

BICH - BIOCHEMISTRY (BICH)

BICH 101/GENE 101 Introduction to Biochemical and Genetics Research Methods

Credit 1. 1 Lecture Hour. Foundational concepts for biochemistry and genetics research methods; topics include principles of the scientific method, experimental design, analytical tools, and logical thinking, with a special focus on the use of emerging technologies such as artificial intelligence (AI) in biochemical and genetics research. **Prerequisites:** Freshman classification in biochemistry or genetics. **Cross Listing:** GENE 101/BICH 101.

BICH 102/GENE 102 Introduction to Biochemical and Genetic Techniques

Credit 1. 2 Lab Hours. Introduction to biochemistry and genetics essential techniques; concepts learned from BICH/GENE 101/BICH 101 utilized in practical laboratory situations to understand the relevance and use of these techniques in real-world research settings. **Prerequisites:** Grade of C or better in BICH 101/GENE 101 or GENE 101/BICH 101; freshman classification in biochemistry or genetics. **Cross Listing:** GENE 102/BICH 102.

BICH 201/GENE 201 Introduction to Information Literacy and Artificial Intelligence Tools for Biochemistry and Genetics

Credit 1. 1 Lecture Hour. Introduction to essential skills and knowledge for effective learning, information retrieval, evaluation, and utilization of AI tools in the fields of biochemistry and genetics; developing critical thinking abilities, learning to navigate scientific literature, evaluating the credibility of information sources, and leveraging AI tools to enhance their research and problem-solving capabilities. **Prerequisites:** Grade of C or better in BICH 102/GENE 102 or GENE 102/BICH 102; sophomore classification in biochemistry or genetics. **Cross Listing:** GENE 201/BICH 201.

BICH 202/GENE 202 Biochemical and Genetic Concepts in Medicine - Case Studies

Credit 1. 1 Lecture Hour. Exploration of the link between fundamental genetic and biochemical processes and disease states, using case studies of several human diseases; deeper comprehension and critical thinking about molecular causes of diseases and treatment strategies. **Prerequisites:** Grade of C or better in BICH 201/GENE 201 or GENE 201/BICH 201; sophomore classification in biochemistry or genetics. **Cross Listing:** GENE 202/BICH 202.

BICH 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Introduction to laboratory research. **Prerequisite:** Freshman or sophomore classification in biochemistry or approval of instructor.

BICH 303 Elements of Biological Chemistry

Credits 3. 3 Lecture Hours. Survey of the biochemical sciences designed for the non-biochemistry major; overview of the chemistry and metabolism of biologically important molecules, the biochemical basis of life processes, cellular metabolism and regulation. Students requiring biochemistry in greater depth should register for BICH 410 and BICH 411. **Prerequisites:** CHEM 222, CHEM 227 or CHEM 257; not open to biochemistry majors.

BICH 403 Cellular Biophysics

Credits 3. 3 Lecture Hours. Current topics in cellular biophysics and systems biology; quantitative and predictive perspectives of cellular life; basic tools of biophysics such as fluorescence imaging and data analysis. **Prerequisites:** BIOL 112 and MATH 152; BICH 440 or concurrent enrollment.

BICH 404 Biochemical Calculations

Credits 2. 2 Lecture Hours. Quantitative and computational approaches to biochemical problems. **Prerequisites:** Grade of C or better in BICH 440 or concurrent enrollment; junior or senior classification.

BICH 406 Molecular Mechanisms of Cell Interactions

Credits 3. 3 Lecture Hours. Current topics in biomolecules, natural product antibiotics and application in infectious diseases, modern and historical approaches to antibiotic discovery, biomedical glycobiology, glycosylation in diseases and pathobiology. **Prerequisites:** BICH 441.

BICH 409 Principles of Biochemistry

Credits 3. 3 Lecture Hours. A rigorous, survey of topics in biochemistry; topics include structure and function of molecules within living cells, major metabolic pathways and their regulation and role in disease; provides preparation for advanced study in the health sciences. **Prerequisites:** CHEM 228 or CHEM 258.

BICH 410 Comprehensive Biochemistry I

Credits 3. 3 Lecture Hours. 1 Lab Hour. Structure, function and chemistry of proteins and carbohydrates; kinetics, mechanisms and regulation of enzymes; metabolism of carbohydrates. Not open to biochemistry or genetics majors. **Prerequisites:** CHEM 228 or CHEM 258; junior or senior classification.

BICH 411 Comprehensive Biochemistry II

Credits 3. 3 Lecture Hours. 1 Lab Hour. A continuation of BICH 410; structure, function, chemistry and metabolism of lipids and nucleic acids; cellular metabolism viewed from the standpoint of energetics and control mechanisms; interrelationships of metabolic pathways. **Prerequisite:** BICH 410; not open to biochemistry or genetics majors.

BICH 412 Biochemistry Laboratory I

Credit 1. 3 Lab Hours. Selected methods used to identify, isolate, purify and characterize biomolecules. Not open to biochemistry or genetics majors. **Prerequisite:** BICH 410 or registration therein.

BICH 414 Biochemical Techniques I

Credits 2. 6 Lab Hours. Analysis of the effects of charge on protein function and stability; techniques include site-directed mutagenesis, protein purification, affinity chromatography, SDS-PAGE, enzyme kinetics, MALDI-TOF, molecular modeling, and protein folding. **Prerequisites:** BICH 440, BICH 409, or BICH 410; major in biochemistry, genetics, microbiology, and molecular and cell biology.

BICH 416/GENE 416 Mechanisms of Cell Division

Credit 1. 1 Lecture Hour. Mitotic cell cycle; progression of biochemical and morphological phases and events; duplication of cellular constituents and segregation into daughter cells. **Prerequisites:** BICH 409, BICH 410, or BICH 440; junior or senior classification in biochemistry or genetics. **Cross Listing:** GENE 416/BICH 416.

BICH 419/GENE 419 Computational Techniques for Evolutionary Analysis

Credits 3. 3 Lecture Hours. Computational techniques for studying evolution; algorithms for construction and analysis of evolutionary relationships. **Prerequisite:** Junior or senior classification or approval of instructor. **Cross Listing:** GENE 419/BICH 419.

BICH 420/GENE 420 Bioethics

Credits 3. 3 Lecture Hours. The application of ethical theory to the use of modern genetics and biochemistry stressing the social implications of genetic engineering, agricultural manipulation and biotechnology. **Prerequisites:** GENE 302 or GENE 303; BICH 409, BICH 410, or BICH 440. **Cross Listing:** GENE 420/BICH 420.

BICH 431/GENE 431 Molecular Genetics

Credits 3. 3 Lecture Hours. Molecular basis for inheritance; gene structure and function, chromosomal organization, replication and repair of DNA, transcription and translation, the genetic code, regulation of gene expression, genetic differentiation and genetic manipulations. **Prerequisite:** BICH 409, BICH 410, or BICH 440; GENE 301, GENE 302, GENE 303, GENE 320/BIMS 320 or BIMS 320/GENE 320. **Cross Listing:** GENE 431/BICH 431.

BICH 432/GENE 432 Laboratory in Molecular Genetics

Credits 2. 6 Lab Hours. Laboratory for molecular genetics providing technical experience with tools of molecular biology. **Prerequisite:** GENE 301, GENE 302, GENE 303, BIMS 320/GENE 320 or GENE 320/BIMS 320; BICH 431/GENE 431 or GENE 431/BICH 431. **Cross Listing:** GENE 432/BICH 432.

BICH 440 Biochemistry I

Credits 3. 3 Lecture Hours. Rigorous treatment of the structure, function and chemistry of proteins and carbohydrates; kinetics, mechanisms and regulation of enzymes; metabolism of carbohydrates; designed for biochemistry and genetics majors. **Prerequisites:** Grade of C or better in CHEM 228 or CHEM 258; grade of C or better in BICH 404 or concurrent enrollment.

BICH 441 Biochemistry II

Credits 3. 3 Lecture Hours. Continuation of BICH 440; structure, function, chemistry and metabolism of lipids and nucleic acids, cellular metabolism viewed from the standpoint of energetics and control mechanisms; interrelationships of metabolic pathways. Course designed for biochemistry and genetics majors and honors students only. **Prerequisite:** Grade of C or better in BICH 440.

BICH 450/BIOL 450 Genomics

Credits 4. 3 Lecture Hours. 3 Lab Hours. The study of genomic data includes consideration of the logic behind the most important genomic approaches, as well as their capabilities and limitations in investigating biological processes; the science of accessing and manipulating genomic data; and practical applications, including development of an hypotheses-driven datamining experiment. **Prerequisites:** BIOL 213, GENE 301 or GENE 302, BICH 431/GENE 431 or GENE 431/BICH 431, or BIOL 351; junior or senior classification or approval of instructor. **Cross Listing:** BIOL 450/BICH 450.

BICH 456 Ribonucleic Acid World

Credits 3. 3 Lecture Hours. Emphasis on novel roles and mechanisms of newly discovered Ribonucleic Acid (RNA) species including non-coding RNA's; RNA silencing, circular RNA's, RNA guided epigenetic regulation, clustered regularly interspaced short palindromic repeats (CRISPR)-Cas immunity, genome editing, telomerase biogenesis, riboswitches, exosome, editosome and RNA remodeling. **Prerequisites:** GENE 301, GENE 302, or GENE 303; BICH 410, BICH 440, BIOL 351, or BIOL 413.

BICH 460 Genome Annotation with Ontologies

Credit 1. 2 Lab Hours. Use of ontologies as structured controlled vocabularies for the organization of biological data; annotation based on critical reading of the scientific literature. May be taken two times for credit. **Prerequisite:** Junior or senior classification or approval of instructor.

BICH 464/GENE 464 Bacteriophage Genomics

Credits 3. 1 Lecture Hour. 4 Lab Hours. Examination of the latest technologies in genomic analysis by sequencing and annotating the genomes of novel bacterial viruses (phage); generates real data which will be submitted to the NIH/NCBI public database; includes phage biology and potential uses. **Prerequisites:** GENE 302 or GENE 303; BIOL 351 or concurrent enrollment. **Cross Listing:** GENE 464/BICH 464.

BICH 485 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Directed study in biochemistry not included in established courses. **Prerequisites:** Junior or senior classification; approval of instructor and department head.

BICH 489 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, biophysics or nutrition. May be repeated for credit. **Prerequisite:** Junior or senior classification in life or physical sciences.

BICH 491 Research

Credits 0 to 4. 0 to 4 Other Hours. Laboratory research supervised by faculty in biochemistry or biophysics. **Prerequisite:** Biochemistry major.