DIPARTIMENTO DI SCIENZE

COURSE: **MOLECULAR BIOLOGY AND BIOINFORMATICS**			
ACADEMIC YEAR: **2019-2020**			
TYPE OF EDUCATIONAL ACTIVITY: **Basic**			
TEACHER: **Prof. Magnus Ludvig Monné**			
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phone: **0971205088**		mobile (optional):	
Language: **ITALIAN**			
ECTS: (lessons e tutorials/practice)	n. of hours: (lessons e tutorials/practice)	Campus: **Potenza** Dept./School: **Dipartimento di Scienze** Program: **Biotechnology**	Semester: (date) (from 1 October 2019 to 20 December 2019 -20 January 2020)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

- **Knowledge and understanding capacity:** the student should demonstrate to know and understand the fundamental processes of molecular biology in the flow of information from DNA to RNA and proteins; the mechanisms that reassures genome integrity and regulate gene expression; the development of methods and therapeutic products that have emerged from basic and applied research in molecular biology and bioinformatics.
- **Capacity to apply knowledge and understanding:** the student should demonstrate to be able to design strategies to apply molecular cloning technology for the production of recombinant pharmacological proteins.
- **Autonomy of judgment:** the student should demonstrate to be capable of independent judgment using the basic knowledge of the subject.
- **Communication skills:** the student should have the ability to summarize and make simple explanations using the terminology of the subject.
- **Learning skills:** the student should be able to understand publications and to follow second level courses, specialized seminars and Master programs of the subject.

PRE-REQUIREMENTS

It is necessary to have the basic knowledge provided by the courses "General and Applied Genetics" (compulsory) and "Biochemistry" (advised).

SYLLABUS

I. The flow of information. (34 hours of lectures)

The central dogma, structure and function of DNA, RNA and proteins. Topology of DNA and topoisomerases. Genes, genomes, nucleosomes and chromosomes.

DNA replication: DNA polymerases, other enzymes at the replication fork, regulation of initiation, telomerase.

Mutations and damage of DNA, systems for repair, homologous recombination and transposons.

Transcription: RNA polymerases, promotors, general transcription factors.

Maturation of RNA: 5'-capping, 3'-polyadenylation, various forms of splicing, the spliceosome, RNA editing.

Translation: mRNA, tRNA, amminoacyl-tRNA synthase, ribosomes, translational regulation.

Transcriptional regulation: transcriptional regulatory sequences and factors, epigenetic inheritance, chromatin remodelling.

The RNA regulators: riboswitches, miRNA, siRNA e CRISPR/Cas9.

II. Methods. (20 hours of lectures + 12 hours of practicals)

Cloning: PCR, gel electrophoresis, restriction enzymes, DNA ligase, vectors, transformation of cells, DNA sequencing.

Production and manipulations of recombinant proteins. Transgenic animals and metabolic engineering.

Bioinformatics: data banks, alignment and analysis of sequences, structures and interactions.

III. Biotechnological products in the pharmaceutical industry. (18 hours of lectures)

Design, function, structure and production of pharmaceutical recombinant proteins: hormones, cytokines, enzymes, coagulation and thrombolysis factors, recombinant vaccines, recombinant monoclonal antibodies, gene therapy.

TEACHING METHODS

The course consists of 84 hours divided between lectures and laboratory practice; 72 hours of lectures and 12 hours of laboratory practice. In some lectures the approach of problem-based learning will be used: the design and production of recombinant proteins; the use of bioinformatics instruments for extraction and analysis of data. In some lectures parts of the course will be summarized and analyzed in a comparative fashion, followed by quiz and discussions.

EVALUATION METHODS

The general comprehension of the students will partly be evaluated by the approach of problem-based learning and by the quiz and the discussions in the summary lectures.
In a final oral exam the capacity of each student will be evaluated to respond to questions on 1) the basics, 2) information flow processes in biological systems and 3) methods or products. For higher marks, the capacity to connect, compare and reason logically on different aspects of the arguments of this course will also be evaluated.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- **Lecture notes.**
- James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine and Richard Losick. *Molecular Biology of the Gene.* 7th edition.
- Terry A. Brown. *Molecular Biotechnology*. 2nd edition, Zanichelli.
- Arthur M. Lesk. *Introduction to Bioinformatics*. 4th edition, Oxford University Press.
- Daan J.A. Crommelin, Robert D. Sindelar and Bernd Meibohm. *Pharmaceutical Biotechnology*. 5th edition, Springer.

INTERACTION WITH STUDENTS

Visiting hours: Thursdays 17-18 in the study of the lecturer (3A241).

Please make a request for appointment with the lecturer by e-mail.

EXAMINATION SESSIONS (FORECAST)[1]

20/02/2020; 19/03/2020; 23/04/2020; 21/05/2020; 25/06/2020; 16/07/2020; 24/09/2020; 15/10/2020; 12/11/2020; 17/12/2020;

SEMINARS BY EXTERNAL EXPERTS NO

FURTHER INFORMATION

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