**Course Number:** Pharmaceutical Chemistry 206

**Course Title:** Advanced Pharmaceutical Biochemistry

**Course Description**: The analysis of biochemical processes and cellular structures that serve as targets for drug design and therapeutic intervention

**Course Credit**: 2 units lecture/1 unit laboratory

**Learning Objectives:**

At the end of the course, the student should be able to:

1. know and relate the structure of key biomolecules to their function;
2. know the biological processes that occur during normal and diseased state on cellular and molecular level;
3. understand how certain biomolecules become drug targets; and,
4. know and apply the latest biochemistry and molecular biology techniques used in studying diseases.

**Course Outline:**

**Lecture:**

|  |  |
| --- | --- |
| 1. Introduction to Molecular Cell Biology | **16 hours** |
| A. Protein Structure and Function | 6 hours |
| 1. 3-dimensional Structure of Proteins |  |
| 1. Protein Folding, Dynamics and Structural Evolution |  |
| 1. Protein Sorting |  |
| 1. Structure-Function Relationships in Selected Proteins |  |
| 1. Protein Expression, Purification and Characterization |  |
| B. Expression and Transmission of Genetic Information and Nuclear Control of Cell Activity | 6 hours |
| 1. Review: The Central Dogma |  |
| 1. Molecular Structure of Genes and Chromosomes |  |
| 1. Regulation of Transcription Initiation |  |
| 1. RNA Processing, Nuclear Transport and Post-Transcriptional Control |  |
| 1. DNA Replication, Repair and Recombination |  |
| 1. Regulation of Eukaryotic Cell Cycle |  |
| 1. Gene Control and Development |  |
| C. Biological Membranes and Subcellular Organization of Eukaryotic Cells | 2 hours |
| 1. Structural Organization of Cell Membrane |  |
| 1. Microscopy and Purification of Cells and their Parts |  |
| D. Basic Molecular Biology Techniques | 2 hours |
| * 1. Manipulating Cells and Viruses in Culture |  |
| * 1. Recombinant DNA and Genomics |  |
| * 1. Genetic Analysis in Cell Biology |  |
| 1st Long Examination |  |
| 1. Cell Interactions | **4 hours** |
| 1. Transport Across Cell Membranes | 2 hours |
| * 1. Passive Diffusion |  |
| * 1. Endocytosis/Phagocytosis |  |
| * 1. Membrane Transport Proteins |  |
| 1. Cell Signaling | 2 hours |
| 1. Cell-Cell Adhesion and Communication |  |
| 1. Membrane-Bound Signaling |  |
| 1. Chemical Signaling |  |
| 1. Molecular Physiology | **12 hours** |
| 1. Blood Clotting | 2 hours |
| 1. Fibrinogen and Its Conversion to Fibrin |  |
| 2. Thrombin Activation and the Function of Vitamin K |  |
| 3. Pathways involved in Clotting |  |
| 1. Control of Clotting |  |
| 1. Clot Lysis |  |
| 1. Immunity | 4 hours |
| 1. Organization of Immune System |  |
| 1. The Immune Response: Cellular and Humoral Immunity |  |
| 1. Immunoglobulins and B Lymphocytes |  |
| 1. Major Histocompatibility Complex and T Lymphocytes |  |
| 1. Effector Mechanisms of Immunity |  |
| 1. Mechanisms: Autoimmunity, Allergy, Transplant Rejection, Immunity to Bacteria and Viruses |  |
| 1. Vaccines and Immunotherapy |  |
| 1. Cell Motility and Shape | 2 hours |
| 1. Actin Cytoskeleton and Assembly Dynamics |  |
| 1. Mechanisms and Control of Muscle Contractions |  |
| 1. Actin and Myosin in Nonmuscle Cells |  |
| 1. Cell Locomotion |  |
| 1. Cancer | 4 hours |
| 1. Tumor Cells and the Onset of Cancer |  |
| 1. Proto-oncogenes and Tumor-Suppressor Genes |  |
| 1. Mutations Affecting Cell Proliferation |  |
| 1. Mutations Causing Loss of Cell Cycle Control |  |
| 1. Mutations Affecting Genome Stability |  |
| 2nd Long Examination |  |

**References:**

Alberts B, Johnson A, Lewis J, Raff M, Roberts K, and Walter P. 2002. The Molecular Biology of the Cell.

Lodish H, Berk A, Zipursky S, Matsudaira P, Baltimore D, Darnell J. 2000. Molecular Cell Biology. 4th ed. NY: WH Freeman & Company.

Voet D and Voet J. 1995. Biochemistry. 2nd ed. NY: John Wiley & Sons, Inc.

Whitford D. 2005. Proteins: Structure and Function. Chichester: John Wiley & Sons, Ltd.

**Laboratory:**

**Mini-Research Project (tie up with other institutions NIH/biochem dept )**

|  |  |
| --- | --- |
| Techniques in Biochemistry and Molecular Biology |  |
| * 1. Cell Disruption and Physiological Solutions |  |
| * 1. Cell and Tissue Culture and Microscopy |  |
| * 1. Centrifugation Techniques |  |
| * 1. Immunochemical Techniques |  |
| * 1. Molecular Biology Techniques |  |
| * 1. Protein Isolation and Analysis |  |
| * 1. Enzyme Assays |  |
| * 1. Spectroscopic Techniques |  |
| * 1. Electrophoretic Techniques |  |
| * 1. Chromatographic Techniques |  |
|  |  |

Wilson K and Walker J, ed.1997. Principles and Techniques of Practical Biochemistry. 4th ed. Cambridge: Cambridge University Press.

**Student Evaluation Tool**

**2/3 Lecture:**

|  |  |
| --- | --- |
| Reports | 50% |
| Problem Sets / Take Home Exam/Quiz | 40% |
| Attendance/ Participation | 10% |
| Total | 100% |

**1/3 Laboratory**

|  |  |
| --- | --- |
| Mini-Research Proposal (Written)  Output  Poster/Oral Presentation  Written  Total | 40%  30%  30%  100% |