UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

One Health Laboratory: From Environment To Health

2627-1-F0602Q110

Aims

Knowledge and Understanding: The course aims to provide an integrated understanding of human health and well-being in relation to the environment, based on the principles of Planetary Health and the One Health approach. Students will acquire knowledge of the main biological, ecological, nutritional, and environmental factors influencing human health, with particular emphasis on disease prevention, the maintenance of homeostasis, and the strengthening of the body's defense mechanisms. The course will explore the relationships between biodiversity, food, nutrition, and health, highlighting the role of balanced and sustainable dietary patterns in promoting physical and mental well-being and preventing chronic and multifactorial diseases. In addition, students will gain an understanding of the biological and molecular mechanisms underlying these interactions, with particular focus on the effects of naturally occurring bioactive compounds and secondary metabolites on human physiology.

Applying Knowledge and Understanding:The course will enable students to apply the acquired knowledge through laboratory activities and fieldwork conducted in ecosystems characterized by different levels of biodiversity and environmental quality. Students will develop the ability to interpret the relationships between human health, environmental quality, biodiversity, and ecosystem services, understanding how natural resources provide functional foods, bioactive compounds, and substances of nutraceutical and pharmaceutical interest. Particular emphasis will be placed on the role of nutrition in primary disease prevention, the importance of sustainable dietary patterns, and the use of natural foods and bioactive compounds to maintain physiological homeostasis, support immune function, reduce oxidative stress and inflammation, and promote healthy ageing.

Making Judgements

By the end of the course, students will be able to critically evaluate the principles of Planetary Health and the One Health approach by assessing the relationships among health, nutrition, the environment, and biodiversity. They will be able to develop and propose strategies for disease prevention and health promotion that integrate nutritional, environmental, and ecological perspectives, fostering sustainable lifestyles and the conservation of ecosystems.

Communication Skills: Students will acquire the ability to communicate clearly and effectively, using appropriate

scientific terminology, the concepts underlying the interactions among the environment, biodiversity, nutrition, and human health. They will also be able to present and discuss scientific data and experimental findings concerning the effects of diet, natural bioactive compounds, and environmental quality on human well-being, adapting their communication to different scientific and professional contexts.

Learning Skills:By the end of the course, students will have developed a multidisciplinary and systems-based approach to the study of health, nutrition, and the environment. They will be able to independently deepen their knowledge through the critical evaluation of the scientific literature, interpret complex data, integrate concepts from the biological, nutritional, and environmental sciences, and engage effectively with experts from different disciplines to address challenges related to disease prevention, sustainability, and health promotion.

Contents

The course is structured into three modules, each worth 2 ECTS credits, designed to integrate fieldwork, laboratory activities, and experimental applications within the framework of Planetary Health and the One Health approach.
The first module, conducted entirely through field-based activities, focuses on the relationships between biodiversity, environmental quality, and human health. Students will investigate ecosystems characterized by different degrees of naturalness and anthropogenic pressure, comparing environments with high ecological integrity (e.g., protected areas, coastal ecosystems, and marine environments) with ecosystems that have been more extensively modified by human activities (such as urban and peri-urban areas). The aim is to understand how environmental changes and anthropogenic stressors affect ecosystem functioning, ecosystem services, and, consequently, human health and well-being.
The second module is dedicated to the study of bioactive compounds derived from biodiversity, with particular emphasis on naturally occurring secondary metabolites and their role in nutrition, nutraceuticals, and disease prevention. Students will also examine the major environmental and food contaminants, evaluating their effects on human health and their potential interactions with biological and metabolic processes.
The third module consists of experimental laboratory activities aimed at evaluating the biological effects of natural compounds and biodiversity-derived resources on human health. Through biochemical, cellular, and metabolomic analyses, students will investigate the mechanisms underlying antioxidant, anti-inflammatory, and neuroprotective responses, exploring the potential application of natural bioactive compounds in the prevention of chronic diseases and in the promotion of health, well-being, and healthy ageing.

Detailed program

The laboratory course is organized into three closely integrated modules, designed to guide students through a multidisciplinary pathway linking biodiversity, the environment, nutrition, and human health, in accordance with the principles of Planetary Health and the One Health approach.

The first module consists of field-based practical activities aimed at investigating ecosystems characterized by different levels of ecological complexity and anthropogenic pressure, with the objective of understanding the major environmental risk factors affecting both human health and the health of other living organisms. Activities will take place in natural settings, including protected areas, parks, coastal and marine ecosystems, as well as in urban, peri-urban, and agricultural environments, to examine the relationships among biodiversity, environmental quality, and human well-being. The program includes a multi-day field excursion complemented by visits to additional natural and human-modified ecosystems. During these activities, students will assess major environmental stressors, including climate change (increasing temperatures, drought, and water scarcity), biodiversity loss, the spread of invasive alien species, allergenic organisms, and emerging pathogens. This module will provide students with the knowledge and practical skills needed to interpret the interactions among ecosystems, ecosystem services, and human health.

The second module focuses on the study of biological resources as sources of bioactive compounds with nutritional, nutraceutical, and pharmaceutical potential. Using approaches from nutritional chemistry and advanced analytical techniques, students will investigate naturally occurring secondary metabolites, their biological properties, and their interactions with living systems. The module will also address the analysis of major environmental and food contaminants that may compromise ecosystem quality and adversely affect human health. Laboratory activities will include the sustainable extraction and characterization of bioactive compounds from biological samples collected during the field activities (e.g., leaves, fruits, seeds, and other plant tissues).
The third module is devoted to the experimental evaluation of the biological effects of natural compounds through laboratory-based activities. Students will investigate the cellular and molecular mechanisms involved in disease prevention and host defense, with particular emphasis on antioxidant and anti-inflammatory responses, cellular ageing, and toxicity associated with protein aggregation, which is closely linked to the development of major neurodegenerative diseases. Through biochemical, cellular, and metabolic assays, students will acquire practical laboratory skills to evaluate the potential of natural bioactive compounds in promoting health, preventing chronic diseases, and supporting healthy ageing.

Prerequisites

Basic knowledge of biology (botany, ecological) and biochemistry

Teaching form

Lessons in the field and in the laboratory.

Textbook and teaching resource

The lesson slides and the material provided in the field will be made available on the e-learning platform.

Semester

Second semester

Assessment method

The oral exam aims to verify the student's acquisition of the technical and scientific concepts treated during the course and will consist of oral questions aimed at ascertaining the understanding of the theoretical arguments and of the experiments carried out in the field and laboratory.
During the exam, the ability to contextualize the topics, the critical ability and the ability to propose appropriate solutions to different contexts and problems will also be assessed.
Evaluation Criteria: scientific and technical knowledge on the issues of biodiversity, ecosystems, one health, critical and individual re-elaboration skills, communication skills and correct use of technical language.

Office hours

By appointment by writing to the reference teachers.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | SUSTAINABLE CITIES AND COMMUNITIES | CLIMATE ACTION | LIFE ON LAND