ACADEMIC YEAR 2022/2023

General information	
Academic subject	**BIOCHEMISTRY 1**
Degree course	Veterinary Medicine LM42
Academic Year	I
ECTS	6 (lectures:5 ECTS; practical activities: 1 ECTS)
Language	Italian
Academic calendar	II 7 weeks period
Attendance	Mandatory

Professor/ Lecturer	E-mail	Telephone
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Headquarter	Campus of Veterinary Medicine, S.P. 62 per Casamassima km 3, 70010 Valenzano	
Virtual headquarter	Teams code: uazerrj	
Tutoring (time and day)	Friday 9:00-11:00 am 3:00-4:00 pm by appointment via mail	

Syllabus	
Learning Objectives	The course aims to provide to the students the key to understanding the behaviour of organic molecules that will be fundamental for understanding the biochemistry and chemistry of biological compounds (proteins, lipids, carbohydrates and nucleic acids). The main training objective is the introduction to a rigorous scientific method gradually introduced in which the behaviour of the molecules and the reaction mechanisms can be deduced on the basis of the knowledge of the basic properties of organic molecules. Finally, the course proposes to impart information on the main laboratory techniques for the qualitative and quantitative study of biological molecules in the medical-veterinary field.
Course prerequisites	Prerequisite: Chemistry. The student must have acquired knowledge and skills relative to general topics of physics (thermodynamic), and cytology (structure of the eukaryotic cell).
Contents **CFU: 5** **Hours: 40**	The course belongs to Basic subjects Introduction to organic chemistry: Alkanes: Nomenclature. Position and conformational isomerism. Reactions of halogenation and combustion. Cycloalkanes. The cyclohexane. Conformational and geometric isomerism in cycloalkanes. The reaction mechanisms. The concept of electrophile and nucleophile. Carbocations and carbanions. Alkenes and alkynes: Nomenclature. Geometric isomerism. Electrophilic addition reactions to alkenes: general mechanism. Addition reactions: hydracids, water and halogens. Stereochemistry of oxidation reactions. Notes on the polymerization reactions of alkenes. Aromatic hydrocarbons Benzene: structure, aromaticity and stabilization energy. Optical Isomerism: Chirality. Enantiomers, racemes and diastereomers. Chiral carbons. Basics Alkyl Halides: Nomenclature. Alcohols and Glycols: Nomenclature. Acidity of alcohols. Alcoholics. Dehydration of alcohols to alkenes (E1 mechanism).

	Oxidation of alcohols to carbonyl compounds. Glycols and glycerol: synthesis and properties. Ethers, epoxides and phenols: Nomenclature and synthesis. Aldehydes and Ketones: Nomenclature. Nucleophilic addition reactions to carbonyl: Acetals and hemiacetals, Aldimmines and Schiff bases. Enols and enolates: keto-enol tautomerism and its importance in metabolic processes. Carboxylic Acids: Nomenclature. Carboxyl structure. Acidity. Esterification. Acyl halides and anhydrides: synthesis and reactions. Reduction reactions. Fatty acids and their salts. Foreign: Nomenclature. Fisher's esterification. Saponification. Soaps. Reactions of formation of the carbon-carbon bond: Aldol condensations. Similarity between Claisen condensation and that of thiolesters. Amino Acids and Proteins: Classification of amino acids. Peptide bond. Proteins: primary, secondary, tertiary and quaternary structure. Functional classification of proteins: catalytic, supporting, transport, hormones. Amino acid derivatives: biogenic amines Carbohydrates (simple and complex): Sugars: Aldoesosis and Ketoesosis. Epimers. Glucosides and their biological importance. Pentosis and N-ribosides. Glucosamines. Disaccharides: maltose, cellobiose, lactose, sucrose. Oligosaccharides. Polysaccharides: starch, cellulose, glycogen and their structure. Glycoproteins: structure and classification: immunoglobulins, milk and plasma glycoproteins and blood groups. Lipids: classification and biological functions. Simple lipids: fatty acids, saturated and unsaturated fatty acids. Isomerization. Triglycerides. Saponifications. Micelles and soaps. Oxidative rancidity. Phospholipids, glycolipids and lipoprotein systems of particular medical-veterinary interest. Prostaglandins and steroids. Phenolic antioxidants, ascorbic acid and carotenoids Nucleic acids: purine and pyrimidine bases, nucleotides and nucleic acids: DNA (nDNA and mtDNA), RNA (mRNA, tRNA) Micronutrients: water-soluble and fat-soluble vitamins, structure, biological action, mechanism of action, hypo and hypervitaminosis. Enzymes: nomenclature and classification, structure, active sites and enzymatic specificity, enzymatic kinetics and regulation. Inhibitors and their mechanism of action. Main reactions catalyzed by enzymes. DNA replication mechanisms in prokaryotic and eukaryotic cells, gene transcription and post transcriptional modifications. Protein synthesis and post-translational modifications. Biochemical laboratory techniques: Preparation and manipulation of biological samples. Buffers used in biochemistry. Spectrophotometry: Properties of electromagnetic radiation, atomic and molecular absorption spectra, Lambert-Beer law, classification of spectrophotometers: single beam, double beam and double wavelength; Structure and function of: sources, monochromators, sample holders and detectors; measurement of the molar extinction coefficient, dosage of enzymatic activity and dosage of a substrate in biological sample. Main molecular biology techniques: PCR, Real time PCR and RT-PCR, restriction enzymes.

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	Recombinant DNA technology and its applications in the heterologous expression of proteins. Chromatographic techniques: classification and principles. Factors influencing the chromatographic process: partition coefficient, capacity factor, selectivity factor and column efficiency. Chromatography by partition, ion exchange, molecular exclusion and affinity. Immunochemical techniques, Immunoprecipitation. Western blotting analysis of a protein sample.
Laboratory acitivity **CFU:1** **Hours: 10**	Students are grouped in 8-10 people. Enzymatic spectrophotometric assay using a biological sample Extraction, purification and electrophoretic assay of DNA plasmid from E.*coli* culture
Biosecurity standards for the frequency of laboratory activities	Access to the laboratories is allowed only to students equipped with protective clothing (lab coats or disposable latex gowns and gloves), who have read the biosecurity manual
Books and bibliography	Chimica e Propedeutica Biochimica - F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. O. Farrell, O. J. Torres - EDISES
Additional materials	Slides from the lessons, scientific articles and others will be available to the students.

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Self-study hours
Hours			
150	*40*	*10*	*100*
ECTS			
6	*5*	*1*	

Teaching strategy	Lectures and exercises are traditionally presented by the teacher in the classroom (no e-learning mode) that are provide of computers connected on-line. The laboratory experience will be done in small groups of students, the principal techniques in the field of biochemistry will be performed under the supervision of teacher.
Expected learning outcomes	
Knowledge and understanding on:	○ The student will be able to recognize the structure, function and reactivity of the principal organic molecules with the complex structure of biological macromolecules. ○ The student will be able to apply the correct laboratory technique for the quantitative or qualitative study of the macromolecules.
Applying knowledge and understanding on:	○ The student will be able to correlate the molecular mechanisms and the functions of biological molecules to cellular function but also how modification of these are able to cause veterinary pathology ○ The student will be able to identify the correct laboratory technique for the quantitative or qualitative assay of the macromolecules
Soft skills	• *Making informed judgments and choices* The student will be able to recognize and describe the principal groups of

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	biological macromolecules, the interactions and the functions of these, will be most important to understand the arguments of the next courses. Moreover, the notions acquired will be used by students to describe different metabolic pathway that occur in the cell (DOC 2.2). • *Communicating knowledge and understanding* The student will be be able to describe the structure, reactivity and function of different biological macromolecules in a comparative and critical manner. this ability must be acquired both with reference to communication to professional entities and for disclosure purpose. (DOC 1.4) • *Capacities to continue learning* The course aims to provide methodological approaches and basic techniques to be applied subsequently in the profession of medical veterinary, particular emphasis on the most relevant aspects for entry into the labour market and professional success. (DOC 1.8)
Summary of the integrated knowledge and skills that the course contributes to acquiring students (Day One Competence) envisaged by the EAEVE	Knowledges: 1.4 1.8 Skills: 2.2

Assessment and feedback	
Methods of assessment	The examination consists in oral test based on the course contents
Evaluation criteria	• *Knowledge and understanding* The student must be able to write the principal functional groups of organic compounds. • *Applying knowledge and understanding* The student must be able to correlate the role of functional groups to the macromolecules and to apply the correct test assay. • *Autonomy of judgment* The student must be able to organize a discussion about a class of biological molecules. • *Communicating knowledge and understanding* The student must be able to use the correct form to describe the macromolecules using scientific terminology. • *Communication skills* The student must be able to use the correct form to describe the macromolecules using scientific terminology, moreover the discussion of contents must be clear and simple for people of the field and not • *Capacities to continue learning* The student must be able to use data bank, original articles for individual update.
Criteria for assessment and attribution of the final mark	The final grade is expressed as out of thirty. The exam is passed when the grade is greater than or equal to 18/30. Knowledge of all biological macromolecules and their reactivity is a prerequisite for passing the exam. The use of correct scientific terminology, the ability to identify the appropriate laboratory techniques for the study of macromolecules, as well

	as the ability to organize a speech by spacing and correlating the various concepts acquired, will contribute to the increase of the final grade.
Additional information	To obtain the attendance signature and take the exam, students must attend 75% of the theoretical lessons and 75% of the exercises, unless the COVID state of emergency persists, in which case the lessons will be provided remotely

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