



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali		
ACADEMIC YEAR	2023/2024		
BACHELOR'S DEGREE (BSC)	GASTRONOMIC SCIENCE		
INTEGRATED COURSE	BIOCHEMISTRY AND FOOD CHEMISTRY - INTEGRATED COURSE		
CODE	22823		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	BIO/10, CHIM/10		
HEAD PROFESSOR(S)	DI STEFANO VITA	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	GHERSI GIULIO	Professore Associato	Univ. di PALERMO
	DI STEFANO VITA	Professore Associato	Univ. di PALERMO
CREDITS	9		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	DI STEFANO VITA Monday 9:00 11:00 GHERSI GIULIO Tuesday 14:00 15:30 Dipartimento STEBICEF, Viale delle Scienze ed.16 - 90128 PalermoSTUDIO		

PREREQUISITES	Basic knowledge of General and Organic Chemistry. Attendance of the course will allow students to acquire the knowledge bases to address the issues of biochemistry and food chemistry
LEARNING OUTCOMES	<p>The course aims to give the student knowledge of biochemistry, the chemical structure, and the functional and nutritional properties of the substances constituting the main foods. The elaboration properties, the independence of judgment, and the ability to apply the newly acquired knowledge will be appreciated. At the end of the course, the student will have to present the topics in a clear and articulated way using appropriately the scientific terminology, required by a course of this type.</p> <p>Ability to apply knowledge and understanding: Knowledge and understanding of the biochemical role of macromolecules, their presence in specific foods, and their energy role; know how to apply the knowledge acquired to identify foods with a nutrigenomic effect distinguishing them from others with a metabolic effect only.</p> <p>Making judgments: Being able to autonomously evaluate and integrate the information obtained from the literature.</p> <p>Communication skills Ability to explain, in a simple and clear way, the main biochemical processes, the composition of foods, the possible presence of biologically active constituents, knowledge of nutraceuticals, which are the basis of correct nutrition and management of food well-being;</p> <p>Learning ability: Students will develop the ability to learn scientific literature in the biochemical-nutritional field which allows them to continue studying in an autonomous way. They will also be able to learn the link between biochemical events connected with the intake of foods or foods and nutraceutical effects and their effects on human health and well-being.</p>
ASSESSMENT METHODS	<p>The final score, which consists of an oral exam, will be given on the answers to questions regarding the program, with reference to the suggested texts. The oral exam aims to verify if the student has acquired the knowledge expected by the program of the course; it will also evaluate his elaboration abilities and his autonomy of judgment about the disciplinary contents with language properties. The score is expressed using a 30-point scale (from min 18/30 to max 30/30 cum laude). The student gains a minimum range score (with a score between 18/30 and 21/30) if he or she will demonstrate sufficient knowledge of the required arguments even if scientific vocabulary is not adequately articulated. The score will be increased (range score from 22/30 to 29/30) if the candidate shows a deep knowledge of the topics with a deeply personal study of the recommended texts. Positive scores will also be given if he/she shows autonomy of judgment and comprehension of acquired knowledge, with the correct use of scientific vocabulary. The score of 30/30 and 30/30 cum laude will be gained by the candidate who shows optimal knowledge of the topics, which he expresses in a clear and articulated way with optimal language skills and good analytical skills, showing his judgment autonomy and his application ability of the newly acquired knowledge.</p>
TEACHING METHODS	<p>The course will be organized in lectures. There will be some seminar activities on topics that will be deemed useful to address. The course aims to provide the student with knowledge of the chemical structure and the functional and nutritional properties of food components. Furthermore, particular attention will be given to the knowledge and understanding of the biochemical role of macromolecules, of their presence in specific foods and their energy role and their nutrigenomic effect.</p> <p>The elaboration properties, the independence of judgment and the ability to apply the newly acquired knowledge will be appreciated. At the end of the course, the student will have to present the topics in a clear and articulated way using the appropriate scientific terminology required by the course. Students will develop the ability to learn scientific literature in the biochemical-nutritional field which will allow them to continue studying independently. They will also be able to learn the link between biochemical events connected with food intake and intracellular nutrigenomic effects with effects on human health and well-being.</p>

MODULE BIOCHEMISTRY OF NUTRITION

Prof. GIULIO GHERSI

SUGGESTED BIBLIOGRAPHY

Campbell & Farrell. Biochimica EdiSES Branden, 4° ed. ISBN 9788833190501.
Leuzzi; Bellocco; Barreca; Biochimica della nutrizione- Zanichelli ISBN: 9788808179265

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INDIVIDUAL STUDY (Hrs)	45
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COURSE ACTIVITY (Hrs)	30
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EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide students with the basis for understanding:

- The composition and role of cellular constituents
- the biochemical and nutritional role of the molecules contained in foods.
- how they are digested, absorbed, and processed metabolically,

Furthermore to know the basic principles for the separation, and characterization of biomolecules from the point of view of applicable technologies.

SYLLABUS

Hrs	Frontal teaching
30	<p>FRONTAL LESSONS.</p> <p>Presentation of the discipline and declaration of the aims of the course. The prokaryotic and eukaryotic cell: structural generality and cellular organization. Structure and function of the biological membrane. Main subcellular organelles (mitochondrion, nucleus, endoplasmic reticulum, Golgi apparatus, ribosomes).</p> <p>Biomolecules. Structure, properties and functions of amino acids and proteins, carbohydrates (monosaccharides, disaccharides, polysaccharides), lipids, nucleotides and nucleic acids. Functional and chemical classification of amino acids. Proteins in the biological world. Structural levels of proteins and chemical bonds involved. The binomial structure-function in the cellular world. Structural motifs and protein domains. Notes on protein folding. Oxygen-binding proteins.</p> <p>The enzymes. Structure/function relationship in enzymes. Recognition sites and catalytic sites. Catalysis enzymatic. The enzyme kinetics. Mentenian kinetics and kinetic parameters (V_{max} and K_m). Inhibition enzymatic. Allosteric enzymes. Cooperative kinetics and Cooperative models. Regulatory mechanisms of the enzymatic activity. Intercellular communication. Main signal transduction pathways. characters of signalers and receptors.</p> <p>Metabolism, anabolism and catabolism. The main metabolic pathways.</p> <p>Sugar metabolism: Digestion of polysaccharides. Glucose transport in cells and its phosphorylation. Glycogenolysis. Glycolysis.</p> <p>Lipid metabolism: Digestion, absorption, translocation, storage and mobilization of lipids.</p> <p>EXERCISES/WORKSHOP</p> <p>Protein extraction methods. Solubilization and precipitation. Homogenization. Protein analysis by colorimetric methods.</p> <p>Centrifugation, general principles. Differential, gradient and isopycnic centrifugation.</p> <p>Chromatographic methods, general principles. Chromatography by molecular exclusion, ion exchange and affinity.</p> <p>Chromatographic methods, general principles. Chromatography by molecular exclusion, ion exchange and affinity.</p> <p>Electrophoretic methods. Electrophoresis on cellulose acetate. SDS-PAGE.</p>

MODULE FOOD COMPOSITION

Prof.ssa VITA DI STEFANO

SUGGESTED BIBLIOGRAPHY

L. Mannina, M. Daglia, A. Ritieni "La chimica e gli alimenti , nutrienti e aspetti nutraceutici, 2019, CEA editrice
P. Cappelli, V. Vannucchi. "Chimica degli alimenti - Conservazione e trasformazioni ". Ed. Zanichelli (2015)

AMBIT	70195-Scienze delle produzioni e delle tecnologie alimentari
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60

EDUCATIONAL OBJECTIVES OF THE MODULE

The aim of the food composition module is to provide the student with knowledge of the chemical structure and nutritional properties of the constituent substances of food, both fresh and preserved.
The course will also provide information on the legislation for the control and marketing of food in Italy and in Europe.
Particular attention will be given to the knowledge of analytical techniques for quality control and for the recognition of food fraud.

SYLLABUS

Hrs	Frontal teaching
2	Introduction. What is Food Chemistry? Food and food principles. The main components e food secondary. Energy content, basal metabolic rate, and body mass index
2	Preservation methods: food alteration. Physical and chemical conservation methods. Use of heat. Freezing. Freezing. Drying. Freeze drying. Ionizing radiations.
3	Organic components Carbohydrates. Generality, classification. Monosaccharides: structure and reactivity. Disaccharides and oligosaccharides. Oxidation and reduction, polyols. Polysaccharides. Starch. Dextrins. glycogen. Dietary fiber. Cellulose, hemicellulose, and lignin. Pectins. Seaweed polysaccharides. Gums and mucilages. Wait for nutrition and carbohydrate metabolism. Reactions of sugars in acidic, alkaline and heat environments. Molecular indicators of thermal degradation, hydroxymethylfurfural, lactulose, Caramelization. Reaction of Maillard.
3	Lipids. Generality, classification, fatty acids, essential fatty acids, cis, and trans fatty acids. Biosynthesis. Saturated and unsaturated fatty acids. Omega and delta nomenclature of fatty acids. Triglycerides. Diglycerides. Unsaponifiable fraction of oils. Terpenes, Phytosterols. Polyphenols, Cholesterol. Waxes. Complex lipids, phospholipids and glycolipids. Reactions involving lipids: lipolytic rancidity. Hydrogenation, trans fatty acids, and effects on health. LARN
3	Protein. Amino acids, peptides, proteins: structure, properties, classification. Essential amino acids e protein quality. Nutritional properties, protein value of foods. Functional properties of proteins (emulsifying, moisturizing properties). Modifications of proteins in foods during technological treatments. Indicators of thermal degradation of proteins and amino acids: isopeptides, lysinoalanine, furosine, Maillard reaction
2	Proteins: LARN. food sources. Analytical methodologies for the separation of proteins and peptides. Electrophoresis on agar and polyacrylamide, SDS PAGE. Revelation. Protein quantification. Analysis of amino acids. Proteomic analysis through MS. Kjeldahl method.
2	Additives: Classification. Description of the chemical properties of the main classes of food additives (preservatives, antioxidants, emulsifiers, etc.) legislation
4	Olive oil: diffusion of the olive tree. Oil and the olive tree, fruit ripening, characteristics of the oils and types. Extraction of oil from olives. Defoliation, Crushing. kneading. Extraction systems. Composition of EVO oil. Triglycerides, fatty acids, unsaponifiable fractions, pigments, phenolic compounds. Legislation. Quality and purity control. Classification of olive oils. Counterfeiting of EVO oil. Typicality. Refining and rectification of oils. pomace oil. Oil and the Mediterranean diet. Seed oils, refining.
2	Butter, chemical composition, fatty acids. Margarines, functional foods, dietetics and supplements containing Omega 3
2	Palm and palm kernel oils: extraction, purification, fatty acid content, uses, presumed danger
2	Functional foods: general principles. Probiotic foods (yogurt), prebiotics (soluble dietary fiber and insoluble), synbiotics; antioxidants; polyunsaturated fatty acids (PUFA).
2	Glycemic index. Synthetic sweeteners: saccharin, aspartame, acesulfame, cyclamates, steviol glycosides, Neotame, advantame, Sweet proteins, Polyols, DGA. Claims EFSA 2012.

3	Cereals: edible plants, general information. Wheat and processing, nutritional composition. Bread and Pasta. Corn, Rice and processing. Oats, Rye, Spelled. Components with nutraceutical activity of cereals
4	Undesirable substances. Fundamentals of toxicology. Physical, biological and chemical contamination. Pesticides, classification, organochlorines, organophosphorus, carbamates, mechanism of action. Legislation on pesticides and MRLs, Medicines for veterinary use, legislation and MRLs. Mycotoxins main classes. ochratoxins, aflatoxins, Extraction and identification through IAC-HPLC-FLD. Contaminants from anthropic sources, Dioxins and PCBs. Melamine, Acrylamide, Bisphenol, Semicarbazide, and Phthalates, Examples of contamination.
2	Toxic metals (As, Pb, Hg, Cd, Cr)
2	Food labeling: function, mandatory indications, nutritional declaration, expiry date, complementary mandatory indications, and indications on ingredients causing allergies and intolerances. Current legislation.
Hrs	Practice
4	Additives:
2	Synthetic sweeteners
4	edible oils
Hrs	Others
10	Seminar activities concerning bibliographic research, reading a label, emerging problems.