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| **FORMAN CHRISTIAN COLLEGE (Spring 2023)** |  | **CREDITS (3)** |
| Bioenergetics & Metabolism (BIOT314)  (Pre-requisite: BIOL313) (Sec. A) |  | **Instructor**: **Dr.Aisha Saleem Khan**  **Lec**: MWF (2-2:50) **Room**: S- 425 **Contact No**: 04299231586 **E-Mail**: aishasaleemkhan@fccollege.edu.pk **Office Location**: 118 S-Block **Ext**. **520** **Office Hours**: [MWF 12:00-1:00] |
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| This course explains metabolics and thermodynamics of fundamental processes which take place in eukaryotes in term of energy synthesis and consumption. It will give detailed knowledge on synthesis and breakdown of molecules in relation to Gibbs free energy, enzymes and co-enzymes involved along with their three-dimensional structures. Bioenergetics of processes like glycolysis, citric acid cycle, pentose phosphate pathway, shikimic acid pathway, photosynthesis, fatty acid synthesis, beta oxidation will be explained. Further, learning will be made interesting and easier through visual aids, out of classroom discussions and through mutual discussions  **Objectives**: Major objectives of this course include **i)** to provide importance of energy relations in plants and animals, **ii)** How products of biochemical pathways are related in terms of energy formation and consumption? **iii)** What are possible fates of metabolically important end products? **iv)** How Gibbs free energy is related with these changes? **v)** How carbohydrate metabolism differs from lipid and why?  **Learning Outcomes**: Students will **i)** understand the fundamentals of metabolic reactions and energy relations **ii)** compare the thermodynamics and metabolism of plants and animals **iii)** be able to share their knowledge with other students **iv)** can apply their knowledge in research  **Semester/Attendance Policy**:  **Plagiarism/cheating** cases are in accordance with FCCU policies  **Grading Policy:** Quizzes (15%), Class Activities (10%), Semester Assignment (25%) Mid-Term (25%) and Final Exam (25%).  **Semester Projects:** Students will present Projects on the Topics assigned after mid-term exams and this activity will constitute 25% of the Total Grade (hard copies to be submitted in S- 118) **Text Books**: Essential Biochemistry by C.W Pratt and K. Cornely (3rd Edition)  **Reference Book**: Principles of Biochemistry by Lehninger (available in library), Plant Biochemistry by Hans-Walter Heldt (3rd Edition)  **Teaching Methodology**: White boards, multimedia, online videos and class rooms discussion will be part of teaching methodology. Important videos and information will also be shared through moodle  **Exams**: Objective and Subjective/Problem-based, diagram-based questions, critical thinking questions and problems will be given from topic covered and discussions during the semester |  | **Materials (Week wise) 1st**. **Introduction and concepts in Bioenergetics**, Exergonic and Endergonic reactions, Laws of thermodynamics, linear and branched pathways. Linear, and cyclic pathway **2nd. Relation of free energy, enthalpy and entropy**, problems related, spontaneous reactions **3rd**. **Role and x-ray crystallographic, cryo-electron** **microscopy structure of important enzymes**, coenzymes (NADPH and Acetyl Co-A) (**Quiz 1**) **4th**. **ATP** as energy currency, ATP synthase: structure and function and binding change mechanism, GTP, UTP, CTP role and structure **5rd**. **Glucose Anabolism and standard free energy changes**: Thermodynamics and metabolism of carbohydrate (glucose) synthesis in plants and animals, Gluconeogenesis (**Quiz2**) **6th**. **Photosystems and photophosphorylation** Thermodynamics of Calvin cycle, Role and structure of RuBiSCo **7th. Glucose Catabolism and standard free energy changes**: i) Glycolysis and fates of Pyruvate **8th.** **Classroom activities**  **MID-TERM EXAM**  **9th**. **Glucose Fates ii)** Citric acid cycle and its amphibolic nature, Pyruvate dehydrogenase complex **10th**. **iii)** Pentose Phosphate pathway in plants and animals (**Quiz 3)** **11th**. **Lipids Metabolism**: Role of fatty acids in biological membranes, synthesis in plants and animals **12th**. Beta-oxidation of fatty acids in term of energy synthesis per round **13th. Solving/ Discussion of Exercise questions at end of chapters**  **14th** and **15th** Projects Presentations  **FINAL EXAM** |