

**COURSE:**

ORGANIC CHEMISTRY OF BIOLOGICAL PROCESSES

ACADEMIC YEAR: **2019-2020**

TYPE OF EDUCATIONAL ACTIVITY: Free choice

TEACHER: Prof. Brigida Bochicchio

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mobile (optional):

Language: **Italian**

ECTS: 6 ( 6 of lessons)

n. of hours: 48 (48 of lessons)

Campus: **Potenza**

Dept./School:

Dipartimento di Scienze

CdS FARMACIA (LM-13)

Semester: II

(from 02.03.2020 to

20.06.2020)

**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

- *The main object of the course is to interpret the main biological and biochemical processes in terms of organic chemistry. The course is focused on the comprehension of the mechanism of action of enzymes.*

*After having completed the course, the student must be able to :*

- 1) demonstrate knowledge of mechanism of action of main enzymes;;
- 2) articulate scientific information through oral communication;
- 3) articulate scientific information through written communication;
- 4) Visualization of I, II, III, IV structures of enzymes and of their active sites by Pymol Software.

**PRE-REQUIREMENTS**

The student should have good knowledge of the basic principles of Organic Chemistry I and II.

**SYLLABUS**

- *Introduction to Bioorganic chemistry (2h)*
- *Proximity Effects in Organic Chemistry: o-Carboxy-phenyl β-D-glucoside; 4-(4'-imidazolyl) butanoic phenyl ester (2h);*
- *Other Basic Concepts: Electrostatic interactions and Hydrophobic forces in proteins (2h);*
- *Proteins. α-L-aminoacids and chirality. Chemical structure of natural α-L-aminoacids (1h);*
- *Primary, secondary, tertiary, quaternary structure of proteins. Secondary structures in peptides and proteins; dihedral angles and Ramachandran map (4h);*
- *Determination of secondary structure of proteins through FTIR (1h), CD (2h), NMR (1h), Crystallography, Molecular Dynamics (2h);*
- *SPPS of peptides; orthogonality of protecting groups; protecting and activating groups in SPPS (4h);*
- *Chemistry of the living cells; ATP as activator of carboxyl function of α-aminoacids: hippuric acid formation, transfer ribonucleic acid (tRNA) and aminoacyl-tRNA formation, S-adenosyl methionine formation (1h);*
- *Analogy between Organic Reactions and Biochemical Transformations: SPPS and in-vivo synthesis of proteins (1h);*
- *Nonribosomal peptide bond formation: antibiotic gramicidin S (1h);*
- *Virus and bacteria (2h);*
- *Asymmetric Synthesis of α-aminoacids: Kagan's synthesis of L-aspartate monomethyl ester (1h);*
- *Corey's method; asymmetric synthesis of D-alanine (1h);*
- *Introduction to Enzymes: intramolecular catalysis; multifunctional catalysis and simple models (2h);*
- *α-Chymotrypsin: mechanism of action (1h); experimental evidences; tetrahedral intermediates and Rogers and Bruice models (2h);*
- *Metalloenzymes: carboxypeptidase A and carbonic anhydrase: the role of Zinc. Mechanism of action of carboxypeptidase A on peptide and ester substrates. Experimental evidences of mechanisms: metanalysis. Breslow's bioorganic models (2h);*
- *Bioisosteric groups: acetylcholine, carbachol, muscarine; Molecular Adaptation and synthesis of agonists, antagonists, antimetabolites. Nomenclature of nucleosides and nucleotides (2h). 5-Fluorocytosine and*

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*citosyne; thymidine and 1-β-D-2'-deoxyribofuranosyl-5-iodo-uracil, adenoside arabinoside and deoxyadenosine: acyclovir (2h);*

- *Bioorganic Chemistry of Phosphate groups and Polynucleotides; Basic Considerations; Energy Storage; DNA and RNA: stability; Hydrolytic Pathways in the hydrolysis of fosfodiester (2h);*
  - *Pseudorotation: "five preference rules" (1h);*
  - *Mechanism of action of ribonuclease A enzyme. "In-line" and "adjacent" mechanism; Breslow and Labelle model (2h);*
  - *Other Hydrolytic Enzymes: lysozyme. Mechanism of action. Experimental evidences (2h).*
  - *Visualisation of I, II, III, IV structure of enzymes and of their active site through Pymol software (2h)*
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#### TEACHING METHODS

*Theoretical lessons and practical lessons. Classroom tutorials, Laboratory tutorials, Technical visits of pharmaceutical companies (if applicable) and lessons from experts in the field (if applicable).*

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#### EVALUATION METHODS

*The aim of the final examination is to evaluate the level of achievement of the educational goals. The final examination consists of an oral examination.*

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- - HERMANN DUGAS, BIOORGANIC CHEMISTRY, SPRINGER.
  - - A. LILJAS, L. LILJAS, J. PISKUR, G. LINDBLOM, P. NISSEN, M. KIELDGAARD. TEXTBOOK ON STRUCTURAL BIOLOGY. WORLD SCIENTIFIC.
  - ORIGINAL SCIENTIFIC PAPERS
  - TEACHER'S NOTES COURSE WILL BE AVAILABLE FROM A SHARED FOLDER (E-LEARNING) WHOSE LINK WILL BE FURNISHED TO THE ST-DENTS ATTENDING THE CLASSROOM.
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#### INTERACTION WITH STUDENTS

*At the beginning of the course the teacher will describe the educational goals, the syllabus and the examination methods to the students. They will give to the teacher their institutional e-mail addresses. All course information will be sent only to the institutional e-mail addresses.*

*Office hour: on Wednesday and Thursday from 16.00 to 17.00; alternatively, by email appointment*

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#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

*4/02/2020; 3/03/2020; 10/06/2020; 7/07/2020; 8/09/2020; 9/10/2020; 4/12/2020*

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SEMINARS BY EXTERNAL EXPERTS    YES x    NO

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#### FURTHER INFORMATION

*Students are strongly encouraged to attend all lessons.*

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<sup>1</sup>Subject to possible changes: check the web site of the Teacher or the Department/School for updates.