MEDICAL BIOTECHNOLOGY AND NANOBIOTECHNOLOGY (LM49)

(Lecce - Università degli Studi)

Teaching MICROBIAL BIOTECHNOLOGIES

GenCod A004553

Owner professor Pietro ALIFANO

Teaching in italian MICROBIAL BIOTECHNOLOGIES

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SSD code BIO/19

Reference course MEDICAL BIOTECHNOLOGY AND

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 50.0

For enrolled in 2021/2022

Taught in 2021/2022

Course year 1

Language ENGLISH

Curriculum PERCORSO GENERICO/COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

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

BRIEF COURSE DESCRIPTION

Lectures

Part 1. Microbial virulence and vaccines
Microbial and viral pathogenesis.
Vaccines.
Part 2. Drugs from microorganisms
Bioactive compounds from microorganisms.
Actinomycetes producing bioactive compounds.

Labs

Large-scale microbial cultivation for industrial purposes.

REQUIREMENTS

No formal prerequisite is required with respect to other courses.
However basic knowledge of general microbiology, basic immunology and microbial genetics is strongly recommended. This knowledge is normally acquired in the bachelor's degrees that give access to the master's degree in Medical Biotechnology and Nanobiotechnology.

COURSE AIMS

Course outline and aims

The course aims to provide knowledge and skills to work professionally with roles of responsibility in the areas of medical biotechnology and nanobiotechnology which make use of micro-organisms or viruses (natural or genetically modified, whole or parts thereof) or which develop diagnostic devices and therapeutic to combat infectious and non-infectious diseases.

Learning outcomes

Knowledge to be attained:

- molecular and cellular mechanisms underlying microbial and viral pathogenicity
- methodological foundations for design and development of vaccines
- methodological foundations for discovery and production of bioactive compounds from microorganisms

Abilities to be attained:

- New drug discovery from microorganisms by bioassays and genome mining
- Mutate-and-screen methods for microbial strain improvement
- Cultivation of microorganisms in stirred-tank bioreactors

TEACHING METHODOLOGY

Learning methods consist of formal Lectures and Labs 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%)

Due to COVID-19 emergency, exams will be held temporarily by telematic devices, using the TEAMS platform according to the instructions on the University website (https://drive.google.com/file/d/11SVWGyWOnEoNwoPXwg5gsDmQuhj68gVy/view).

FULL SYLLABUS

Programs of Lectures and Labs

Lectures

Part 1. Microbial virulence and vaccines

Microbial and viral pathogenesis. Host-microbes interaction: positive interactions. The human microbiota. The stable normal flora of skin, oral cavity, respiratory tract, intestinal tract, urogenital tract. Probiotics. The gut metagenome. Host-microbes interaction: negative interactions. Infectivity, pathogenicity and virulence. The Koch's postulates and their molecular version. "Alien" DNA and evolution of virulence and drug resistance. Virulence factors and toxins. Adhesion, invasion, growth/survival in host microenvironments. Quorum sensing. Biofilm. Evasion of innate and adaptive immunity. Regulation of virulence genes. Powerful approaches to study the microbial virulence: Signature-tagged mutagenesis (STM); In vivo expression technology (IVET)

Vaccines. Historical notes on vaccines. Immunological principles. Conventional vaccines: killed or inactivated vaccines, attenuated live vaccines, subunit vaccines. Recombinant vaccines: recombinant viral vaccine, recombinant bacterial vaccine, genetically-attenuated live vaccines, edible vaccines. Reverse vaccinology.

Part 2. Drugs from microorganisms

Bioactive compounds from microorganisms. Chemical diversity and structural classes. Biological activity (antibiotic, antifungal, antiprotozoal, immunosuppressive, anticancer, etc.). Biosynthetic pathways: synthesis of precursor substrates, polyketides and polyketide synthase (PKS), oligopeptides and NRPS, PKS_NRPS hybrid systems, oligopeptides of ribosomal origin, oligosaccharides and terpenes, the main decoration reactions; manipulation of biosynthetic pathways.

Actinomycetes producing bioactive compounds. The life cycle and life style of the actinomycetes. Regulation of secondary metabolite biosynthesis: pathway-specific and pleiotropic regulators, extracellular signals, influence of nutrients. Strain improvement with classical methods and genetic engineering. Genome and transcriptome analysis of actinomycetes. New drug discovery by genome mining.

Labs

Large-scale microbial cultivation for industrial purposes. The growth curve. Discontinuous or batch fermentation. Continuous fermentation. Fed-batch fermentation.

REFERENCE TEXT BOOKS

- G. Dehò, E. Galli. Biologia dei microrganismi. Edizione 2018. Casa Editrice Ambrosiana. Distribuzione esclusiva Zanichelli.
- S. Donadio, G. Marino. Biotecnologie microbiche. Edizione 2008. Casa Editrice Ambrosiana.
- M. Madigan, J. Martinko, K. Bender, D. Buckley, D. Stahl. Brock Biology of Microorganisms (14th Edition). Global Edition. Pearson.
- Y. K. Lee. Microbial Biotechnology (Third Edition). World Scientific.