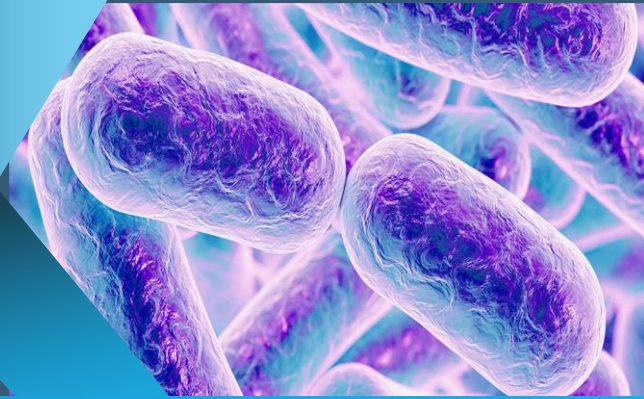


BIOTECHNOLOGY & MICROBIOLOGY

LEARNING PROGRAMME



Course applicability

Students holding a M.Sc. degree in Biological, Medical, and Agricultural Sciences or other related disciplines.

Course structure

- LO1. Systems Biology and Omics Technologies – Advanced level
- LO3. Biosensors & Biochips for Sustainable Future – Advanced level
- LO5. Scientific resources open access: digital databases – Basic level
- LO6. Social and political acceptability of modern biotechnology tools – Basic level
- LO7. Environmental benefit from modern biotechnology and ICT application – Basic & Advanced levels

Course authors

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Course outline

Modern biotechnology has been recognized as the bound of the next technological revolution. It is a forceful machine that offers a range of potential environmental, social, and economic profits and requires stringent attention. The progress in microbial biotechnology has been so quick in the last years that it is extremely important to deepen the preparation in the field. New technologies have partially or completely substituted the older ones and new training is envisaged. In this respect, the educational goals of this course are focused to provide trainees with a reliable background on:

- ✓ New insights on “omics sciences” and their impact in several generic fields: molecular medicine, toxicology, environment and biodiversity, biotechnology and bioprocess engineering, as well as nutrigenomics research.
- ✓ Practical applications of specific types of biosensors and biochips. Advanced tools and methodologies for dealing with the data generated.
- ✓ Basic rules of using open access resources and code of conduct related to the use and publishing of open access resources.
- ✓ Factors that influence the social attitude towards modern biotechnology, the advantages of societal acceptability, and the bottleneck steps of the process.
- ✓ Use of microbial-based processes for the exploitation of renewable energy processes, to clean the environment, and in a biorefinery cycle.
- ✓ New advances in microbial-based technologies.

Keywords

System biology; Omics technologies; Medicine; Toxicology; Bioengineering; Biodiversity; Nutrition; Glucose biosensors; Cardiovascular diseases detection biosensors; Cancer detection biosensor; Tuberculosis biochips; Nutrient detection; Nanomaterials; Pathogens detection; Toxins detection; Pesticides detection; Endocrine-disrupting chemicals detection; Open Access Resources; Database; Data Management; Metadata; Analytics; Modern biotechnology tools; Social perception; Social acceptability; Risks vs. Benefits; Diffusion of biotechnology; Microbial-based technology; Biogas; Bioethanol; Decontamination of wastewaters; Soil bioremediation; - Anaerobic digesters; Bioreactors; Bioplastics; New technologies to study the microbiota; Probiotics.

Learning outcomes

Knowledge & Skills

- ✓ Differentiate omics approaches and their possible uses.
- ✓ Understand how computational systems can be used for the analysis of different data sets.
- ✓ Apply omics approaches to accelerate discoveries in different areas of research.
- ✓ Match the suitable bioinformatics tool with the specific research area.
- ✓ Process and interpret experimental data.

- ✓ Demonstrate an understanding of how biochips and biosensors could be successfully applied in medical diagnostics.
- ✓ Characterize different medical biosensors and biochips: for the detection of diabetes, cardiovascular diseases, cancer, tuberculosis, etc.
- ✓ Recognize and apply different biochips and biosensors employed in food and agriculture.
- ✓ Define properties and operate with biosensors and biochips utilized for environmental monitoring.
- ✓ Demonstrate knowledge of what data are.
- ✓ Understand the basic vocabulary when using open-access resources.
- ✓ Structure a database.
- ✓ Use open access resources.
- ✓ Recognize the most common open-access databases used in science.
- ✓ Recognize and understand the factors influencing the social perception of modern biotechnology.
- ✓ Distinguish and apply the indices that determine the variety of social acceptance patterns of modern biotechnology: norms, value systems, and cultural backgrounds.
- ✓ Present societal acceptability of benefits and risks imposed by modern biotech applications.
- ✓ Evaluate the societal dilemma: benefits vs. risks.
- ✓ Know and use the structural models to predict attitudes towards biotechnology.
- ✓ Distinguish the tools for measuring public attitudes towards risks and benefits.
- ✓ Identify and formulate issues related to the possible negative impact of biotechnological development on socio-economy, biodiversity, sustainable agriculture, and public welfare.
- ✓ Know and recognize the major biosafety issues of modern biotechnology.
- ✓ Know basic concepts underpinning the production of renewable energy in Europe.
- ✓ Know which microorganisms may be involved in biogas production.
- ✓ Understand the potential of using bioethanol as a biofuel and the main microorganisms used for bioethanol production (yeasts and bacteria).
- ✓ Understand the potential of microorganisms for the decontamination of contaminated sites.
- ✓ Know and recognize the major benefits and issues of modern biotechnology.
- ✓ Highlight the main plant and reactor configuration for biogas production (anaerobic digesters).
- ✓ Know and develop the main plant and reactor configuration for bioethanol production (fermenters inoculated with the target organisms).
- ✓ Know the main bioplastics on the market (starch-derived plastics, PLA, and PHB) and the use of biotechnology tools for their production.
- ✓ Understand the importance of the study of the soil microbiota for the evaluation of soil health and how anthropogenic factors may influence the soil microbiota composition.
- ✓ Be in contact with new applications of microbial-based technologies.

Autonomy & responsibility

- ✓ **Problem-solving skills**
- ✓ **Communication skills:** good verbal and written communication skills.
- ✓ **Computing skills:** competencies and skills in the use of modern technological tools.
- ✓ **Use of media:** knowledge of the principles of preparation and delivery of messages through media; ability to develop written and oral presentations.
- ✓ **Personal issues:** logical thinking capabilities; being independent and organized.
- ✓ **Collaborative working:** capable of teamwork.

ECTS points

Successful completion of the course will result in the participant being awarded **15 ECTS** (European Credit Transfer System) points

Credit transfer within Partners' countries

- Bulgaria – 12.5 – 15 ECTS
- Germany - 12.5 – 15 ECTS
- Greece – 12.5 ECTS
- Italy – 15 ECTS