

MODULE DESCRIPTION (ANALYTICAL PROGRAM).

1. Module Information Code:	
• Name of the Institution and School	Universidad Autónoma de Nuevo León, School of Medicine
• Name of the Learning Unit	Biochemistry and Molecular Biology
• Total classroom hours for theory and/or practice.	129 hours
• Total extra classroom hours	141 hours
• Course Modality	Schooled
• Type of academic period in which the module is offered	1st semester
• Type of Learning Unit in the Curriculum	Compulsory
• Curriculum area:	ACFB Basic
• UANL credit points	9
• Date of module creation:	September 14, 2014.
• Date of last amendment:	March 19, 2020.
• Person(s) responsible for the module design and amendments:	Dra. C Ana María Rivas Estilla.
2. Introduction	
<p>This learning unit is divided in 3 stages or phases which address the following topics: on the first phase, students acknowledge the importance Biochemistry has for the fundamentals of the human body's and cell's composition and chemical functioning. Students reinforce organic chemistry concepts which help them to understand macromolecules' structure and functioning, as well as the features water molecules have which let them function as the main solvent in the organism. In addition, students analyze the vitamins' metabolic function and the diseases which are related to a lack or excess of the vitamins' concentration. Also, they analyze proteins', carbohydrates' and lipids' chemical composition, their different organization levels, as well as the functions they have as structural, transport or oxygen or energy storage biomolecules, catalytic activity, and the changes which appear when there are defects in their synthesis or degradation to detect the alterations which explain the metabolic origin some diseases have.</p> <p>On the second phase, students analyze the integration of carbohydrates, lipids, and nitrogenous compounds metabolism, explaining</p>	

their usage for the functioning of the liver, muscles, adipose tissue, and brain, and the metabolic adaptations these organs make in order to work in the postprandial state, and during an extended fast, taking these organs as a model for understanding the organism's functioning thoroughly.

On the third phase, students analyze Molecular Biology's tenets in the genetic information flow: DNA, from its structure to the important processes such as replication and repairing; RNA structure and transcription, translation, mechanisms and important components of this process, as well as the regulating mechanisms which control the gene expression. There is also a general revision on the applications for different molecular methods used for disease molecular diagnostic and for the biotechnology field.

3. Purpose(s)

This learning unit, through the study of Biochemistry and Molecular Biology, the student analyzes the importance of biochemistry for medicine, the structure and function of the main organism components: amino acids, carbohydrates, lipids, nucleotides, vitamins, and hormones. The will also analyze the metabolic processes from such compounds which make possible for the living organism fulfill its functions in order to have a better understanding of the way biochemical alterations provoke different pathologies.

In the molecular biology phase, students analyze DNA, RNA, and proteins as well as the interactions that occur among them during the cell's or organism's growth and differentiation processes. Additionally, we also establish an organism's general homeostasis molecular basis in order to analyze the causes an inherited or acquired disease has, as well as the basis for different techniques which are used in the molecular diagnostic.

This learning unit allows setting the fundamentals for the medical practice, and provides the basis for a later study of physiology, genetics, pharmacology and toxicology, microbiology, clinical pathology and Medical Sciences I and II. It contributes to the Medical Surgeon and Obstetrician's graduate profile by providing the basis of knowledge needed for maintenance of the body homeostasis, and understand thoroughly the interrelationship between health and disease.

4. Competences of the graduate profile

a. General competences contributing to this learning unit.

Instrumental skills:

1. Apply autonomous learning strategies in the different levels and fields of knowledge that allow them make appropriate and relevant decisions in the personal, academic and professional fields.
2. Use the logical, formal, mathematical, iconic, verbal and non-verbal languages according to their stage of life, in order to understand, interpret and express ideas, feelings, theories and streams of thinking with an ecumenical focus.

3. Use the information and communication technologies as access tools to information and its transformation in knowledge, as well as for learning and collaborative work with cutting-edge techniques that allow its constructive participation in society.

4. Dominate their native language in oral and written form with correctness, relevancy, opportunity and ethics adapting its message to the situation or context, in order to transmit of ideas and scientific findings.

5. Employ logical, critical, creative and proactive thinking to analyze natural and social phenomena that let them make relevant decisions in its area of influence with social responsibility.

Personal and social interaction skills

9. Maintain an attitude of commitment and respect towards the diversity of social and cultural practices that reaffirm the principle of integration in the local, national and international context with the purpose of promoting environments of peaceful coexistence.

10. Intervene in front of the challenges of contemporary society at the local and global level with a critical attitude and human, academic and professional commitment to help consolidate the general wellness and sustainable development.

11. Practice the values promoted by the UANL: truth, equality, honesty, liberty, solidarity, respect for life and anyone's, peace, respect for nature, integrity, ethics behavior and justice, within their personal and professional environment in order to make a sustainable society.

Integrative skills

12. Make innovative proposals based on the holistic understanding of reality to help overcome the challenges of the interdependent global environment.

13. Take the lead according to social and professional needs to promote relevant social change.

14. Resolve personal and social conflicts in accordance with specific techniques in the academic field and their profession for the proper decision making.

15. Achieve the adaptability required in uncertain professional and social environments of our time to improve living conditions.

b. Specific competences of the graduate profile that contributes to the learning unit

Scientific Base of Medicine

1.- To use the scientific foundations of medicine by considering the economical, psychological, social, cultural and environmental factors which contribute to the development and evolution of diseases in order to make decisions and take medical actions.

Professional Clinical Practice

2.- To solve clinical problems through deductive reasoning, interpretation of findings and the definition of their nature in order to make decisions and determine principles of actions of the medical practice to be followed in a responsible way, impacting individual and collective health.

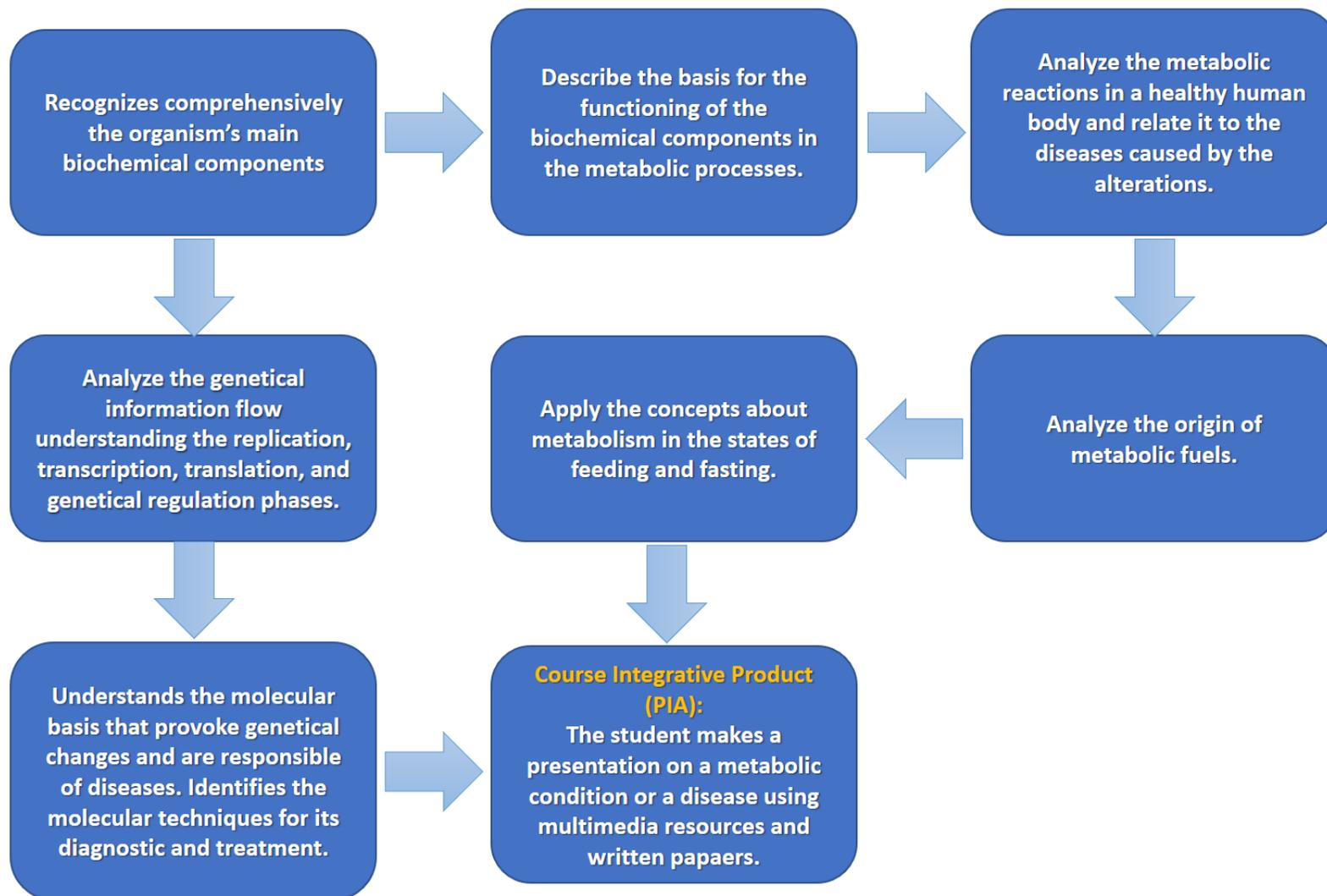
Critical thinking and research

7.- To apply the scientific method in the resolution of medical problems with an innovative, analytical and self-critical attitude toward the prevention, diagnosis and treatment of diseases.

Communication

11.- To apply the principles of effective communication by establishing a respectful and empathetic relationship with the patient, relatives, the community and other health professionals in order to use the information properly.

5. Course roadmap:



6. Structuring into stages or phases

Phase 1: Biomolecules.

Component(s) of the competence:

Analyze the basis of biochemistry recognizing the main biomolecules, their components and functional groups, the different types of links, as well as the properties of a water molecule and vitamins, in order to describe the basis of its functions in the metabolic processes.

Analyze principles of Bioenergy, chemical composition of the main biomolecules, its structures, functions and metabolic reactions in a healthy human body, in order to understand the diseases provoked by alterations in them.

Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
<p>Evidence 1: Concept map about vitamins and a questionnaire about their relationship with diseases caused by a lack or excess of them.</p> <p>Evidence 2: Resolución de un caso clínico relacionado con proteínas especializadas: Hemoglobina</p>	<p>Classifies vitamins according to their solubility.</p> <p>Relates comprehensively the vitamins' functions with the metabolic processes.</p> <p>Includes diseases caused by a lack or excess of vitamins.</p> <p>Relates the structures and functions of globular hemoproteins.</p> <p>Includes hemoglobinopathies caused by alterations in the hemoglobin structure or synthesis.</p>	<p>Knowledge-Acquisition Activities: Professor's lecture The professor guides the students to identify the importance of Biochemistry and the main characteristics of molecular bonds. The professor also solves doubts on the human body biochemical composition and how it relates to its properties.</p> <p>Promotes group discussions for integrating the knowledge acquired.</p> <p>Provides, if necessary, more readings for students to be able to review the concepts from the topic.</p> <p>The professor guides the students to identify the main characteristics biomolecules have and their metabolism.</p> <p>In a group session with the</p>	<p>Conceptual Content:</p> <p>The foundations of Biochemistry and its importance in medicine.</p> <p>Main biomolecules: proteins, carbohydrates, lipids and nucleic acids,</p> <p>Water as a solvent: molecular structure, hydrogen bonds in water</p> <p>Shock absorbers: characteristics, physiological importance</p> <p>Types of links: non-covalent and covalent</p> <p>Vitamins: Classification and functions in the metabolism</p>	<p>Classrooms from the School of Medicine.</p> <p>Biochemistry and Molecular Medicine Laboratories.</p> <p>Text books.</p> <p>Reference books.</p> <p>Handbook for laboratory practices.</p> <p>Internet.</p> <p>Computer.</p> <p>Projector.</p> <p>Speakers.</p> <p>Power point Slides for presentations.</p> <p>Videos.</p> <p>Whiteboard.</p> <p>Markers.</p>

		<p>professor, students review concepts and solve questions.</p> <p>Professor presents a series of clinical cases for these to be solved in groups.</p> <p>Promotes the discussion on the importance of metabolic routes to obtain energy.</p> <p>Learning Activities</p> <p>The students read the passages suggested by the professor and from the analytical program.</p> <p>Discuss in teams an assignment on the new terms' meanings learned and solve questions with the teacher's help.</p> <p>Elaborate a list with the definitions from the concepts reviewed.</p> <p>Relate metabolic processes with health and disease through group discussions.</p> <p>Analyze during the lecture how the water molecule's form affects the properties of this liquid which allows it to function as the main organism's fluid.</p> <p>Describe relevant aspects biochemistry has for medicine.</p> <p>Classify the types of chemical bonds in molecules, explaining the properties each of them</p>	<p>Chemical composition of the main biomolecules, their structures, functions and metabolism</p> <p>Structure and function of proteins:</p> <p>Structure and classification of amino acids according to their nature.</p> <p>Structure and function of proteins, levels of organization</p> <p>Globular (myoglobin and hemoglobin) and fibrous (collagen and elastin) proteins</p> <p>Function, kinetics and properties of enzymes.</p> <p>Intermediate metabolism: Bioenergetics, Gibbs free energy, delta G (+) and (-), ATP synthesis. Respiratory chain, oxidative phosphorylation, Mitchell's chemosmotic hypothesis, decouplers and inhibitors of the respiratory chain.</p> <p>Introduction to carbohydrates: classification, structure, function Digestion of dietary carbohydrates</p> <p>Routes of carbohydrate</p>	
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<p>First Partial Exam .</p> <p>Evidence 3: Clinical case analysis related to carbohydrates metabolism: Diabetes.</p>	<p>Explains the main pathways for carbohydrates metabolism and their regulation.</p> <p>Relates the alterations in carbohydrates metabolism with some metabolic diseases.</p>	<p>have. Explain the alterations in the Hydric balance and the consequences in the metabolism.</p> <p>Define the terms isotonic, hypertonic and hypotonic.</p> <p>Read a text about vitamins.</p> <p>Analyze the concepts of water-soluble and fat-soluble vitamins.</p> <p>Research the diseases provoked by a vitamin lack or toxicity</p> <p>Attend the lab session according to the Schedule programmed.</p> <p>Answer the laboratory practices individually or in team.</p> <p>Analyze and repeat the results obtained, solve problems to apply the knowledge learned, elaborate and hand in a written report following the instructions provided by the professor.</p> <p>Makes a deep reading from the literature recommended by the professor.</p> <p>Research in the book references about proteins, their biochemical composition, their classificaton according to their tridimensional shape and either they work as a subunit or several subunits.</p>	<p>metabolism:</p> <p>Glycolysis.</p> <p>Cycle of tricarboxylic acids.</p> <p>Gluconeogenesis.</p> <p>Glycogen metabolism</p> <p>Metabolism of monosaccharides and disaccharides</p> <p>Pathway of pentose phosphate and NADPH.</p> <p>Glycosaminoglycans.</p> <p>Proteoglycans and glycoproteins.</p> <p>Basis of metabolic diseases related to carbohydrates.</p> <p>Lipid metabolism:</p> <p>Metabolism of dietary lipids.</p> <p>Metabolism of fatty acids and triacylglycerols.</p> <p>Metabolism of complex lipids.</p> <p>Metabolism of cholesterol and steroids.</p> <p>Amino acids: elimination of</p>	
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<p>Second Partial Exam</p> <p>Evidence 4: Clinical case analysis on Colesterol and lipo proteins metabolism.</p>	<p>Describes cholesterol metabolism, and plasma lipoproteins origin and function.</p> <p>Relates defects in cholesterol and lipoproteins metabolism with the risk of cardiovascular diseases.</p>	<p>Discuss the structural and catalytic functions enzymes have and describe the functions that different types of these have.</p> <p>Make a scheme about the electron transport chain representing its compounds, and the spots for transporting electrons, as well as the electrochemical potential development. Students point at the spots which get blocked by the oxidative phosphorylation decouplers.</p> <p>From the text, the student obtains the definitions for metabolism, anabolism, catabolism, intermediate metabolism, metabolic pathway, reactants, products, and the limiting reaction.</p> <p>Defines carbohydrate and what its functions are in the organism. Analyzes the structure, classification and function of the main sugars in the diet. Describes the carbohydrates digestive process. Describes the main metabolic carbohydrates pathways, explaining for each of them the following components:</p> <p>a) substrate, b) regulatory enzyme c) organelle in which it is carried out</p>	<p>nitrogen.</p> <p>Function of aminotransferases, glutamine synthetase and glutaminase.</p> <p>Urea cycle: reactions, global stoichiometry and its regulation.</p> <p>Ammonia metabolism: sources, transport in the circulation, main causes of hyperammonemia.</p> <p>Degradation and synthesis of amino acids:</p> <p>Classification of amino acids: essential, non-essential, glycogenic and/or ketogenic</p> <p>Catabolism of the carbon skeletons of the amino acids.</p> <p>Biosynthesis of non-essential amino acids.</p> <p>Abnormalities in the metabolism of amino acids.</p> <p>Conversion of amino acids into specialized products: porphyrins, catecholamines, neurotransmitters, histamine, creatine and melanin.</p>	
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		<p>d) product(s) e) inhibitors or activators f) the diseases described Relates diseases provoked by defects in the carbohydrates metabolic pathways.</p> <p>Defines lipid and classifies different types of lipid molecules found in the organism. Describes the lipids digestion and absorption processes in the diet. In team work, elaborates a a chart with the names of the main types of lipids, their molecular structure, their properties in the organism and functions in it. Defines what lipids, fatty acids and triacylglycerols are and what functions they have in the organism, as well as the alterations presented when they are not consumed in adequate conditions. Describes each of the pathways for lipids synthesis and degradation mentioned in the chart done in the previous activity. Describes cholesterol, lipoproteins, and steroid hormones metabolism. Identifies the importance of prostaglandinas, trombxanos y leucotrienos synthesis. Classifies essential and non-essential amino acids, pointing</p>	<p><u>Procedural Content</u></p> <ul style="list-style-type: none"> - Understanding and correlation of concepts. - Application and analysis of laboratory procedures: Determination of total proteins in serum using the Biuret method. Determination of lactate dehydrogenase activity and its importance in clinical diagnosis. Identification of biologically important sugars through specific chemical reactions for monosaccharides, reducing sugars, ketoazucars, pentoses and polysaccharides. Determination of blood glucose by the glucose oxidase method. Determination of blood cholesterol by means of an enzymatic method. <p>Laboratory practices: Measures to work safely in the laboratory: General basic recommendations, individual protection, collective protection and classification of potential risk agents in the laboratory. Determination of pH in different solutions: using the colorimetric and potentiometric</p>	
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		<p>out if they are glycogenic or ketogenic. Describes the importance of aminotransferases and glutamine synthetase to eliminate the amino group from amino acids.</p> <p>Analyze the importance of the urea cycle for nitrogen excretion in the human being and the diseases that appear when there are changes in the functioning of this pathway.</p> <p>Schematize the urea cycle</p> <p>Outlines the urea cycle, highlighting the precursors, the enzyme that regulates the pathway and the diseases related to the altered function of any of the enzymes involved in it</p> <p>Describes the causes of hyperammonemia and the reason for it to be considered a medical emergency.</p> <p>Analyzes the catabolism which occurs in carbonated skeletons which result from the deamination of amino acids and identifies the glucogenic amino acids, the ketogenic amino acids, and those which are both at the same time.</p>	<p>method. Buffer solutions:</p> <p>Check the buffer capacity of a phosphate buffer with a concentration of 0.01M and 0.1M by adding acids and bases</p> <p><u>Attitudinal Content</u></p> <ul style="list-style-type: none"> - Willingness to learn and work in teams - Respect for the professor and classmates 	
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		<p>It relates amino acids as precursors of the synthesis of porphyrins, catecholamines, serotonin, neurotransmitters, purines and pyrimidines.</p> <p>Attends the laboratory session according to the appointment scheduled.</p> <p>Completes individually or in team the laboratory practices.</p> <p>Completes homeworks, evaluations and the corresponding written reports following the instructions provided by the professor.</p> <p>Hands in the reports (written in the practices manual) according to the due line agreed for this.</p>		
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Phase 2: Integración del metabolismo				
Component(s) of the competence:				
Applies the concepts of metabolism in the states of feeding and fast in order to understand the mechanisms that regulate the interactions among different organs.				
Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Evidence 5: Analysis of a clinical situation related to the cycle feeding-fast	Explains the main metabolic pathways in the liver, adipose tissue, skeletal muscle, and the brain in either the absorption and fast mode. Describes the relationships among tissues during the feeding and fast cycle, as well as hormonal signs which favor them.	Knowledge-Acquisition activities. The professor helps the students to integrate the knowledge acquired in the exercises for building metabolic maps. The professor provides the students a set of clinical cases for them to be related to metabolic conditions, and in group work, they diagnose a possible cause for the disease. Learning activities. Read the bibliography required by the professor. Compares the active pathways for each organ in the postprandial and fast states, and points out the relationship insulin-glucagon. Describes the importance of adaptations made in the use of metabolic fuels in the process of	<u>Conceptual Content:</u> Postprandial state, fasting, hormones that regulate the use of metabolic fuels. Metabolism of the brain, liver, skeletal muscle and adipose tissue <u>Procedural Content</u> - Understanding and correlation of concepts. - Urine general analysis: physical and chemical properties evaluation. <u>Attitudinal Content</u> - Willingness to learn and work in teams - Respect for the professor and classmates	Classrooms from the School of Medicine. Biochemistry and Molecular Medicine Laboratories. Text books. Reference books. Handbook for laboratory practices. Internet. Computer. Projector. Speakers. Power point Slides for presentations. Videos. Whiteboard. Markers.

<p>Third partial exam.</p>		<p>change from feeding state to fast.</p> <p>In a group activity, student analysis specific pathways on each metabolic condition, discussing the importance they have for the organism's survival.</p> <p>Attends the laboratory session according to the appointment scheduled.</p> <p>Completes individually or in team the laboratory practices.</p> <p>Completes homeworks, evaluations and the corresponding written reports following the instructions provided by the professor.</p> <p>Hands in the reports (written in the practices manual) according to the due line agreed for this.</p>		
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Phase 3: Molecular Biology**Component(s) of the competence:**

Analyze nucleotides, DNA, and RNA structure and function, describing the genetic code's functions and its translation into the protein synthesis, as well as the control mechanisms of the gene expression in order to understand the diseases caused by genetic disorders and identify the molecular techniques for their diagnostic and treatment.

Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
<p>Evidence 6: Clinical case resolution related to the transcription and translation processes.</p>	<p>Describes the principles of genetic transcription and translation.</p> <p>Explains different consequences of the alterations in the nucleotides sequence in the RNA.</p>	<p>Knowledge-acquisition activities:</p> <p>Assign the topics to be presented by each team.</p> <p>Alternated oral questions session.</p> <p>Promotes group discussions.</p> <p>Leads these group discussions. Exposition with presentations and videos.</p> <p>Explains and shows laboratory procedures.</p> <p>Provides the bibliography needed for the course.</p> <p>Verifies that students hand in the written report on time.</p> <p>Checks up the results handed in.</p> <p>Learning Activities:</p> <p>Information search, elaboration of the written report, and team</p>	<p><u>Conceptual content:</u></p> <p>Nucleotide metabolism: Nucleotide structure Synthesis of purine nucleotides Synthesis of deoxyribonucleotides Degradation of purine nucleotides Synthesis and degradation of pyrimidines. DNA structure, replication and repair Structure of DNA. Stages in the synthesis of DNA from prokaryotes Eukaryotic DNA replication Organization of eukaryotic DNA. DNA repair</p> <p>RNA structure, synthesis and processing RNA structure. Transcription of prokaryotic genes.</p>	<p>Classrooms from the School of Medicine.</p> <p>Biochemistry and Molecular Medicine Laboratories.</p> <p>Text books.</p> <p>Reference books.</p> <p>Handbook for laboratory practices.</p> <p>Internet.</p> <p>Computer.</p> <p>Projector.</p> <p>Speakers.</p> <p>Power point Slides for presentations.</p> <p>Videos.</p> <p>Whiteboard.</p> <p>Markers.</p>

		<p>organization.</p> <p>Consult other information sources.</p> <p>Makes schemes.</p> <p>Discuss their points of view inside the team.</p> <p>Discussion and resolution of the problems presented in the case.</p> <p>Concepts and processes analysis through discussions in teams and plenary sessions.</p> <p>Class expositions by teams.</p> <p>The student completes laboratory practices individually or in teams.</p> <p>Attends the laboratory session according to the appointment scheduled.</p> <p>Applies procedures for laboratory practices.</p> <p>Completes homeworks, evaluations and the corresponding written reports following the instructions provided by the professor.</p> <p>Hands in the reports (written in the practices manual) according</p>	<p>Eukaryotic gene transcription. Post-transcriptional modification of RNA</p> <p>Protein synthesis. The genetic code. Necessary components for translation. Recognition of codons by tRNAs Stages in protein synthesis Cotranslational and post-translational modification of polypeptide chains</p> <p>Regulation of gene expression. Sequences and regulatory molecules. Regulation of gene expression in prokaryotes Regulation of gene expression in eukaryotes Biotechnology and human disease. Restriction endonucleases. DNA cloning. Probes. Southern transfer. Length polymorphism of restriction fragments. Polymerase chain reaction. Analysis of gene expression. Gene therapy. Transgenic animals.</p>	
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<p>Fourth partial exam</p>		<p>to the due line agreed for this.</p> <p>Analysis and interpretation of results obtained in the laboratory.</p> <p>Problem solving.</p>	<p><u>Procedural Content</u></p> <ul style="list-style-type: none"> - Understanding and correlation of concepts. - Application and analysis of laboratory procedures. - Laboratory practices. - DNA extraction and analysis. - Electrophoresis for DNA PCR for the amplification of a region of the beta globin gene Electrophoresis for PCR. - Medical bioinformatics. <p><u>Attitudinal Content</u></p> <ul style="list-style-type: none"> - Willingness to learn and work in teams - Respect for the professor and classmates 	
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7. Summative Evaluation:

Learning Evidence 1: Activity related to Amino acids.....	2%
Learning Evidence 2: Clinical case related to specialized proteins: Hemoglobin	2%
Learning Evidence 3: Clinical case analysis related to carbohydrates metabolism: Diabetes.....	3%
Learning Evidence 4: Clinical case analysis related to cholesterol and lipoproteins' metabolism	3%
Learning Evidence 5: Clinical case analysis related to the cycle feeding and fasting.....	3%
Learning Evidence 6: Clinical case resolution related to the transcription and translation processes.....	3%
Laboratory.....	12%
First Partial Exam	12%
Second Partial Exam	12%
Third Partial Exam.....	12%
Fourth Partial Exam.....	12%
Final Evaluation	14%
Course Integrative Product (CIP)	10%
Total.....	100%

8. Course Integrative Product.

Bibliographic research with its corresponding written report as well as a multimedia presentation. These will be evaluated by professors from the department with specific evaluation instruments.

The students research a topic which involves a metabolic situation which appears in situations such as pregnancy, exercising, or any other disease in which the metabolic alterations in the organism can be described.

The requirements are that students develop their research consulting several resources of information and attend two follow-up sessions with the professor to clarify doubts.

9. References

Ferrier, D. R. (2018). *Bioquímica*. Barcelona: Lippincott Williams & Wilkins 7a Edición

McKee, T. & McKee, J. (2014). *Bioquímica: las bases moleculares de la vida*. México: McGraw-Hill.

Vasudevan D. M., Sreekumaris S, Vaidyanathan K. (2011). *Bioquímica*. México: Cuellar-Ayala.

Manual de Laboratorio de Bioquímica. (Agosto-Diciembre 2019). Departamento de Bioquímica y Medicina Molecular. Monterrey, México: Facultad de Medicina, UANL.

Electronic resources:

International Federation for clinical chemistry and laboratory medicine: <http://www.ifcc.org/>

The Journal of biological chemistry/ F1000: <http://www.jbc.org/browserellinks>

HB Minireview: <http://academic.research.microsoft.com>

Cab Direct: <http://www.jstage.jst.go.jp/browse/bbb/-char/en>

APPENDIX.

ASSESSMENT AND WORKLOAD

Module workload		Number of hours	Percentage
Contact hours	Class-based instruction	70 h (54.26%)	47.8% = 129 horas
	Clinical case analysis and resolution	6 h (4.65%)	
	Laboratory practice	42 h (32.55%)	
	Course integrative product (CIP)	3 h (2.32%)	
	Exam taking	8 h (6.20%)	
Independent study	Study	100 h (70.92%)	52.2% = 141 horas
	Exam preparation	41 h (29.07%)	
Total hours of the workload: 30 hours X 9 credits UANL/ECTS*		270 h	

*European Credit Transfer and Accumulation System
1 UANL credit = 30 hours

NOTE: Rubrics, checklists and evaluation formats are elaborated by using the performance criteria described in each stage of the module.

SUPLEMENTO COVID-19

Siguiendo las recomendaciones de la Secretaría de Salud del país y la Rectoría de la Universidad, ante la coyuntura de salud COVID-19, la organización de la docencia desde marzo del 2020, seguirá un modelo híbrido, donde la docencia se ajustará a los horarios aprobados por la Secretaría de Salud siguiendo un modelo de Presencialidad / No presencialidad en la medida en que las circunstancias sanitarias y la normativa lo permitan. Los estudiantes asistirán a las clases de manera no presencial mediante la transmisión de las mismas de manera síncrona/asíncrona vía “on line”.