UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Industrial Microbiology

2324-2-E0201Q069

Aims

Microbiology is one of the most versatile, cutting-edge, applicable fields of study in Biology. Microbiology is present in all aspects of everyday life. Think of the daily news stories on vaccines, diseases, remediation, biotechnology, food production and safety, etc.: all represent a field of microbiology. Microorganisms are everywhere. They are essential to our well-being as individuals, maintain the balance of chemicals and living organisms in the global environment, and they help to recycle chemical elements in the land and water. On the other hand, some can be nasty pathogens for humans as well as for other organisms. Microorganisms (in the context of this course) are minute living things that are individually too small to be seen with the naked eye. The term includes bacteria, archea, microscopic fungi (yeasts and molds), protozoans, microscopic algae. Despite not considered as living forms, also viruses are included as part of the microbial world. The course aims to provide students with the basic knowledge necessary to undertake fundamental and applied studies in microbiology.

Knowledge and understanding
The student will gain knowledge and the principles of microbiology, spanning from fundamental to diverse applied field of studies, learning how microbes have a fundamental role on our living planet.

Applying knowledge and understanding
The student will be able to apply the acquired knowledge to evaluate all the potential of the microbial world

Making judgements
The contents will provide the basis for thinking critically about issues in microbiology.

Communication skills
Use of an appropriate scientific/chemical vocabulary and ability in oral reports

Learning skills
Subjects learned previously in Themes of Biology will be applied to the microbial world, as will those learned in General and Organic Chemistry and Biochemistry, when discussing the makeup and energy usage of microorganisms.

Contents

The course shed lights on the basic knowledge necessary to understand the basis of microbial biodiversity (with a specific attention to peculiar and unique cellular structures), as well as the diverse metabolisms that sustain our living planet. Moreover, attention will be given to the understanding of the abundance and diversity of microbial life on Earth, its role of microorganisms in our everyday lives. The theme of microbial communities and symbiosis will be also introduced, with a section dedicated to the mechanisms of microbial pathogenicity.
The following topics will be addressed:
1. The history of Microbiology.
2. Microbial evolution.
3. Microbial physiology.
4. Microbial metabolism.
5. Genetics of microorganisms.
6. Symbiosis.
7. Antibiotics and quorum sensing.
8. Biogeochemical cycles.
9. Microbial pathogenicity.
10. Virology.

Detailed program

1. The history of Microbiology. Brief historical excursus on the main events and on the prestigious scientists that made Microbiology a recognized discipline in life science.
2. Microbial evolution. The origin of life on Earth: from ancient to modern theories and the most recent versions and descriptions of the tree of life.
3. Microbial physiology. Principles of growth and nutrition. Microbial structures and functions (Bacteria, Archaea, unicellular Eukarya).
4. Microbial metabolism. Catabolisms and unique pathways for the assimilation and organication of the essential elements for life will be presented.
5. Genetics of microorganisms. Mechanisms of horizontal gene transfer, examples of two-component systems.
6. Symbiosis. Principles and detailed examples of different forms of symbiosis.
7. Antibiotics and quorum sensing.
8. Biogeochemical cycles. General principles and specific description for the Carbon and Nitrogen cycle
9. Microbial pathogenicity. General principles, endo- and exotoxins
10. Virology. Basis of virology and general morpho- physiological descriptions, including the relation with the hosts

Prerequisites

Background: General Chemistry; Organic Chemistry; Biochemistry
Specific prerequisites: Biochemistry
General prerequisites: Students can take the exams of the second year after passing the examinations of Introductory Biology, General and Inorganic Chemistry, Mathematics, and Foreign Language.

Teaching form

Classroom lessons supported by PowerPoint presentation and scientific videos. In addition, the lecturer will perform some exercises together with the students to assess the understanding of couse issues.
Teaching language: italian.

Textbook and teaching resource

Learning material (slides, suggested web sites, and scientific article) is available at the e-learning platform of the course.

Recommended textbooks:
- Brock – Biologia dei Microrganismi (Madigan, Martinko, Stahl, Clark – Casa Editrice PEARSON);
- Biologia dei Microrganismi (Dehò-Galli – Casa Editrice Ambrosiana);
- Microbiologia (Prescott, Harley, Klein – Casa Editrice McGRAW-HILL);
- Microbiologia (Wessner, Dupont, Charles– Casa Editrice Ambrosiana)

Semester

Second semester

Assessment method

Written + oral examination.
Written examination: 1.5 hours, 1 wide question (on microbial metabolism) and two specific questions.
Oral examination: discussion about the weaknesses identified during the written examination and a possible additional question on a different topic.

Office hours

Contact: on demand, upon request by mail to lecturer, or during the course.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | CLEAN WATER AND SANITATION | AFFORDABLE AND CLEAN ENERGY | INDUSTRY, INNOVATION AND INFRASTRUCTURE | SUSTAINABLE CITIES AND COMMUNITIES | CLIMATE ACTION | LIFE BELOW WATER | LIFE ON LAND