DIPARTIMENTO DI SCIENZE

COURSE: **PHYSIOLOGY AND GENETICS OF MICROORGANISMS**			
ACADEMIC YEAR:**2019-2020**			
TYPE OF EDUCATIONAL ACTIVITY: **Characterizing**			
TEACHER: **Maria Grazia BONOMO**			
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phone: **0971205572**		mobile (optional):	
Language: **ITALIAN**			
ECTS: 8 (6 lessons and 2 tutorials/practice)	n. of hours: 72 (48 lessons and 24 tutorials/practice)	Campus:**Potenza** Dept./School:**Dipartimento di Scienze** Program: **Biotecnologie (L2)**	Semester: I Beginning on 1st October 2019, ending on 20 December 2019/ 20 January 2020

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The main objective of the course is to provide students with the basis to face the study of the physiology and genetics of microorganisms.
The main knowledge provided will be:

- *fundamentals of molecular microbiology;*
- *key features of the genetic information in bacteria;*
- *basic knowledge of the regulation mechanisms of the genetic expression in bacteria;*
- *knowledge on the physiology of bacteria in nature and bacterial stress response;*
- *knowledge of the molecular basis of microbial interactions;*
- *pathogenicity fundamentals and bacterial virulence;*
- *knowledge on a global analysis of the bacterial cells, genomics, metagenomics and functional genomics.*

The main skills (ie the ability to apply their knowledge) will be:

- *identify and analyze critically the fundamentals and the molecular mechanisms underlying the physiology and genetics of microorganisms;*
- *evaluate and choose the different applications that the most modern molecular techniques can have in different fields of genomics, metagenomics and functional genomics;*
- *use the knowledge gained to the use of the main molecular techniques for the study of the physiological changes of microorganisms in different growth conditions.*

PRE-REQUIREMENTS

You must have acquired and assimilated the knowledge provided by the courses of "General and Applied Microbiology" and "Molecular Biology".

SYLLABUS

Organization of the genetic information in bacteria (8 h)

Genomes of prokaryotes. Physical structure of the nucleoid. Architecture of the bacterial chromosome. Additional genetic elements: plasmids, transposable elements, insertion sequences, transposons, invertible elements, genomic islands. Mechanisms of genetic variability. Gene mutation. Horizontal gene transfer.

Regulation of gene expression in bacteria (8 h)

Molecular mechanisms of gene expression regulation in bacteria. Regulation systems of cell functions and levels of adjustment. Regulation in catabolic systems. Regulation in anabolic systems. Global regulation.

Bacterial physiology and stress response (8 h)

The physiological state of the bacteria in nature. How the cell faces the stress. The nature of stress. Main systems of stress response. Response to stress and microbial diversity. Deal with stress through a collective commitment.

Microbial interactions (16 h)

Interactions between bacteria. Strategies of cooperation and competition. Intercellular communication: quorum sensing. Microbial associations: biofilms. Interactions with animals. Microbiota. Endogenous microflora of humans. Microbiome. Probiotics. Interaction with animal organisms. Pathogenesis. Bacterial pathogenicity and virulence. Koch postulates. Measure of virulence. Virulence factors. Mechanisms of host defense. Innate immunity. Adaptive immunity. Interactions of microorganisms with plants.

Global analysis of the bacterial cells (8 h)

Biodiversity. Microbial ecology. Methods for the analysis of microorganisms and microbial communities. Culture-dependent methods. Culture-independent methods. Applications and benefits of different approaches. Molecular microbial ecology. DGGE technique. Transcriptome analysis. NGS methodologies.

Laboratory exercises (24 h)

Application of molecular methods for the physiological and genotypic characterization of bacterial strains;

Extraction and purification of DNA and RNA;
Application of different PCR techniques;
Sequencing of the amplification products and alignment sequences;
Assessment of intra-specific biodiversity;
Study of the physiological changes of microorganisms in different growth conditions.

TEACHING METHODS

The course includes 72 hours of teaching between lessons and exercises. In particular it is provided 48 hours of lectures and 24 hours of guided exercises in the laboratory.

EVALUATION METHODS

The aim of the examination is to test the level of achievement of the previously mentioned educational goals.
The exam consists of a final written test in which it will be evaluated the ability to link and compare different aspects covered during the course; to pass the test you must acquire at least 18 points out of 30. The written exam will include 22 questions, 13 multiple choice and 9open tracks, 17 of which related to the theoretical contents of the course and 5 in relation to those practical / application. The time available will be 1 hour and 30 minutes.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Reference texts:

- *Dehò, Galli. Biologia dei microrganismi. Casa Editrice Ambrosiana.*
- *Schaechter, Ingraham, Neidhardt. Microbiologia. Zanichelli.*

Notes provided by the teacher.

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and methods of verification, the teacher provides students educational materials. Simultaneously, it collects a list of students who intend to enroll in the course, together with name, registration number and email.
Office hours: Tuesdays from 15 to 18 at its 118 laboratory, II Floor, 3A North building, Department of Science and Wednesdays from 15 to 18 at its 118 laboratory, II Floor, 3A North building Department of Science .
In addition to weekly reception, the teacher is available at all times for a contact with the students, through its e-mail.

EXAMINATION SESSIONS (FORECAST)[1]

12/02/2020, 11/03/2020, 17/06/2020, 08/07/2020, 23/09/2020, 2016/10/2020, 15/12/2020

SEMINARS BY EXTERNAL EXPERTS YES □ NO x

FURTHER INFORMATION

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.