles; microbial bioremediation; microbial interactions with plants.

REFERENCE TEXT BOOKS

- M. T. Madigan, K. S. Bender, D.H. Buckley, W. M. Sattley, D. A. Stahl. Brock Biology of Microorganisms, Global Edition. 16th Edition. 2021. Pearson. Print-ISBN: 978-1-292-40479-0; E-ISBN: 978-1-292-40506-3
- I. L. Pepper, C. P. Gerba, T. J. Gentry. Environmental Microbiology. 3rd Edition. 2015. Elsevier. ISBN: 978-0-12-394626-3.
- I. L. Pepper, C. P. Gerba. Environmental Microbiology: A laboratory manual. 2nd Edition. 2004. Elsevier. ISBN: 9780125506564
  eBook ISBN: 9780080470511
- W. F. Martin, K. Kleinermanns. The Geochemical Origin of Microbes. 2024. CRC Press. Taylor & Francis Group. ISBN 10: 1032457678 ISBN 13: 9781032457673