DEPARTMENT OF BIOCHEMISTRY/BIOPHYSICS

Curriculum in Biochemistry is administered by the Department of Biochemistry and Biophysics.

Biochemists seek to understand life at the molecular level, including the detailed structures of biological molecules and the chemical reactions in which they participate. They study the molecules of living systems of all kinds, from the simplest viruses and bacteria to higher plants and animals. In their work, biochemists use experimental tools ranging from x-ray crystallography and nuclear magnetic resonance to bioinformatics and genetic engineering. Biochemistry is a dynamic and diverse field that has become the basic discipline for the life sciences, and biochemists have made significant discoveries that relate to medicine, agriculture, and the environment.

Faculty

Ayres, Nicola M, Senior Lecturer
Biochemistry & Biophysics
PHD, University of Nebraska - Lincoln, 1987

Bryk, Mary E, Associate Professor
Biochemistry & Biophysics
PHD, Albany Medical College, 1994

Cho, Jae H, Assistant Professor
Biochemistry & Biophysics
PHD, State University of New York at Stony Brook, 2006

Cruz-Reyes, Jorge A, Professor
Biochemistry & Biophysics
PHD, London School of Hygiene & Tropical Medicine, 1992

Datta, Sumana, Associate Professor
Biochemistry & Biophysics
PHD, University of California - San Diego, 1987

Devarenne, Timothy P, Associate Professor
Biochemistry & Biophysics
PHD, University of Kentucky, 2000

Glasner, Margaret E, Associate Professor
Biochemistry & Biophysics
PHD, Massachusetts Institute of Technology, 2003

Gohil, Vishal M, Assistant Professor
Biochemistry & Biophysics
PHD, Wayne State University, 2005

He, Ping, Professor
Biochemistry & Biophysics
PHD, Kansas State University, 2003

Henderson, Michelle, Lecturer
Biochemistry & Biophysics
PHD, Texas A&M University, 2010

Herman, Jennifer K, Associate Professor
Biochemistry & Biophysics
PHD, Indiana University, 2005

Hu, James C, Professor
Biochemistry & Biophysics
PHD, University of Wisconsin - Madison, 1987

Igumenova, Tatyana I, Associate Professor
Biochemistry & Biophysics
PHD, Columbia University, 2003

Kaplan, Craig D, Associate Professor
Biochemistry & Biophysics
PHD, Harvard University, 2003

Kunkel, Gary R, Associate Professor
Biochemistry & Biophysics
PHD, University of California - Los Angeles, 1977

Kurouski, Dzmitry L, Assistant Professor
Biochemistry & Biophysics
PHD, Suny at Albany, 2013

Li, Pingwei, Professor
Biochemistry & Biophysics
PHD, Peking University, 1996

Meek, Thomas D, Professor
Biochemistry & Biophysics
PHD, Pennsylvania State University, 1981

Miles, Bryant W, Senior Lecturer
Biochemistry & Biophysics
PHD, Texas A&M University, 1998

Mullet, John E, Professor
Biochemistry & Biophysics
PHD, University of Illinois - Urbana-Champaign, 1981

Mullins, Leisha H, Senior Lecturer
Biochemistry & Biophysics
PHD, Texas A&M University, 1989

Panin, Vladislav M, Professor
Biochemistry & Biophysics
PHD, Moscow State University, 1990

Park, William D, Professor
Biochemistry & Biophysics
PHD, University of Florida, 1977

Pellois, Jean-Philippe, Professor
Biochemistry & Biophysics
PHD, University of Houston, 2002

Peterson, David O, Professor
Biochemistry & Biophysics
PHD, Harvard University, 1977

Pishko, Elizabeth J, Lecturer
Biochemistry & Biophysics
PHD, University of Texas, 1993

Polymenis, Michael S, Professor
Biochemistry & Biophysics
PHD, Tufts University, 1994
Reinhart, Gregory D, Professor  
Biochemistry & Biophysics  
PHD, University of Wisconsin - Madison, 1979

Reynolds, Mollie M, Lecturer  
Biochemistry & Biophysics  
PHD, Texas A&M University, 2010

Rye, Chavela M, Lecturer  
Biochemistry & Biophysics  
PHD, MIT, 2014

Rye, Hays S, Associate Professor  
Biochemistry & Biophysics  
PHD, University of California-Berkeley, 1995

Sacchettini, James C, Professor  
Biochemistry & Biophysics  
PHD, Washington University in St. Louis, 1987

Shippen, Dorothy E, Professor  
Biochemistry & Biophysics  
PHD, University of Alabama at Birmingham, 1987

Straight, Paul D, Associate Professor  
Biochemistry & Biophysics  
PHD, University of Colorado, 2000

Young, Ryland F, Professor  
Biochemistry & Biophysics  
PHD, University of Texas at Dallas, 1975

Zeng, Lanying, Assistant Professor  
Biochemistry & Biophysics  
PHD, University of Illinois at Urbana-Champaign, 2007

Zhang, Xiuren, Associate Professor  
Biochemistry & Biophysics  
PHD, Cornell University, 2003

Biochemistry

**BICH 101/GENE 101 Perspectives in Biochemistry and Genetics**  
Credit 1. 1 Lecture Hour.  
Introduction to biochemistry and genetics and their relationship to the biological, biophysical and chemical sciences.  
**Prerequisite:** Biochemistry and genetics major or approval of instructor.  
**Cross Listing:** GENE 101/BICH 101.

**BICH 281 Seminar in Biochemical Research**  
Credit 1. 1 Lecture Hour.  
Round table discussions with visiting seminar speakers; review current literature; topics including cutting edge research in biochemistry.  
**Prerequisites:** BICH 107 and freshman or sophomore classification in biochemistry or approval of instructor.

**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 289 Special Topics in...**  
Credits 1 to 4. 1 to 4 Lecture Hours.  
Selected topics in an identified area of biochemistry. May be repeated for credit.  
**Prerequisite:** Freshman or sophomore classification in biochemistry or approval of instructor.

**BICH 291 Research**  
Credits 0 to 4. 0 to 4 Other Hours.  
Research conducted under the direction of faculty member in Biochemistry. May be taken three times for credit.  
**Prerequisites:** Freshman or sophomore classification and approval of instructor; biochemistry majors only.

**BICH 303 Elements of Biological Chemistry**  
Credits 3. 3 Lecture Hours. 1 Lab Hour.  
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.  
**Prerequisite:** CHEM 222 or equivalent; 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 407 Horizons in Biological Chemistry II**  
Credit 1. 1 Lecture Hour.  
Application of formal classroom instruction; applied view of biochemical concepts; use of biochemical principles to ascertain, evaluate, and make judgments on research information. May be taken five times.  
**Prerequisite:** BICH 411 or BICH 441.
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.
Prerequisite: CHEM 228 or approval of instructor.

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. Not open to biochemistry or genetics majors.
Prerequisite: BICH 410.

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.
Techniques currently used in biochemistry such as spectrophotometry, column chromatography (gel filtration, ion exchange) electrophoresis and immunoelectrophoresis, performed in purification of proteins, enzymes and nucleic acids. For majors in biochemistry, genetics, molecular and cell biology and microbiology.
Prerequisite: BICH 440 or BICH 410.

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 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.
Prerequisites: BICH 410 or BICH 440; GENE 301 or GENE 302 or GENE 320/BIMS 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, 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. Course designed for biochemistry and genetics majors and honors students only.
Prerequisite: Grade of C or better in CHEM 228 and concurrent enrollment in BICH 404, or approval of instructor.

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 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 461 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: BICH 460; junior or senior classification or approval of instructor.

BICH 464 Bacteriophage Genomics
Credits 3. 1 Lecture Hour. 6 Lab Hours.
Examines 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; BIOL 351 or concurrent enrollment; approval of instructor.

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.
**Genetics**

**GENE 101/BICH 101 Perspectives in Biochemistry and Genetics**  
Credit 1. 1 Lecture Hour.  
Introduction to biochemistry and genetics and their relationship to the biological, biophysical and chemical sciences.  
**Prerequisite:** Biochemistry and genetics major or approval of instructor.  
**Cross Listing:** BICH 101/GENE 101.

**GENE 285 Directed Studies**  
Credits 1 to 4. 1 to 4 Other Hours.  
Introduction to laboratory research.  
**Prerequisite:** Freshman or sophomore classification in genetics or approval of instructor.

**GENE 289 Special Topics in...**  
Credits 1 to 4. 1 to 4 Lecture Hours.  
Selected topics in an identified area of genetics. May be repeated for credit.  
**Prerequisites:** Freshman or sophomore classification in genetics; approval of instructor.

**GENE 291 Research**  
Credits 0 to 4. 0 to 4 Other Hours.  
Research conducted under the direction of faculty member in genetics. May be repeated 2 times for credit.  
**Prerequisites:** Freshman or sophomore classification in genetics; approval of instructor.

**GENE 301 Comprehensive Genetics**  
Credits 3. 3 Lecture Hours.  
Survey of the fundamental principles of genetics: Physical basis of Mendelian inheritance, expression and interaction of genes, linkage, sex linkage, biochemical nature of genetic material and mutation. Only one of the following will satisfy the requirements for a degree: GENE 301, GENE 302, GENE 315 or GENE 320/BIMS 320. Not open to biochemistry or genetics majors.  
**Prerequisite:** BIOL 111.

**GENE 302 Principles of Genetics**  
Credits 3. 3 Lecture Hours.  
Mechanisms of inheritance, stressing the conservation of fundamental genetic processes throughout evolution, from bacteria to humans; mutations and phenotypes, Mendelian genetics, population genetics and evolution, and complex inheritance. Course designed for biochemistry, genetics and all majors in biology. Only one of the following will satisfy the requirements for a degree: GENE 301, GENE 302, GENE 315 and GENE 320/BIMS 320.  
**Prerequisite:** BIOL 112; concurrent enrollment in GENE 312.

**GENE 310 Principles of Heredity**  
Credits 3. 3 Lecture Hours.  
Basic principles of classical genetics, molecular genetics, mutation theory and genetic engineering; emphasis on humans and society. Not open to biochemistry and genetics majors.  
**Prerequisite:** Junior classification.

**GENE 312 Comprehensive Genetics Laboratory**  
Credit 1. 0 Lecture Hours. 3 Lab Hours.  
Exercises in Mendelian genetics, meiosis, probability theory in pedigrees, population and quantitative genetics, as well as other genetics theory; molecular techniques to examine DNA and analyze outcomes.  
**Prerequisite:** GENE 301 or GENE 302 or registration therein.

**GENE 315 Genetics of Plants**  
Credits 3. 3 Lecture Hours.  
Fundamental genetic principles as applied to plants: transmission, replication, expression and interaction of genes; linkage, recombination and mapping; chromosomal and gene mutation; behavior of genes in populations; selection, mating systems, cytoplasmic inheritance; molecular analysis and manipulation of genes and gene products; genetically modified plants. Not open to biochemistry or genetics majors. Only one of the following will satisfy the requirements for a degree: GENE 301, GENE 302, GENE 315 or GENE 320/BIMS 320.  
**Prerequisite:** BIOL 101 or BIOL 111.

**GENE 320/BIMS 320 Biomedical Genetics**  
Credits 3. 3 Lecture Hours.  
Fundamental genetic principles as applied to biomedical science; Mendelian inheritance, linkage and genetic mapping, mutagenesis and pedigree analysis; molecular basis of gene function and inherited disease; gene therapy and genetic counseling. Only one of the following will satisfy the requirements for a degree: GENE 301, GENE 302, GENE 315 or GENE 320/BIMS 320.  
**Prerequisite:** BIMS major with a minimum overall 2.5 Texas A&M GPA.  
**Cross Listing:** BIMS 320/GENE 320.

**GENE 404/HORT 404 Plant Breeding**  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Application of genetics and other sciences to breeding and improvement of horticultural crops; methods and special techniques employed. Offered in even numbered years. Only one of the following will satisfy the requirements for a degree: HORT 404/GENE 404 and SCSC 304.  
**Prerequisite:** HORT 201, SCSC 205, or GENE 302, or approval of instructor.  
**Cross Listing:** HORT 404/GENE 404.

**GENE 405/BIMS 405 Mammalian Genetics**  
Credits 3. 3 Lecture Hours.  
Comparative mammalian genetic systems with emphasis on laboratory animals; organization and expression of mammalian genes; development and use of genetically defined animals in biomedical and genetic research.  
**Prerequisite:** GENE 302.  
**Cross Listing:** BIMS 405/GENE 405.

**GENE 406/BIOL 406 Bacterial Genetics**  
Credits 3. 3 Lecture Hours.  
A problem oriented course surveying the manipulation and mechanisms of genetic systems in bacteria; recombination, gene structure and regulation of bacterial genes, plasmids and phages.  
**Prerequisites:** GENE 302; BIOL 351.  
**Cross Listing:** BIOL 406/GENE 406.

**GENE 411 Biotechnology for Crop Improvement**  
Credits 3. 3 Lecture Hours.  
Use of biotechnology to improve agricultural, horticultural and forest crops; techniques and methods used and case studies where biotechnology has been used to alter traits such as pathogen resistance, protein or oil consumption, ripening, fertility and wood properties.  
**Prerequisite:** BIOL 111 or equivalent.  
**Cross Listing:** MEPS 411 and SCSC 411.

**GENE 412 Population and Ecological Genetics**  
Credits 3. 3 Lecture Hours.  
Concepts of population genetics including dynamics of natural populations with emphasis on ecological interactions.  
**Prerequisite:** GENE 302.
GENE 419/BICH 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: BICH 419/GENE 419.

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; BICH 410 or BICH 440.

GENE 421/BIMS 421 Advanced Human Genetics
Credits 3. 3 Lecture Hours.
A rigorous, analytical approach to genetic analysis of humans including diagnosis and management of genetic disease in humans; transmission of genes in human populations; human cytogenetics; the structure of human genes; human gene mapping; molecular analysis of genetic disease; genetics screening and counseling.
Prerequisites: GENE 302; BICH 410 or BICH 440.
Cross Listing: BIMS 421/GENE 421.

GENE 431/BICH 431 Molecular Genetics
Credits 3. 3 Lecture Hours.
Molecular basis for inheritance including 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.
Prerequisites: BICH 410 or BICH 440; GENE 301 or GENE 302 or GENE 320/BIMS 320.
Cross Listing: BICH 431/GENE 431.

GENE 432/BICH 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, or GENE 320/BIMS 320; BICH 431/GENE 431 or GENE 431/BICH 431.
Cross Listing: BICH 432/GENE 432.

GENE 450 Recombinant DNA and Biotechnology
Credits 3. 3 Lecture Hours.
Basic genetic engineering techniques; cloning with plasmid, lambda, cosmid and M13 vectors; gene libraries; DNA sequencing and mutagenesis; PCR; eucaryotic expression with yeast, baculovirus and mammalian vectors; transgenic animals and plants; gene therapy; monoclonal antibodies; bioremediation.
Prerequisites: BICH 431/GENE 431 or GENE 431/BICH 431 or concurrent registration; BICH 411 or 441 or concurrent registration.

GENE 452/BIMS 452 Modifying Mammalian Genomes for Biomedical Research
Credits 3. 3 Lecture Hours.
Review advances in the production of transgenic animals, the manipulation of embryonic stem cells for transgensics and therapeutics, the modification of specific genes in mammalian species by homologous recombination and RNA interference; special emphasis on genetic manipulation of cells and animals for biomedical research, stem-cell and gene therapy.
Prerequisite: BIMS 320/GENE 320, GENE 301 or GENE 320/BIMS 320.
Cross Listing: BIMS 452/GENE 452.

GENE 481 Genetics I Seminar
Credit 1. 1 Lecture Hour.
Seminar topics on recent developments in genetics.
Prerequisites: GENE 302; GENE 431/BICH 431 or concurrent registration; senior classification or approval of instructor.

GENE 482 Genetics II Seminar
Credit 1. 1 Lecture Hour.
Student preparation and presentation of pertinent genetics topics.
Prerequisites: GENE 481; senior classification or approval of instructor.

GENE 485 Directed Studies
Credits 1 to 4. 1 to 4 Other Hours.
Directed study in genetics not included in established courses.
Prerequisites: Junior or senior classification; approval of instructor and department head.

GENE 489 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours.
Selected topics in an identified area of genetics. May be repeated for credit.
Prerequisite: Approval of instructor.

GENE 491 Research
Credits 0 to 4. 0 to 4 Other Hours.
Laboratory research supervised by a faculty member.
Prerequisites: Major in genetics; junior or senior classification in genetics or approval of instructor.