BIOCHEMISTRY

Our Website (http://www.biochem.vt.edu)

Overview

The Bachelor of Science in biochemistry is designed to provide students with a thorough foundation in chemistry and biology and an appreciation of how these sciences are integrated to explore the molecular mechanisms underlying biological processes. The plan of study prepares students for careers in medicine, veterinary medicine, biomedical research, agriculture, industrial biochemistry, or biotechnology. In addition, it provides the background for post-graduate studies in the life sciences or professional studies in medicine, nursing, veterinary medicine, dentistry, pharmacy, and clinical chemistry.

The department offers the undergraduate biochemistry degree in the College of Agriculture and Life Sciences.

Bioinformatics/Genomics

The department supports students' interest in bioinformatics/genomics by providing instruction and laboratory experience in those areas. Students are advised of appropriate supporting courses in computer science that may be used toward a minor in Computer Science.

Satisfactory progress requirements toward the B.S. in Biochemistry can be found on the major checksheet by visiting the University Registrar website at https://www.registrar.vt.edu/graduation-multi-brief/checksheets.html.

Degree Requirements

To qualify for a major in biochemistry, the department requires that students maintain a minimum 2.0 grade point average (GPA) for the hours passed in all required biochemistry, biology, and chemistry courses. In addition, the department requires that a student earn a C- or better in all required biochemistry, chemistry, and biology courses.

The plan of study allows time for qualified students to participate in undergraduate research (BCHM 4994 Undergraduate Research). Qualified students are strongly encouraged to initiate research activity prior to their senior year. A minimum GPA of 2.5 is required for enrollment in BCHM 4994 Undergraduate Research. Students participating in undergraduate research are encouraged to present a senior thesis. Students admitted to the Honors College may use undergraduate research credits toward an Honors Laureate Diploma.

Biochemistry majors may participate in the Cooperative Education Program that alternates academic study with employment experience. Additional information pertaining to the CO-OP program is included in the "General Information" section of this catalog. Summer internships with various businesses and governmental agencies are frequently available, particularly to rising seniors.

The minimum number of credits required for the B.S. in Biochemistry is 120.

The department also offers a graduate program leading to the M.S. and Ph.D. The Department of Biochemistry offers a route to earn a Master of Science in the Life Sciences for students currently enrolled in our B.S. program, who earn an accelerated B.S./M.S. degree combination. Twelve credits may be counted toward the requirements for both degrees.

- Biochemistry Major (https://catalog.vt.edu/undergraduate/agriculture-life-sciences/biochemistry/biochemistry-bs/)

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Associate Head: P. Sobrado
Professors: D. R. Dean, G. E. Gillaspy, P. J. Kennelly, T. J. Larson, J. Li, B. Mukhopadhyay, P. Sobrado, Z. Tu, and J. Zhu
Associate Professors: R. F. Helm, M. W. Klemba, and D. Slade
Assistant Professors: K. D. Allen, B. J. Jutras, C. Lahondere, J. Lemkul, C. Vinauger
Professor of Practice: J. Tokuhisa
Research Assistant Professors: K. Phillips and E. Purwanti
Collegiate Professors: K. Hite, and S. Marine
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Undergraduate Course Descriptions (BCHM)

BCHM 1014 - Biochemistry First Year Experience (1 credit)
Applications of biochemistry in agricultural and life science disciplines; topical research areas in biochemistry; educational requirements and career opportunities for biochemistry majors; critical thinking and data interpretation in biochemistry.

BCHM 1024 - Introductory Experience in Biochemistry Research Skills (1 credit)
Introduction of foundational knowledge on the central tenets of biochemistry and research skills. Development of critical thinking skills and professional development through networks. Collection, analysis, and interpretation of data. Evaluation of literature, use of citation management programs, and development of scientific writing and presentation skills. Data management, visualization, and ethics in the context of biochemistry. Emphasis on teamwork, literature reading, and scientific communication skills.

BCHM 1984 - Special Study (1-19 credits)

BCHM 2024 - Concepts of Biochemistry (3 credits)
Short course in fundamentals of the chemistry of living systems. Introduction to major categories of biochemical substances, metabolic pathways, and principles of biochemical information transfer. (No credit for majors).
Prerequisite(s): CHEM 2514 or CHEM 2535

BCHM 2114 - Biochemical Calculations (2 credits)
Fundamental mathematical relationships in biochemistry. Calculations central to the investigation of biochemical phenomena including aqueous chemistry, spectrophotometry, enzyme kinetics and thermodynamics. Introduction to the core calculations used in experimental biochemistry and the strategies employed for solving biochemical problems.
Prerequisite(s): CHEM 2535 or CHEM 2565

BCHM 2354 - Biochemical Techniques (3 credits)
Fundamental aspects of biochemical laboratory measurements. Properties of biomolecules and methods for their isolation, separation, detection and quantification. Calculations required to provide quantitative biomolecular data. Common instrumentation in biochemical laboratories, their principles of operation, and their roles in biochemical assays and measuring biochemical interactions. Overview of on-line resources for biochemical information.
Prerequisite(s): CHEM 2514 or CHEM 2535 or CHEM 2565

BCHM 2364 - Biochemical Techniques Laboratory (1 credit)
Operation of key equipment found in a biochemistry/molecular biology laboratory (e.g., enzyme kinetics, PCR); analyzes, interpretation and presentation of data acquired in laboratory-based protocols; report of results of experiments; use of laboratory automation for biochemical measurements.
Corequisite(s): BCHM 2354

BCHM 2974 - Independent Study (1-19 credits)

BCHM 2974H - Independent Study (1-19 credits)
Honors section.

BCHM 2984 - Special Study (1-19 credits)

BCHM 2994 - Undergraduate Research (1-19 credits)

BCHM 3114 - Biochemistry for Biotechnology and the Life Sciences (3 credits)
Survey presentation of the basic principles of biochemistry as they apply to biotechnology. Topics covered include protein structure, enzymology, cellular organization, and biochemical regulation. Special emphasis will be given to gene structure, transcription, and translation, cellular organization, and cloning, sequencing, modification and expression of recombinant DNA. Examples will be given of agricultural/medical/industrial applications of cellular and molecular biochemical knowledge. Non-majors only.
Prerequisite(s): CHEM 2536 or CHEM 2566

BCHM 3634 - Analysis of Biochemical Literature (3 credits)
Analysis of primary scientific literature using recently published biochemical research articles. Application of the CREATE model (Consider, Read, Elucidate and generate a hypothesis, Analyze and interpret the data, and Think of next Experiment) as a conceptual framework. Evaluation of article data, limitations and broader impacts. Impact of scientific philosophy, experimental design, and peer review in scientific research and publishing. Pre: Junior standing.
Prerequisite(s): (BIOL 2134 or BIOL 2604) and CHEM 2535

BCHM 3984 - Special Study (1-19 credits)

BCHM 4054 - Genomics (3 credits)
A contemporary analysis of the development, utility and application of high-resolution methods for the study and manipulation of the complete genomes of organisms. The use of new techniques for genomic, metabolic and protein engineering (functional genomics), including high-throughput methods and nanotechnology, will be emphasized.
Prerequisite(s): BCHM 3114 or BCHM 4116 or BIOL 3774
Cross-listed: APSC 4054

BCHM 4074 - Career Orientation (1 credit)
Examination of various career opportunities for biochemists in industry, academia, medicine and related health sciences. Introduction to resources for locating career opportunities, resume preparation and interview skills. Restricted to biochemistry majors. Junior standing required. I
Corequisite(s): BCHM 4115

BCHM 4115 - General Biochemistry (4 credits)
Metabolism and chemistry of carbohydrates, proteins, lipids, and nucleic acids with emphasis on interactions and comparative aspects of microbial, plant, and animal forms. For students in the biochemistry curriculum and other students interested in a foundation course. (Students are required to have at least a C- in both CHEM 2535 and 2536 to be admitted to BCHM 4115).
Prerequisite(s): (CHEM 2536 or CHEM 2566) and (BCHM 2114 or CHEM 2154)

BCHM 4116 - General Biochemistry (3 credits)
Metabolism and chemistry of carbohydrates, proteins, lipids, and nucleic acids with emphasis on interactions and comparative aspects of microbial, plant, and animal forms. For students in the biochemistry curriculum and other students interested in a foundation course. (Students are required to have at least a C- in both CHEM 2535 and 2536 to be admitted to BCHM 4115). I,II
Prerequisite(s): BCHM 4115

BCHM 4124 - Laboratory Problems in Biochemistry and Molecular Biology (6 credits)
Presentation of major analytical techniques of importance to biochemistry and molecular biology, including spectrophotometry, electrophoresis, chromatography. Lab study of selected principles and methods used in biochemistry and molecular biology.
Prerequisite(s): BCHM 4115 and (CHEM 2114 and CHEM 2124) or (CHEM 3114 and CHEM 3124)
Corequisite(s): BCHM 4116

BCHM 4354 - Biochemical Communication (3 credits)
Exploration of how chemical signals are produced, transported, and influence microbes (Bacterial and unicellular organism (chemotaxis), plants, and animals (olfactory neuroethology). Applications to cell biology, neurobiology, and ecology. Analysis of the interaction between biochemical communication systems and health (diseases). Management, statistical analysis, and interpretation of large datasets related to biochemical communication, using computational approaches.
Prerequisite(s): (BCHM 3114 or BCHM 4115) and (STAT 2004 or STAT 3615)

BCHM 4554 - Biophysics for Biochemistry (3 credits)
Thermodynamics, quantum mechanics, and statistical mechanics in biological systems, with emphasis on theoretical understanding of experimental biophysical methods. Fundamental concepts in protein and nucleic acid folding, dynamics from bond vibrations to kinetics and diffusion, molecular orbital theory, protein-ligand interactions and associated molecular visualization tools. Computational modeling, calculations, and simulation using both quantum and classical mechanics.
Prerequisite(s): BCHM 3114 or BCHM 4115

BCHM 4754 - Internship (1-19 credits)

BCHM 4784 - Applications in Molecular Life Science (3 credits)
Synthesis and application of biochemistry, cell biology, genetics, genomics, physiology, immunology concepts and techniques to address medical and agricultural problems. Gene characterization and manipulation, protein-based drugs, diagnostics, vaccines, transgenic plants/animals. Analysis, critique, application of research in molecular life science.
Prerequisite(s): (BCHM 3114 and BCHM 3124 and BIOL 3774 and BIOL 4774) or (BCHM 4116 and BCHM 4124)

BCHM 4974 - Independent Study (1-19 credits)

BCHM 4974H - Independent Study (1-19 credits)
Honors section.

BCHM 4984 - Special Study (1-19 credits)

BCHM 4994 - Undergraduate Research (1-19 credits)

BCHM 4994H - Undergraduate Research (1-19 credits)
Honors section.