



Universitat de Lleida

DEGREE CURRICULUM
**BIOCHEMISTRY AND
METABOLISM**

Coordination: SANCHIS MORALES, DANIEL

Academic year 2016-17

Subject's general information

Subject name	BIOCHEMISTRY AND METABOLISM			
Code	100600			
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Typology	Modality
	Double bachelor's degree: Degree Physiotherapy and Degree in Human Nutrition and Dietetics	1	COMMON	Attendance-based
	Bachelor's Degree in Human Nutrition and Dietetics	1	COMMON	Attendance-based
ECTS credits	9			
Groups	2GG,3GM			
Theoretical credits	4.9			
Practical credits	4.1			
Coordination	SANCHIS MORALES, DANIEL			
Department	CIENCIES MEDIQUES BASIQUES			
Teaching load distribution between lectures and independent student work	All information in the program is in class attendance. The student has to prepare three presentations equipment (seminars metabolism disorders) for which attendance is also intended time (it is up to the student whether used or prepares independently). The autonomous student work focuses ideally in reviewing what is in class for their understanding and final maturation.			
Important information on data processing	Consult this link for more information.			
Language	Catalan /Spanish some material in English			
Distribution of credits	Magisterial Classroom Activity 4.9 Practice 1.8 Seminar 2.3			
Office and hour of attention	A acordar amb l'estudiant que ho sol·liciti			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
DELASPRES, FABIEN	fdelaspre@cmb.udl.cat	4,5	
FLEITAS PÉREZ, CATHERINE	catherine.fleitas@gmail.com	4,5	

Subject's extra information

Bibliography

1. Berg, J.M. Tymoczko, .L., Stryer, L. (2007) Bioquímica. 6ª ed. Editorial Reverté. (Versió en català i en castellà)
2. Biesalski, H.K., Grimm, P. (2007) Nutrición. Texto y atlas. Editorial Médica Panamericana. **
3. Devlin, T.M. (2004) Bioquímica. Editorial Reverté. *
4. Feduchi, Blasco, Romero, Yáñez. Bioquímica. Conceptos esenciales. Editorial Médica Panamericana.*
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6. Mathews, C.K., van Holde, K.E. Ahern, K.G (2002) Bioquímica. 3ª ed. Editorial Adisson-Wesley.
7. Müller-Esterl, Werner. Bioquímica. Fundamentos para Medicina y Ciencias de la Vida. Editorial Reverté. *
8. Mckee, T., Mckee, J.R. (2003) Bioquímica. La base molecular de la vida. 3ª ed. Editorial McGraw Hill.
9. Voet, D., Voet, J.G., Pratt, C.W. (2007) Fundamentos de Bioquímica. 2ª ed. Editorial Médica Panamericana.

web resources:

BioRom: <http://sebbm.bq.ub.es/BioROM/indices/index.html>

MolviZ.org: <http://www.umass.edu/microbio/chime/>

Learning objectives

As for knowledge, the student must pass the subject:

1. Know the basic scientific terminology applied to biochemistry.
2. Recognize and classify the most important biomolecules that make up living things.
3. Know the basics of enzymology and regulation of enzyme activity and apply to human nutrition.
4. Recognize the mechanism of energy production from staple foods.
5. Know and differentiate the main routes of metabolism of carbohydrates, lipids, amino acids, nucleotides and its regulation.

6. Integrate different metabolic pathways using compounds and have an overview of metabolism.
7. Distinguish the role of the most important hormones in energy metabolism
8. Know the basic elements of a laboratory of biochemistry and basic to ensure reliability in the results and safety at work in the laboratory guidelines.

In terms of procedure, the student must pass the subject:

1. Understand and discuss basic scientific articles related to the biochemistry of human nutrition.
2. Knowing how to use the basic elements of a biochemistry laboratory.
3. Use spectrophotometric techniques to calculate parameters of metabolic importance
4. Know how to use electrophoretic techniques to separate macromolecules.
5. Analyze and compare the experimental results and assess their importance and limitations.
6. To collect basic information on a topic, prepare a summary and expose their peers.
7. Teamwork in solving problems.

Competences

Specifics		Objectives	
Use and learn the basic language of biochemistry and metabolism especially			
Transverse	Activities	Evaluation	
Communication and oral and written expression	seminars of metabolic pathologies	seminars exposure with computer support	

Subject contents

BIOCHEMISTRY AND METABOLISM

Structural Biochemistry and Enzymology

Item 1. Composition of the living matter. Water and buffer systems

- Constitution of living beings.
- Structure, characteristics and properties of water.
- Biological importance. Distribution in the human body.
- pH concept. Buffers of biological importance.

Item 2. I Biomolecules: Carbohydrates

- General characteristics and classification.
- monosaccharides: structure, properties, derivatives and biological interest.
- Disaccharides. The glycosidic bond. Maltose, cel.lobiosa, lactose and sucrose.

- Oligosaccharides. Structure, properties and biological interest.
- Polysaccharides booking. structure and function of starch and glycogen.
- structural polysaccharides. Cellulose, xylans, glucomannan, chitin.

Item 3. Biomolecules II: lipids

- General characteristics of lipids. Function and classification.
- Fatty acids. physicochemical properties and nomenclature.
- triacylglycerols.
- membrane lipids: glycerophospholipids, sphingolipids and cholesterol.
- Other lipids of biological interest: waxes, soaps, eicosanoids and isoprenoid

Item 4. Biomolecules III: proteins

- Structure, nomenclature and properties of amino acids.
- protein primary structure. The peptide bond.
- Secondary structure: helix and beta pleated sheet.
- Concept of tertiary structure. structural motifs and domains. native structure and denaturation.
- Quaternary structure: oligomeric proteins.
- Fibrous proteins: keratins and collagen.
- Globular proteins: myoglobin and hemoglobin.
- Technical study of proteins. Concept proteomic

Item 5. enzymes, enzyme kinetics and regulation

- Introduction to enzyme catalysis: activation energy.
- Nature, nomenclature and classification of enzymes. Concept isoenzyme.
- enzymatic reaction mechanisms: active center concept
- Prosthetic and coenzymes Groups.
- Effect of pH, temperature and ionic strength on the enzyme activity. Quantitative determination of enzyme activity
- Enzyme kinetics. Michaelis-Menten equation. K_m and V_{max} . Lineweaver-Burk representation.
- irreversible and reversible enzyme inhibition: competitive and noncompetitive.
- regulation of enzyme activity: covalent and allostérica.

Item 6. Vitamins and micronutrients

- Concept of vitamin and micronutrient.
- Fat-soluble vitamins.
- Water-soluble vitamins
- Micronutrients.

Bioenergetics and Metabolism

Item 7. Introduction to bioenergetics

- concept of metabolism and metabolic pathway
- Free energy. Standard free energy change
- endergonic and exergonic reactions
- Coupled reactions •
- Role of ATP
- oxidation-reduction concept
- Main mechanisms of metabolic regulation

Item 8. central routes of oxidative metabolism

- concept of metabolism and metabolic pathway
- Formation of acetyl-CoA: pyruvate dehydrogenase complex.
- citric acid cycle and regulation.
- Anaplerotic reactions
- Anabolic Role of the citric acid cycle

Item 9. Electronic transport and oxidative phosphorylation

- electron transport chain: stages and inhibitors.
- Hypothesis Chemiosmotic Mitchell
- The enzyme ATP synthase
- Launchers. ATP-ADP translocase.
- Energy efficiency
- Decoupling. thermogenesis
- generation of toxic oxygen radicals. physiological importance.

Item 10. glucose metabolism

- Glucolysis: stages, regulation and energy balance. physiological importance.
- Incorporation of other carbohydrates in the glycolytic pathway: galactose and fructose.
- metabolic fates of pyruvate
- anaerobic glycolysis: lactic fermentation.
- glycogen metabolism. Regulation.
- Gluconeogenesis: precursors, stages and regulation.
- Blood glucose monitoring: importance of different organs and tissues
- Via pentose phosphate: steps and regulation. physiological importance.

Item 11. Lipid metabolism

- Oxidation of (beta-oxidation) fatty acids. energy efficiency and regulation.
- Ketones. Origin and regulation. physiological importance.
- Biosynthesis of fatty acids and triglycerides.
- Cholesterol: biosynthesis and regulation.
- Degradation of cholesterol. Acids and bile salts.
- plasma lipoproteins: structure and function.

Item 12. Metabolism of amino acids and proteins

- protein catabolism. protein turnover.
- catabolism of amino acids: transamination and oxidative deamination.
- Urea cycle.
- Destination carbon skeleton of amino acids.
- ammonium metabolism.
- amino acid biosynthesis. Amino acids essential and nonessential.
- compounds Biosynthesis of amino acid derivatives.

Item 13. Metabolism of nucleotides

- Biosynthesis and pyrimidine nucleotides purínics. De novo synthesis and recovery mechanisms.
- Degradation and pyrimidine nucleotides purínics
- Biosynthesis deoxyribonucleotides

Methodology

KEYNOTE SESSIONS

49 Theoretical sessions of approximately 50 minutes where the teacher presents the theme, aided by computer equipment (presentations * * power- point, web pages, etc). These sessions aim to introduce the different topics in students, guide them in their assimilation, highlighting the most important points and facilitate integration globally. It is expected that during classes and encouraged by the teacher, the student contribution and contribute prior knowledge (prior to the completion of the course and prior agenda) and a dialogue to facilitate the teaching of the agenda is established. It is an important part of the course where teachers can go following the progress of the students individually, assessing interest, assistance and spontaneous moments of dialogue or intervention.

LAB PRACTICES

Practice 1. Colorimetric determination of proteins

Determination of total serum protein concentration by colorimetric techniques. Biuret method. Performing a standard curve with bovine serum albumin.

Practice 2. Electrophoretic separation of proteins:

Milk protein separation by electrophoresis with SDS. Coomassie blue staining. Comparison and discussion of results

3. Practice enzyme activity assay

Study of alcohol dehydrogenase activity. Catalyzes reaction and quantification strategies activity. Calculation of enzyme activity and specific activity. Determination of the constants K_m and apparent V_{max} .

Practice 4. Determination of ethanol in beverages

As the content of ethanol by spectrophotometric techniques in wine and beer. Test coupling of two reactions: alcohol dehydrogenase and acetaldehyde dehydrogenase. Determination of the concentration of ethanol from the measurement of NADH formed.

5. Practice Study of iron metabolism

Hematocrit determination

Determination of total iron from human serum

Comparison and discussion of results

6. Test practice glucose tolerance

Measurement of fasting glucose with glucose meter.

Determination of blood glucose curve postabsorptive after ingestion of 75 g glucose solution or an equivalent amount in bread

Comparison and discussion of results

7. Practice Triacylglyceridemia and cholesterolemia

Determination of cholesterol and triglycerides by spectrophotometric techniques

Determination of total cholesterol and HDL cholesterol

Comparison and discussion of results

SEMINARS

Structure of carbohydrates and lipids: Work in the computer room to assimilate various concepts of structure of carbohydrates and lipids seen in theory. (2h)

Protein Structure: Work in the computer room to assimilate various concepts of protein structure seen in a theory. (2h)

Troubleshooting enzymology: practical exercises to facilitate the assimilation of theoretical concepts of enzyme kinetics. (2h)

Apoptosis: programmed cell death concepts to present how the enzyme activity involved in the regulation of other biological phenomena not directly related to metabolism. (1 hour)

Pathologies arising from alterations in metabolism:

Students prepare in small groups (3-5 people) a presentation that integrates the knowledge acquired on aspects of metabolism and diseases resulting from alterations in metabolism, with the guidance and support of the teacher if they consider it. Then they expose their presentation in front of the class, in about 15-20 minutes. It gives time

teaching hours of the subject and teacher support for the preparation and presentation of seminars.

Pathologies arising from alterations in the metabolism of micronutrients
Pathologies arising from alterations in carbohydrate metabolism
Pathologies derived from alterations in lipid metabolism.

(There is available to students a guidance document for the preparation of proposals including seminars and advice to make this work)

Evaluation

- Program of lectures: 50%. 3 exams compounds test questions multiple choice and short-answer questions. To pass the course is necessary for each of the three blocks is overcome with a 4 out of 10 or higher.
- Program of Seminars: 30%. Solving problems. Presentation of chips. Exhibition of work produced and presented by groups. The note of the seminars presented by students will be progressively stricter since after each presentation strengths and points will be reviewed to improve the student / group.
- Laboratory practices: 20%. an examination with short questions regarding the practices carried out will be performed. To be eligible for consideration, you must have attended at least 70% of practices and always, in his absence, must show justification. participation and skill shown in the practice sessions will be assessed if the teacher deems it necessary.

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1. Berg, J.M. Tymoczko, .L., Stryer, L. (2007) Bioquímica. 6ª ed. Editorial Reverté. (Versió en català i en castellà)
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