

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
COLLEGE OF SCIENCE
Department of Biochemistry and Biotechnology

Course: BCHEM 365
Biophysics
First Semester, August to December 2018

Credits: 3

Instructor: Dr. (Mrs.) Antonia Y. Tetteh
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Class period: Tuesday 4:00 -5:00 pm; Wednesday 8:00 - 10:00 am

Location: TF1

Course Description

During this course we will explore the physical properties of macromolecules of the cell and study the techniques used to investigate their properties, functions, and modifications. Knowledge of these macromolecules would determine their utilities in medical, industrial, pharmaceutical, and agricultural applications. The principles of electrophoresis, microscopy and radiobiology and their applications will be addressed with emphasis on biological.

Course Objectives

By the end of this course, the student will be able to:

1. Describe the physical structure of nucleic acids and proteins
2. Explain how the physical structure of these macromolecules determines the technique for their isolation, purification, characterization and modification
3. Explain how researchers use these techniques to elucidate function, mechanism and manipulation of macromolecules to produce products of importance to health, agriculture, and environment
4. Apply critical thinking to problem solving and decision-making in the use of these techniques
5. Examine scholarly articles and appreciate writing style of articles in the use of electrophoresis, microscopy and radiotracer techniques

Student Learning Outcomes

Upon successful completion of the course, students will:

1. Obtain understanding of macromolecule structure and physical properties
2. Obtain practical understanding of the use of the physical characteristics of macromolecules in their isolation, characterization and elucidating their functions
3. Learn the basic biophysical techniques used in molecular biology and biochemistry
4. Appreciate the writing style of research articles related to biophysics

Course Format

Class will be conducted in lecture format and reading/discussion of scientific research articles, and evidence of learning. All students are expected to be prepared for each class through careful reading of the assigned materials. Brief quizzes will be given every week. There will be examination at the end of every four weeks.

Prerequisites: none

Required text:

Attendance Policy

You are strongly urged to attend all lectures. Attendance will be taken daily by your presence or absence from weekly quizzes.

Grading

2 exams at 10 % each	20%
Mid-Semester exam	10%
Final exam	<u>70%</u>
Total	100%

A	70- 100
B	60-69
C	50-59
D	40-49
F	<40

Exams

Each exam will cover approximately $\frac{1}{3}$ of the material covered in the course. See the tentative schedule for dates and material covered on each exam. Exams will cover material from lecture including slides and handouts. Exams will be multiple choice questions, matching questions, and short essays. Missed exams will be recorded as "0".

Academic Integrity

University regulations require that Instructors remind students that the code of student conduct defines a university policy on academic integrity already pledged by each student at the time of your acceptance of offer of admission to the university. Guidelines set forth in the KNUST Policy on Academic Integrity will be strictly followed. These can be obtained in the student handbook. Plagiarism, cheating and helping others if independent work is requested constitute a violation of the code of conduct. Plagiarism is unethical and will affect your grade. When reading scientific material, take notes. Then take notes on your notes before composing your own sentences. This process will help you avoid copying someone's

writing *verbatim*. Anytime you paraphrase a reference, you are required to cite that reference in your bibliography.

Course Outline

Wed Sept 05	Lecture 1- Review of syllabus; Introduction: Importance of biophysical techniques in the study of the biomolecules, nucleic acids and proteins as well as membranes
Tue Sept 11	Lecture 2- Physical and chemical structure of DNA; Alternative forms of DNA structures; Circular and Superhelical DNA.
Wed Sept 12	Lecture 3- Physical and chemical structure of RNA, proteins
Tue Sept 18	Lecture 4- Physical and chemical structure of proteins: primary, secondary and tertiary structures.
Wed Sept 19	Lecture 5- Theory and methods of electrophoresis. Native and denaturing Gel Electrophoresis; Electrophoresis of nucleic acids. Agarose gel electrophoresis.
Tue Sept 25	Lecture 6- Electrophoresis of Proteins on SDS polyacrylamide gel electrophoresis and their applications
Wed Sept 26	Lecture 7- Isoelectric Focusing (IEF); Two dimensional Gel Electrophoresis; Protein detection techniques
Tue Oct 03	Lecture 8- Electrophoresis of nucleic acids: RFLP, Southern blotting, Northern blotting and Western blotting. Electrophoresis of nucleic acids:
Wed Oct 03	Lecture 9- Genetic fingerprinting, Chain Termination sequencing, Maxam-Gilbert sequencing; Pulsed Field Gel Electrophoresis (PFGE).
Tue Oct 09	Lecture 10 - Characterization of nucleic acids by Affinity Electrophoresis. Exam #1
Wed Oct 10	Lecture 11 - Applications of protein electrophoresis: serum protein electrophoresis; cardiac markers in myocardial infarction, electrophoresis in detection of sickle-cell anemia.
Tue Oct 16	Lecture 12 - Characterization of proteins by Capillary Electrophoresis. Recap on Electrophoresis
Wed Oct 17	Lecture 13- Important parameters in Microscopy. Magnification; Resolving power; Contrast. Phase Contrast Microscopy; DIC Microscopy
Tue Oct 23	Lecture 14- Fluorescence Microscopy. Confocal Microscopy; Electron Microscopy: Transmission Electron Microscopy
Wed Oct 24	Lecture 15 - Scanning Electron Microscopy; Practical Microscopy- Stereomicroscopy
Tue Oct 30	Lecture 16 - Radioisotope techniques: Origin and properties of radioactivity; types of radiation; artificial radioactivity; Atomic Transmutation, Kinetics of radioactive decay; Detection and measurement of Radioactivity Exam #2
Wed Oct 31	Lecture 17 - Labeled tracers: Autoradiography; Phosphorimaging; Liquid Scintillation Counting - technique and application; Non-radioactive tracers
Mon Nov. 05-Fri Nov 09	Mid-Semester Exams
Mon Nov 12-Fri Nov 16	Mid-Semester Break
Tue Nov 20	Lecture 18 - Imaging Techniques; Isotope Dilution; Radiotracer Techniques in Metabolic studies; Autoradiography; Advantages and Restrictions of Radiotracer Techniques

Wed Nov 21	Lecture 19- Applications of radiotracer techniques in Biological Sciences Biological effects of Nuclear Radiation; Radiation Dosimetry; Activation Analysis; Safe Handling of Radioisotopes; Disposal of Radioactive Wastes
Tue Nov 27	Lecture 20 - Introduction to nanotechnology
Wed Nov 28	Student presentation; Last day of class

Final exam: Dec. 03-Dec 21, 2018

General Information

1. There are no extra expenses associated with this course
2. Students are asked to turn cell phones and pagers off during lectures
3. Grades are determined as outlined above. Grades will not be curved.
4. Exams are to be exclusively the student's own work. Students are encouraged to ask questions during class and participate in class discussions; however, students should refrain from extraneous conversations with each other when the instructor or TA is presenting information. Talking at inappropriate times violates academic integrity since you are interfering with another student's desire to hear and see what is going on in class.
5. An 'I' (Incomplete) grade for work not completed because of serious interruption in their work, which is not caused by their own negligence and must be supported by a documented serious event. An 'I' grade must be made up for during the supplementary Examination .