



مركز الاعتماد  
وإضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

**Course Syllabus**

**Course Name:**

|    |  |                                     |
|----|--|-------------------------------------|
| 1  | Course title   | Biochemistry II for Dental Students |
| 2  | Course number  | 0541231                             |
| 3  | Credit hours (theory, practical)                     | 3 theory                            |
|    | Contact hours (theory, practical)                    | 3 theory                            |
| 4  | Prerequisites/corequisites                           | Biochemistry I for dental students  |
| 5  | Program title  | Doctor of Dental Surgery DDS        |
| 6  | Program code   |                                     |
| 7  | Awarding institution                                 | Faculty of Dentistry                |
| 8  | Faculty  | School of Medicine                  |
| 9  | Department   | Physiology and Biochemistry         |
| 10 | Level of course                                      | Undergraduate                       |
| 11 | Year of study and semester (s)                       | Second year/second semester         |
| 12 | Final Qualification                                  |                                     |
| 13 | Other department (s) involved in teaching the course | None                                |
| 14 | Language of Instruction                              | English                             |
| 15 | Date of production/revision                          | December 2018/2019                  |

**16. Course Coordinator:**

Dr. Diala Abu-Hassan [d.abuhassan@ju.edu.jo](mailto:d.abuhassan@ju.edu.jo)  
 School of Medicine, First Floor  
 +962-6-5355000 ext. 23484

**17. Other instructors:**

Prof. Naif Karadsheh [nsohk@ju.edu.jo](mailto:nsohk@ju.edu.jo)  
 Dr. Faisal Al-Khatib [khatibfa@ju.edu.jo](mailto:khatibfa@ju.edu.jo)  
 Dr. Mamoun Ahram [m.ahram@ju.edu.jo](mailto:m.ahram@ju.edu.jo)  
 Dr. Nafez Abu Tarboush [n.abutarboush@ju.edu.jo](mailto:n.abutarboush@ju.edu.jo)

**18. Course Description:**

This three-credit hour course is mandatory for second-year dental students. The course is preceded by biochemistry I where the introduction to biochemistry via covering the basic concepts of structures and functions of macromolecules has been given. In this course, a detailed description of the various metabolic processes will be given. This includes structure-function relationship of specific proteins, metabolism of energy, carbohydrates, lipids, proteins, and nucleic acids, followed by a brief material that covers nutrition and vitamins with respect to the human body.

**19. Course aims and outcomes:****A- Aims:**

- 1) learn the structure-function relationship of specific proteins
- 2) Know the various human metabolic processes that affect different macromolecules
- 3) Link different macromolecules to the concept of nutrition and vitamins

**B- Intended Learning Outcomes (ILOs):** Upon successful completion of this course students will be able to

Successful completion of the course should lead to the following outcomes:

**A. Knowledge and Understanding:** Student is expected to

- A1- Understand the need for energy in the human body, list the phases of energy transformation, and be familiar with the different bioenergetic terms
- A2- Explain the concept of thermogenesis
- A3- Explain the concept of oxidation-reduction (Redox) reactions and differentiate between the different classes of enzymes responsible for them. Also be able to calculate the energy requirements from the redox potential
- A4- Understand the caloric value of different nutritional fuels
- A5- Explain the concept of energy balance
- A6- Be able to answer why do we need the TCA cycle, explain how different fuels get converted to Acetyl CoA with the detailed description of its fate in the TCA cycle
- A7- Understand and memorize the different reactions coenzymes and enzymes of the TCA cycle
- A8- Understand the concept of substrate level phosphorylation
- A9- Be able to calculate the bioenergetics of the TCA cycle and understand how it is regulated, know the intermediates in relation to amino acids and explain the concept of anaplerotic reactions
- A10- define the oxidative phosphorylation process and know why do we need it
- A11- List the requirements of oxidative phosphorylation, and explain the concept of electrochemical potential gradient with the detailed description of the different oxidation reduction components of the electron transport chain
- A12- Know the proton pumping mechanism & role
- A13- Explain the structure, mechanism and role of ATP synthase
- A14- Understand the mechanism of oxidative phosphorylation blockers & uncouplers
- A15- Explain the classes of genetic diseases associated with the process
- A16- Explain how carbohydrates get digested, absorbed, & transported
- A17- Explain glycolysis (reactions, regulation, energetic, disorders)
- A18- Know the metabolic fate of pyruvate under different conditions, reactions & enzymes involved in these processes
- A19- Explain gluconeogenesis (reactions, regulation, significance)
- A20- Explain glycogen metabolism: glycogenesis reactions, glycogenolysis reactions, significance, regulation, disorders
- A21- Explain the pentose phosphate pathway (reactions, regulation, significance, disorders)
- A22- Understand the concept of oxygen & reactive oxygen species (generation, major cellular sources, fenton reaction, Haber-Weiss reaction)
- A23- Understand the concept of oxygen & reactive oxygen species
- A24- Discuss the effect of nitric oxide & reactive nitrogen-oxygen species, formation of free radicals during phagocytosis & inflammation, cellular defenses against oxygen toxicity

- A25- Describe the uronic acid pathway (reactions & significance)
- A26- Know galactose metabolism & disorders associated
- A27- Know fructose metabolism & disorders associated
- A28- Discuss blood glucose level & regulation
- A29- Explain the general digestion & transport processes of dietary lipids
- A30- Explain the synthesis of chylomicrons, transport in blood & fate
- A31- Explain the synthesis of fatty acids, triacylglycerols, & the major membrane lipids
- A32- Explain the synthesis of triacylglycerols & VLDL particles, their storage & fate
- A33- Discuss the metabolism of glycerphospholipids & sphingolipids
- A34- Explain cholesterol absorption, transport, synthesis, metabolism & fate
- A35- Discuss eicosanoids (metabolism, sources, synthesis)
- A36- Discuss the integration of carbohydrate & lipid metabolism (regulation in the fed & fasting states)
- A37- Discuss protein metabolism (digestion, absorption & transport)
- A38- Define the concept of nitrogen balance
- A39- Know the amino acids pool & protein turn-over processes
- A40- Discuss protein degradation pathways (proteasomes vs. lysosomes)
- A41- Explain the metabolism of the amino group in amino acids (pathways, transamination reactions, diagnostic value of plasma aminotransferases, the oxidative deamination reactions, transport of ammonia)
- A42- Describe the urea cycle in detail (reactions, enzymes, regulation, & diseases associated)
- A43- Explain the metabolism of the carbon skeleton in amino acids (important coenzymes, amino acid synthesis (general features), amino acid degradation (general features), amino acids derived from intermediates of glycolysis, amino acids related to intermediates of the TCA cycle)
- A44- List and discuss diseases & metabolic defects in amino acid metabolism
- A45- Know the conversion process of amino acids to specialized products (porphyrin, catecholamines, histamine, serotonin, creatine, melanin, glutathione)
- A46- Discuss porphyrin metabolism (structure, detailed synthesis & degradation of heme, porphyrias, jaundice & its types, & determination of bilirubin concentration)
- A47- Know the general metabolism of catecholamines, histamine, serotonin, creatine, melanin, & glutathione
- A48- Explain nucleic acids digestion & absorption
- A49- Discuss the biosynthesis of purine nucleotides, DE NOVO synthesis of purine nucleotides (precursors, major steps, & regulation), salvage pathway synthesis of purine nucleotides, synthesis of deoxyribonucleotides
- A50- Discuss the biosynthesis of pyrimidine nucleotides, DE NOVO synthesis of pyrimidine nucleotides & its regulation, salvage pathway for pyrimidine nucleotide synthesis
- A51- Explain the catabolism of purine & pyrimidine nucleotides, the significance of uric acid, & diseases associated with their metabolism
- A52- Discuss the concept of nutrition (classes of nutrients, macronutrients vs. micronutrients, daily requirements, Acceptable Macronutrient Distribution Ranges (AMDR))
- A53- Discuss dietary fats (types, sources, requirements & markers for disease especially CHD)
- A54- Explain the benefit of Mediterranean diet through their contents
- A55- Discuss dietary carbohydrates (types, energy content, fibers, requirements for carbohydrates, & diseases)
- A56- Discuss dietary proteins (quality of proteins, Protein Digestibility-Corrected Amino Acid Scoring (PDCAAS), animal proteins vs. plant proteins, nitrogen balance & protein requirements, protein-calorie malnutrition & diseases associated)
- A57- Define & discuss vitamins, their classification, naming of water soluble ones & list the associated coenzymes & to list the diseases that are associated with water soluble vitamins excess or deficiency
- A58- List fat soluble vitamins & discuss their naming, detailed structure description, mechanism, function, & diseases associated with their excess or deficiency
- A59- List constituents of saliva, detailed description of the protein content and the function of each salivary protein
- A60- Discuss the demineralization process with respect to salivary molecules, peptides, proteins, and chemical content

- A61- Discuss the antimicrobial function of some salivary proteins  
 A62- Know the basic steps of saliva handling and manipulation in research  
 A63- Discuss the role of saliva in as a research material  
 A64- Discuss the role of saliva as a diagnostic material  
 A65- List some diseases where saliva can be a great asset either for diagnosis or research

**B. Intellectual Analytical and Cognitive Skills:** Student is expected to

- B1- Calculate the energy requirements for different reactions  
 B2- Predict the favorability of biochemical pathways  
 B3- Interpret data from biochemical calculations of human processes  
 B4- Differentiate between various carbohydrate metabolic pathways  
 B5- Differentiate between various lipid metabolic pathways  
 B6- Integrate carbohydrate & lipid metabolism  
 B7- Determine healthy diets through its composition

**20. Topic Outline and Schedule:**

| Topic   | Week  | Instructor | Achieved ILOs | Evaluation Methods | Reference                            |
|---|-------|------------|---------------|--------------------|--------------------------------------|
| Bioenergetics of the cell                         | 1     | TBD        | A1-5          | MCQ Exams          | Marks, Ch 19                         |
| Energy Metabolism (TCA cycle)                     | 2     | TBD        | A6-9          | MCQ Exams          | Marks, Ch 20                         |
| Energy Metabolism (Oxidative Phosphorylation)     | 2,3   | TBD        | A10-15        | MCQ Exams          | Marks, Ch 21                         |
| Carbohydrate metabolism & ROS                     | 3-7   | TBD        | A16-28        | MCQ Exams          | Lippincott, Ch. 7,8, 10-14 & handout |
| Lipid metabolism                                  | 7-10  | TBD        | A29-36        | MCQ Exams          | Lippincott, Ch. 15-18, 24            |
| Amino acids & protein metabolism                  | 10-12 | TBD        | A37-44        | MCQ Exams          | Lippincott, Ch. 19-20                |
| Conversion of amino acids to specialized products | 12    | TBD        | A45-47        | MCQ Exams          | Lippincott, Ch. 21                   |
| Nucleic acid metabolism                           | 13,14 | TBD        | A48-51        | MCQ Exams          | Lippincott, Ch. 22                   |
| Nutrition   | 14    | TBD        | A52-56        | MCQ Exams          | Lippincott, Ch. 27                   |
| Vitamins  | 14    | TBD        | A57-58        | MCQ Exams          | Lippincott, Ch. 28                   |
| Biochemistry of teeth and saliva                  | 15    | TBD        | A59-61        | MCQ Exams          | Handout                              |
| Saliva in research and diagnostics                | 15    | TBD        | A62-65        | MCQ Exams          | Handout                              |

**21. Teaching Methods and Assignments:**

Development of ILOs is promoted through the following teaching and learning methods:  
 Lectures and discussions in 100% of lectures

**22. Evaluation Methods and Course Requirements:**

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

| <b>Evaluation</b>   | <b>Point %</b> | <b>Date</b> |
|---------------------|----------------|-------------|
| <b>Midterm Exam</b> | 40%            | TBD         |
| <b>Final Exam</b>   | 60%            | TBD         |

**23. Course Policies:**

A- Attendance policies:

Attendance is mandatory and is checked by the lecturer.

B- Absences from exams and handing in assignments on time:

Excuses are submitted to the office of examinations and arrangements are performed to schedule an incomplete essay exam if absence is accepted by the deanship

C- Health and safety procedures: None

D- Honesty policy regarding cheating, plagiarism, misbehavior:

Misbehaviour is not permitted and is subjected to punishment according to university laws and regulations

E- Grading policy:

Grading policy is approved upon and decided by the faculty council. Exams are scored electronically.

F- Available university services that support achievement in the course:

Lecture halls, computers, and data shows are provided. Textbooks in the library, textbook sale in the bookshop and internet access to resources of the e-library and educational websites.

**24. Required equipment:**

Computers, and data shows.

**25. References:**

A- Required book (s), assigned reading and audio-visuals:

Marks' Basic Medical Biochemistry: A Clinical Approach, 3<sup>rd</sup> Edition  
Lippincott's illustrated reviews, Biochemistry, 6<sup>th</sup> edition

B- Recommended books, materials, and media:

NCBI Bookshelf:

(<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=Books>)

- The Medical Biochemistry Page: (<http://web.indstate.edu/thcme/mwking/home.html>)

- Biochemistry, Garret and Grishan, Second Ed.: <http://web.virginia.edu/Heidi/home.htm>

**26. Additional information:**

- Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.
- For more details on University regulations please visit:  
<http://www.ju.edu.jo/rules/index.htm>

Name of Course Coordinator: Dr. Diala Abu-Hassan.                      Signature: DAH                      Date: 13/12/2016

Head of curriculum committee/Department: Prof. Faisal Mohammad    Signature: -----

Head of Department: Prof. Faisal Mohammad Signature: -----

Head of curriculum committee/Faculty: ----- Signature: -----

Dean: ----- -Signature: -----


Copy to:

Head of Department  
Assistant Dean for Quality Assurance  
Course File

Name of Course Coordinator: **Mamoun Ahram**

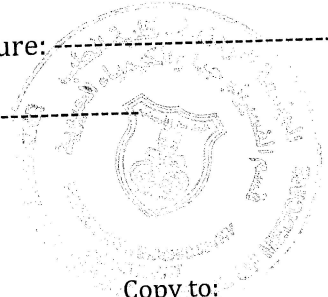
Signature: ----- Date 2022/2023

Head of curriculum committee/Department: ----- Signature: -----

Head of Department: د. نائل سنان Signature: 

Head of curriculum committee/Faculty: ----- Signature: -----

Dean: ----- Signature: -----



Copy to:  
Head of Department  
Assistant Dean for Quality Assurance  
Course File