

# BICH - BIOCHEMISTRY

## **BICH 601 Fundamentals of Biochemistry I**

**Credits 3. 3 Lecture Hours.**

Basic biochemical concepts pertaining to the structure of the major biomolecules (proteins, carbohydrates, lipids and nucleic acids); the relationship of structure to function of these molecules; structure and action of enzymes; principles of bioenergetics.

**Prerequisite:** One year of organic chemistry.

## **BICH 602 Fundamentals of Biochemistry II**

**Credits 3. 3 Lecture Hours.**

Major metabolic pathways for carbohydrates, lipids, amino acids, proteins and nucleic acids, emphasizing oxidative processes and the biosynthesis of RNA, DNA and protein; regulation of cellular metabolism.

**Prerequisite:** BICH 601.

## **BICH 603 Principles of Biochemistry & Biophysics**

**Credits 3. 3 Lecture Hours.**

Principles of Biochemistry & Biophysics. A modern quantitative, analytical and model-building-based approach to expand knowledge of the biochemical and biophysical properties of macromolecules found in living matter, including proteins, lipids, carbohydrates and nucleic acids.

**Prerequisites:** BICH 410 or BICH 601; CHEM 228 and CHEM 323; or approval of the instructor.

## **BICH 605 Methods of Biochemical Analysis**

**Credits 3. 3 Lecture Hours.**

Experimental techniques important in biochemistry including methodologies for data analysis.

**Prerequisite:** Graduate classification in biochemistry or approval of instructor.

## **BICH 606 Foundations of Biochemistry**

**Credits 3. 3 Lecture Hours.**

Exploration of the broad scope of fundamental biochemistry, including structure and function of major biomolecules, organization and regulation of major metabolic pathways and biosynthesis of nucleic acids; emphasis on quantitative approaches and analyses.

**Prerequisite:** CHEM 227 and CHEM 228; or approval of instructor.

## **BICH 608 Critical Analysis of the Biochemical Literature**

**Credits 2. 2 Lecture Hours.**

Reading and presentation of original articles in biochemistry and related fields to enhance understanding of experimental logic and scientific communication.

**Prerequisite:** Graduate classification in biochemistry or approval of instructor.

## **BICH 609 Preparation of a Biochemical Research Proposal**

**Credits 2. 2 Lecture Hours.**

Development and presentation of hypotheses, specific aims, significance and experimental approaches for a biochemical research proposal.

**Prerequisite:** Graduate classification in biochemistry.

## **BICH 624 Enzymes, Proteins and Nucleic Acids**

**Credits 3. 3 Lecture Hours.**

Chemical and physical properties of enzymes, proteins and nucleic acids; thermodynamics, kinetics and mechanisms of enzyme-catalyzed reactions and protein-nucleic acid interactions.

**Prerequisites:** BICH 603; CHEM 324.

## **BICH 625/MCMD 625 Nucleic Acid--Protein Interactions**

**Credit 1. 1 Lecture Hour.**

Mechanisms of nucleic acid-protein interactions involved in fundamental biochemical processes such as DNA replication and rearrangement, transposition, transcription, RNA splicing and translation; original research articles presented focusing on experimental approaches, interpretation of results and overall significance. Course may be taken 8 times for credit.

**Prerequisites:** BICH 431/GENE 431 or GENE 431/BICH 431 or equivalent; approval of instructor.

**Cross Listing:** MCMD 625/BICH 625.

## **BICH 628/CSCE 628 Computational Biology**

**Credits 3. 3 Lecture Hours.**

Introduction to computational biology; formulations of biology problems as computational problems; computational approaches to solve problems in genomics and proteomics.

**Prerequisite:** Graduate classification or approval of instructor.

**Cross Listing:** CSCE 628/BICH 628.

## **BICH 631/GENE 631 Biochemical Genetics**

**Credits 3. 3 Lecture Hours.**

Genetic control of cellular metabolism; mechanism of gene action; gene-enzyme relationships; regulation of gene expression; structure and organization of genomes; biochemical manipulation and characterization of genetic molecules.

**Prerequisites:** BICH 431/GENE 431 or GENE 431/BICH 431; BICH 603.

**Cross Listing:** GENE 631/BICH 631.

## **BICH 637 Advanced Topics in Metabolism**

**Credit 1. 1 Lecture Hour.**

Advanced topics in metabolism; including evaluation of modern scientific literature and historical context; emphasis on critical analysis of scientific literature, experimental design and written and oral science communication.

**Prerequisites:** BICH 603 or approval of instructor.

## **BICH 650/BIOL 650 Genomics**

**Credits 3. 3 Lecture Hours.**

Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics.

**Prerequisite:** Graduate classification or approval of instructor.

**Cross Listing:** BIOL 650/BICH 650.

## **BICH 654 Structural Biochemistry**

**Credits 3. 3 Lecture Hours.**

Basic physics of X-ray diffraction, crystal structure methods, introduction to structural data bases, molecular geometry and molecular modeling.

**Prerequisite:** Approval of instructor.

## **BICH 655 Crystallography Methods**

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

The practice of x-ray diffraction in the study of biomolecules; solving protein crystal structures.

**Prerequisite:** Graduate classification.

## **BICH 656 RNA World**

**Credits 3. 3 Lecture Hours.**

Emphasis on newly discovered RNA-mediated processes and regulation; range of topics in modern RNA biology include RNA silencing; RNA-guided epigenetic regulation, CRISPR/Cas immunity and genome editing, telomerase biogenesis, riboswitches, exosome and editosome; application of RNA biology in medicine and biotechnology.

**Prerequisites:** BICH 301 and BICH 302.

**BICH 657 Introduction to Structural Biology****Credit 1. 1 Lecture Hour.**

Protein expression, purification, characterization, crystallization and structural determination by X-ray crystallography; includes an eight hour workshop on crystallography.

**Prerequisite:** Graduate classification.

**BICH 658 Application of Scientific Values in Daily Research Practice****Credit 1. 1 Lecture Hour.**

Core scientific values motivated by professional research culture in Biochemistry and related fields; exploration of the core values of science; application of values to responsibly, effectively and efficiently navigate daily research practice.

**Prerequisite:** Graduate classification and approval of instructor.

**BICH 661 Advanced Genome Annotation with Ontologies****Credit 1. 2 Lab Hours.**

Advanced topics in functional annotation using ontologies; usage issues and quality control for ontologies and annotations; mentoring annotation activities from BICH 460 and evaluation of annotations. May be taken three times for credit.

**Prerequisite:** Graduate classification or approval of instructor.

**BICH 662 Eukaryotic Transcription****Credit 1. 1 Lecture Hour.**

Intensive short course in molecular mechanisms of eukaryotic transcription, and its regulation.

**Prerequisite:** BICH 631/GENE 631 or GENE 631/BICH 631 or approval of instructor.

**BICH 664 Fluorescence Spectroscopy****Credit 1. 1 Lecture Hour.**

Theory underlying fluorescence spectroscopy as well as practical considerations that must be understood when utilizing fluorescence as an analytical tool; the use of both steady-state and time-resolved fluorescence measurements to evaluate fluorescence quantum yield, quenching, anisotropy, and energy transfer.

**Prerequisite:** Graduate classification.

**BICH 665 Biochemical Kinetics****Credit 1. 1 Lecture Hour.**

Theoretical principles and practical approaches to analysis of chemical kinetics with specific examples of applications to biochemistry and biochemical investigations.

**Prerequisite:** Graduate classification.

**BICH 667 Molecular Probes****Credit 1. 1 Lecture Hour.**

Function of biomolecules in the context of living cells (in cellulo as opposed to in vitro); chemical tools and analytical techniques; application in the investigation of cellular processes; identification of biological problems and design.

**Prerequisite:** Graduate classification.

**BICH 671/MCMD 671 Macromolecular Folding and Design****Credit 1. 1 Lecture Hour.**

Oral presentations and discussions in the general area of biomolecular structure, folding, function and design. May be taken 12 times.

**Prerequisite:** Approval of instructor.

**Cross Listing:** MCMD 671/BICH 671.

**BICH 672/MCMD 672 Biological Membranes****Credit 1. 1 Lecture Hour.**

Seminar-based course examining recent discoveries in the structure, function and assembly of biological membranes; oral presentation by students on current literature in molecular biology and biochemistry.

**Prerequisite:** Approval of instructor.

**Cross Listing:** MCMD 672/BICH 672.

**BICH 673/GENE 673 Gene Expression****Credit 1. 1 Lecture Hour.**

Oral presentations and discussions related to the biochemistry and molecular biology of gene expression in animal, plant and microbial systems. May be repeated for credit up to 12 times.

**Prerequisite:** Graduate classification in biochemistry or genetics or approval of instructor.

**Cross Listing:** GENE 673/BICH 673.

**BICH 674/MCMD 674 Protein Folding and Stability****Credit 1. 1 Lecture Hour.**

Selected topics from recent literature in the general areas of protein folding, structure, and stability.

**Prerequisite:** Approval of instructor.

**Cross Listing:** MCMD 674/BICH 674.

**BICH 675 Plant Biochemistry and Genomics****Credit 1. 1 Lecture Hour.**

Overview of current literature dealing with plant biochemistry/genomics; biochemistry topics will include the function of protein-protein interactions related to plant specific processes such as plant-pathogen interactions; genomics topics will focus on current analysis of plant genomes and how the derived information is being utilized to elucidate biochemical pathways.

**Prerequisite:** Graduate classification.

**BICH 676 Bacteriophage Biology****Credit 1. 1 Lecture Hour.**

Oral presentation and discussion in the general area of the viruses of microbes and bacteria; literature review with a broad scope, from basic molecular biology of phages to practical applications of microbial virus technology. May be taken 12 times for credit.

**Prerequisite:** Approval of instructor.

**BICH 677 Chemical Genetics and Drug Discovery****Credit 1. 1 Lecture Hour.**

Review, discuss and present scientific literature studies based on the usage of small molecules to alter protein function. May be repeated for credit.

**Prerequisite:** Graduate classification.

**BICH 678 Metal Ions****Credit 1. 1 Lecture Hour.**

Understanding the roles of metals in biological systems and the methods used in biochemical and cell biological processes; reading primary research literature critically, critiquing research designs in terms of innovation, significance and logic, and uncovering both strengths and weaknesses of the discussed articles.

**Prerequisites:** CHEM 628 or approval of instructor.

**BICH 679/MGMT 674 Building Scientific Relationships****Credit 1. 1 Lecture Hour.**

Addressing aspects of human element of scientific research; emotional and cultural intelligence, resiliency, team dynamics, leadership, effective communication with others, strategies for conflict resolution and best practices for mentoring undergraduates.

**Prerequisites:** Successful completion of one year of graduate study and affiliation with a research laboratory in the life sciences.

**Cross Listing:** MGMT 674/BICH 679.

**BICH 681 Seminar****Credit 1. 1 Lecture Hour.**

Original articles in biochemistry and related fields designed to broaden understanding of problems in the field and to stimulate research.

**BICH 684 Professional Internship in Biochemistry****Credits 1 to 6. 1 to 6 Other Hours.**

Independent study and supervised experiences related to a professional area or interest in the broad field of biochemistry. May be repeated one time for credit.

**Prerequisites:** Graduate classification in biochemistry; approval of faculty advisor.

**BICH 685 Directed Studies****Credits 1 to 12. 1 to 12 Other Hours.**

Biochemical laboratory procedures; preparations and instrumentation; problems assigned according to experience, interests and needs of individual student.

**Prerequisite:** Approval of instructor.

**BICH 689 Special Topics in...****Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.**

Selected topics in an identified area of biochemistry. May be repeated for credit.

**Prerequisite:** Approval of instructor.

**BICH 690 Theory of Biochemical Research****Credits 2. 2 Lecture Hours.**

State-of-the-art examination of modern trends in various subfields of modern biochemistry concentrating on the design of experiments, evaluation of research results and discussion of the current literature. May be repeated for credit.

**BICH 691 Research****Credits 1 to 23. 1 to 23 Other Hours.**

Research for thesis or dissertation. Laboratory facilities available for original investigations in various phases of biochemistry.

**Prerequisite:** Approval of major advisor.

**BICH 697 Methods in Teaching Biochemistry Laboratory****Credit 1. 1 Lecture Hour.**

Theory and practical aspects of teaching Biochemistry labs, with emphasis on content, grading, instructional methods and practical aspects of biochemistry labs. May be repeated for credit.

**Prerequisite:** Graduate classification in biochemistry.