

SYLLABUS DEL CORSO

Marine Environmental Microbiology

2223-1-F7502Q035

Aims

The course aims at providing in-depth knowledge on microbial communities in marine environments, on their ecology and their functions.

1. Knowledge and understanding. At the end of the course the student must know: the methods for characterization of microbial communities; the principles at the basis of microbial taxonomy and related problems; the main microbial taxa inhabiting the marine habitats; the impact of microbial metabolism on geochemistry of marine environments; the environmental issues in oceans involving microbial activities.
2. Applying knowledge and understanding. At the end of the course the student must be able to apply the knowledge acquired during the course demonstrating his/her ability to evaluate the impact of perturbations (e.g., human impact, climate change) on marine microbial metabolisms and its possible consequences.
3. Making judgments. The student must be able to critically read scientific papers about marine microbiology.
4. Communication skills. At the end of the course the student will be able to describe appropriately the topics studied using the correct specific vocabulary.
5. Learning skills. At the end of the course the student will be able to consult the literature on the topics covered and autonomously integrate the knowledge acquired with other sources related to marine sciences, with a multidisciplinary approach.

Contents

1. Methods for the characterization of microbial communities in marine environments. 2. Taxonomic diversity of marine microorganisms. 3. Role of microorganisms in marine biogeochemical cycles and climate change impact on microbial activities. 4. Microbial marine habitats. 5. Marine viruses. 6. Microbial aspects of environmental issues in marine environments. 7. Bioinformatics practical

Detailed program

1. Methods for the characterization of microbial communities in marine environments.
Cultivation techniques, isolation and identification of microbial strains. Microbial taxonomy. Culturability issues. Microscopy methods. Molecular techniques for community characterization. Evaluation methods of in situ microbial activity. "Omics" methods.
2. Taxonomic diversity of marine microorganisms.
Main marine taxa of domains Bacteria and Archaea and their functions. The universal tree of life. The unknown diversity in oceans.
3. Role of microorganisms in marine biogeochemical cycles and climate change impact on microbial activities.
Biological carbon cycle in oceans: phototrophy/chemotrophy; autotrophy/heterotrophy; methane cycle. The biological cycles of nitrogen, phosphorus, sulfur, iron and minor elements in oceans. The impact of climate change on microbiological marine activities.
4. Microbial marine habitats.
Coastal environments. Open ocean. Cold seeps. Hydrothermal vents. Living macroorganisms as microbial habitats.
5. Marine viruses.
Diversity and functions of marine virome.
6. Microbial aspects of environmental issues in marine environments.
Remediation of oil spills: aerobic and anaerobic biodegradation of aliphatic and aromatic hydrocarbons. Biological treatment of contaminated sediments.
7. Bioinformatics practical.
Bioinformatics analysis of metagenomic data for microbial community characterization.

Prerequisites

Basics of Microbiology and/or Cell Biology

Teaching form

Lectures supported by PowerPoint presentations (5 CFU; 35 h). Bioinformatics practical (1 CFU: 12 h). Teaching material will be made available to students through e-learning.

Textbook and teaching resource

Slides are available at the e-learning page of the course.

Reference books:

1. Brock - Biology of Microorganisms (Brock, Madigan and Martinko), Pearson (available at the Library both in English and in Italian).
2. Microbial ecology of the oceans (Gasol and Kirchman), Wiley Blackwell.
3. Marine microbiology: ecology and applications (Munn), CRC Press.
However, since there is no proper textbook covering all the program contents, attending the course is highly recommended.

Scientific papers provided by the lecturer (case studies, supplementary study).

Semester

Second semester

Assessment method

REPORT ON BIOINFORMATICS PRACTICAL: to be handed in before oral examination. This report will allow testing the acquired bioinformatics competencies applied to environmental microbiology. It constitutes 20% of the final mark.

ORAL EXAMINATION ON TOPICS COVERED IN CLASS: 3 general questions on the topics covered during the lectures. The students must demonstrate to be able to clearly expose the acquired knowledge, demonstrating their complete understanding and language properties. It constitutes 80% of the final mark.

Optionally, it is possible to choose a topic of interest and study it in more detail through one of the available papers. In this case, one of the three questions will be replaced by the selected topic.

Office hours

By appointment (e-mail: isabella.gandolfi@unimib.it)

Sustainable Development Goals

CLIMATE ACTION | LIFE BELOW WATER
