Biochemistry (BIOCHM)

BIOCHM 1090: Introduction to Biochemistry
Fundamental concepts in biochemistry and molecular biology: structure function relationships, reactivity, thermodynamics, gene expression. Professional skills for biomedical careers. Graded on A-F basis only.

Credit Hours: 3
Prerequisites or Corequisites: CHEM 1320 or CHEM 1400 and CHEM 1401
Prerequisites: MATH 1100 or MATH 1160 or MATH 1500 and Freshman or Sophomore standing

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BIOCHM 1094: Introductory Biochemistry Laboratory
Techniques course involving biochemical experiments with proteins, nucleic acids, carbohydrates and lipids. Instruction in the use and application of instrumentation in biochemistry; purification or proteins and enzyme activity assays. Focus on interpretation of data and error analysis, critical thought and analytical skills. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: BIOCHM 1090; Biochemistry majors only

BIOCHM 2110: The Living World: Molecular Scale
Survey of modern biochemistry and biotechnology. Structure and function of DNA, proteins, lipids and carbohydrates. The role of biopolymers in life processes and everyday living is emphasized.

Credit Hours: 3
Prerequisites: for non-Biochemistry majors only

BIOCHM 2112: Biotechnology in Society
Biotechnology in a social context covers three areas: introduction to terminology and concepts, specific biotechnological applications to modern problems, and ethical questions.

Credit Hours: 3
Prerequisites: for non-biochemistry majors only

BIOCHM 2112H: Biotechnology in Society - Honors
Biotechnology in a social context covers three areas: introduction to terminology and concepts, specific biotechnological applications to modern problems, and ethical questions.

Credit Hours: 3
Prerequisites: for non-biochemistry majors only

BIOCHM 2480: Introduction to Macromolecular Structure and Function
The function of biochemical macromolecules is directly related to their structure. The three-dimensional structures of proteins, nucleic acids, polysaccharides and membranes are each explored in the context of their functions and their microenvironments within living organisms. Graded on A-F basis only.

Credit Hours: 3
Prerequisites or Corequisites: CHEM 2100 or CHEM 2110
Prerequisites: C- or higher in BIOCHM 1090

BIOCHM 2482: Integrative Cellular and Molecular Biochemistry
This course enhances students' understanding of biochemistry by placing macromolecules and biochemical reactions in a cellular and organismal context. Experimental examples from primary literature are used to introduce students to classical and modern biochemical techniques, so that students develop skills in analyzing and interpreting experimental data relevant to cellular and molecular biochemistry. Students will learn how (sub)cellular compartmentalization plays an important role in the correct outcome of biochemical processes; and how perturbations of cellular biochemical pathways can result in broader biological defects, including in human diseases. This course emphasizes the interdisciplinary nature of biochemistry, thereby encouraging students to think in an integrated manner using different perspectives and approaches. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: BIO_SC 1010 and BIO_SC 1020, or BIO_SC 1030, or BIO_SC 1500; BIOCHM 2480

BIOCHM 2950: Undergraduate Research in Biochemistry
Research for students in which independent research is less than 50% of total. Graded on S/U basis only.

Credit Hour: 1-3
Prerequisites: departmental consent

BIOCHM 3630: General Biochemistry
Survey of biochemistry; static/dynamic aspects of carbohydrates, lipids, proteins, nucleic acid. Discussion of metabolic pathways, energy production, and metabolic regulatory mechanism.

Credit Hours: 3
Prerequisites: CHEM 2030 or CHEM 2100

BIOCHM 4001: Topics in Biochemistry
Experimental courses; highly specialized topics taught infrequently or courses taught by visiting professors.

Credit Hour: 1-99

BIOCHM 4270: Biochemistry
(cross-leveled with BIOCHM 7270). First semester of comprehensive biochemistry course: metabolic pathways, amino acids/proteins, carbohydrates, lipids, nucleic acids, kinetics, energy requirements, metabolic regulation in living cells.

Credit Hours: 3
Prerequisites: CHEM 2110

BIOCHM 4270H: Biochemistry - Honors
(cross-leveled with BIOCHM 7270). First semester of comprehensive biochemistry course: metabolic pathways, amino acids/proteins, carbohydrates, lipids, nucleic acids, kinetics, energy requirements, metabolic regulation in living cells.

Credit Hours: 3
Prerequisites: CHEM 2110; Honors eligibility required

BIOCHM 4272: Biochemistry
(cross-leveled with BIOCHM 7272). Second semester of a comprehensive biochemistry course, including metabolism of carbohydrates, fatty acids, steroids, amino acid synthesis and metabolism, molecular genetics, hormones, photosynthesis and integrated metabolism.

Credit Hours: 3
Prerequisites: C- or higher in BIOCHM 4270

BIOCHM 4300: Physical Chemistry of Biological Systems
To present fundamental principles of physical chemistry in the context of the structure and function of biological macromolecules. Graded on A-F basis only.

Credit Hours: 3
Prerequisites or Corequisites: BIOCHM 4270
Prerequisites: MATH 1500 and PHYSCS 1210 or PHYSCS 2750
Recommended: MATH 1700 and PHYSCS 1220 or PHYSCS 2760

BIOCHM 4385: Problems in Biochemistry

Credit Hour: 1-3
Prerequisites: departmental consent

BIOCHM 4510: Single Molecule Biophysics
(same as PHYSCS 4510; cross-leveled with BIOCHM 7510, PHYSCS 7510). The course provides an overview of the biophysics of enzymes, nucleic acids and the cytoskeleton. Topics covered will include diffusion, molecular motors, polymerization and the cytoskeleton and the polymer properties of nucleic acids and microtubules.

Credit Hours: 3
Prerequisites: PHYSCS 2760

BIOCHM 4945: Experiential Learning in Industry Internship in Biochemistry
Learning experience combining observation, application, and reflection in a discipline-based industry internship. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

Credit Hours: 0
Prerequisites: instructor's consent

BIOCHM 4950: Advanced Undergraduate Research in Biochemistry
Research credit for students doing an independent research project under the guidance of a faculty member. Project must be arranged by student and faculty member prior to registration. Graded on A-F basis only.

Credit Hour: 1-3
Prerequisites: departmental consent

BIOCHM 4955: Experiential Learning in Research in Biochemistry
A supervised learning experience contributing to faculty research. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

Credit Hours: 0
Prerequisites: instructor's consent

BIOCHM 4964: Industrial Internship with Eurofins
This 5-credit course is a school and field-based learning experience combining the study, observation, and employment with Eurofins laboratories in Columbia, MO. The internship provides opportunities to apply skills, concepts and theories about biochemistry and analytical chemistry in a practical context. The purpose of the internship experience is to provide the intern with the opportunity to develop knowledge and skills deemed desirable for a career in the biotechnology industries. During the time indicated in this agreement for the internship experience, the intern is expected to become a productive employee of Eurofins. This course will provide technical instruction on commonly used laboratory skills and instrumentation at the University of Missouri followed by technical instruction on software and instrumentation at Eurofins. After the training period, the interns will have the opportunity to work at Eurofins full time for the summer.

Credit Hours: 5
Prerequisites or Corequisites: BIOCHM 4272
Prerequisites: BIOCHM 1090, BIOCHM 4270
Recommended: CHEM 3200

BIOCHM 4970: Senior Problem Based Learning in Biochemistry
Problem-based learning course applying fundamental concepts of biochemistry. Primary literature is used to create case-based learning which is then applied to one of the following: 1) NSF/NIH style research proposal, 2) a biotechnology-based project development or 3) a research review publication. A major portion of the course is conducted in small groups to enhance peer-to-peer learning and to advance understanding. This is intended to develop scientific writing skills, team-work, communication skills, leadership skills and deductive reasoning skills within the content of your major. Graded on A-F basis only.

Credit Hours: 3
Prerequisites or Corequisites: BIOCHM 4272
Prerequisites: BIOCHM 4270 and ENGLSH 1000

BIOCHM 4970W: Senior Problem Based Learning in Biochemistry-Writing Intensive
Problem-based learning course applying fundamental concepts of biochemistry. Primary literature is used to create case-based learning which is then applied to one of the following: 1) NSF/NIH style research proposal, 2) a biotechnology-based project development or 3) a research review publication. A major portion of the course is conducted in small groups to enhance peer-to-peer learning and to advance understanding. This is intended to develop scientific writing skills, team-work, communication skills, leadership skills and deductive reasoning skills within the content of your major. Graded on A-F basis only.

Credit Hours: 3
Prerequisites or Corequisites: BIOCHM 4272
Prerequisites: BIOCHM 4270 and ENGLSH 1000

BIOCHM 4971: Biochemistry of Obesity
The incidence of obesity and associated comorbidities has grown to epidemic proportions. In this course, students will explore the biochemical basis for body weight and energy homeostasis, and the mechanisms of dysregulation that can lead to obesity. Metabolism of carbohydrates and lipids will be reviewed, and their complex hormonal regulation will be introduced. Students will examine the biochemical bases of several fad diets or nutritional regimens, and the intersection between socioeconomic status and nutrition that can lead to obesity. The format of the course relies largely on the learning strategy employed by the MU School of Medicine, in which the students are given the responsibility for researching relevant topics (learning objectives) and teaching them to the rest of the class. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: BIOCHM 4270

BIOCHM 4972: Post-Normal Biochemistry
Post-normal science refers to research and results that have influence far beyond the laboratory, impacting issues in law, ethics and public policy. In this seminar-style course, students will explore the intersection of science, politics and public attitudes. They will apply their scientific training to explore issues that affect them as informed consumers and voters in a democratic society. Students will develop skills that will help them understand and communicate to the general public the scientific foundations underlying potentially contentious issues. Critical thinking skills will be honed through reflective writing assignments. Extensive classroom discussions will explore the means and consequences of the spread of misinformation, and how it can be combated. Graded on A-F basis only.

Credit Hours: 2
Prerequisites or Corequisites: BIOCHM 4272
Prerequisites: BIOCHM 4270

BIOCHM 4974: Biochemistry Laboratory
(cross-leveled with BIOCHM 7274). Techniques course involving analytical experiments with carbohydrates, lipids, proteins, nucleic acids; use of instrumentation in biochemistry; purification and kinetics of enzymes. One of two capstone courses required for biochemistry majors.

Credit Hours: 5
Prerequisites or Corequisites: BIOCHM 4272

BIOCHM 4974H: Biochemistry Laboratory - Honors
(cross-leveled with BIOCHM 7274). Techniques course involving analytical experiments with carbohydrates, lipids, proteins, nucleic acids; use of instrumentation in biochemistry; purification and kinetics of enzymes. One of two capstone courses required for biochemistry majors.

Credit Hours: 5
Prerequisites or Corequisites: BIOCHM 4272; Honors eligibility required

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BIOCHM 4974W: Biochemistry Laboratory - Writing Intensive
(cross-leveled with BIOCHM 7274). Techniques course involving analytical experiments with carbohydrates, lipids, proteins, nucleic acids; use of instrumentation in biochemistry; purification and kinetics of enzymes. One of two capstone courses required for biochemistry majors.

Credit Hours: 5
Prerequisites or Corequisites: BIOCHM 4272

BIOCHM 4978: Cancer Biology
(same as BIO_SC 4978; cross-leveled with BIOCHM 7978, BIO_SC 7978). The cellular and molecular basis of cancer, with emphasis on the application of genomics, proteomics, and genetic manipulations in model organisms to the study of cancer biology.

Credit Hours: 3
Prerequisites: BIO_SC 2200 and BIO_SC 2300 or BIOCHM 4270
Recommended: BIO_SC 4976 or BIOCHM 4272

BIOCHM 4996H: Honors Thesis Research in Biochemistry
Laboratory research for honors students doing an honors thesis research project in their final two semesters. Enrollment limited to Honors eligible students with senior standing who have CAFNR honors approval. Graded on A-F basis only.

Credit Hour: 1-3
Prerequisites: departmental consent

BIOCHM 7085: Problems in Biochemistry
Problems in Biochemistry.

Credit Hour: 1-6
Prerequisites: Consent of Director of Graduate Studies required

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BIOCHM 7270: Biochemistry
(cross-leveled with BIOCHM 4270). First semester of comprehensive biochemistry course: metabolic pathways, amino acids/proteins, carbohydrates, lipids, nucleic acids, kinetics, energy requirements, metabolic regulation in living cells.

Credit Hours: 3
Prerequisites: CHEM 2110

BIOCHM 7272: Biochemistry
(cross-leveled with BIOCHM 4272). Second semester of a comprehensive biochemistry course, including metabolism of carbohydrates, fatty acids, steroids, amino acid synthesis and metabolism, molecular genetics, hormones, photosynthesis and integrated metabolism.

Credit Hours: 3
Prerequisites: BIOCHM 7270

BIOCHM 7274: Biochemistry Laboratory
(cross-leveled with BIOCHM 4974). Techniques course involving analytical experiments with carbohydrates, lipids, proteins, nucleic acids; use of instrumentation in biochemistry; radioisotope tracers in metabolism; isolation, purification and kinetics of enzymes.

Credit Hours: 5
Corequisites: concurrent enrollment in BIOCHM 7270

BIOCHM 7510: Single Molecule Biophysics
(same as PHYSCS 7510; cross-leveled with BIOCHM 4510, PHYSCS 4510). The course provides an overview of the biophysics of enzymes, nucleic acids and the cytoskeleton. Topics covered will include diffusion, molecular motors, polymerization and the cytoskeleton and the polymer properties of nucleic acids and microtubules.

Credit Hours: 3
Prerequisites: PHYSCS 2760

BIOCHM 7978: Cancer Biology
(same as BIO_SC 7978). The course will cover major molecular and cellular aspects of cancer. Students will read original research articles, present overviews and lead class discussions.

Credit Hours: 3
Prerequisites: BIOCHM 4270, BIO_SC 2300 and BIO_SC 4976

BIOCHM 8060: Ethical Conduct of Research
(same as BIO_SC 8060). Discussion of ethical issues in biological research, including the rules and conventions for appropriate research conduct. Graded on S/U basis only.

Credit Hour: 1

BIOCHM 8070: Professional Communication Development
(same as BIO_SC 8070, MICROB 8070). The purpose of this course is to develop professional communication skills in students that are planning to attend graduate school or are in their first year of graduate training. Graded on A-F basis.

Credit Hour: 1-2
Prerequisites: Graduate standing is required. Graduate students must be be enrolled in one of the PhD programs in the life sciences at MU and have completed less than 30 credit hours of graduate study at MU. Graduate students who participate in the IMSD T32 training program are required to take this class. IMSD T32 trainees are students who are enrolled in one of four PhD programs (Biochemistry, Biology, MPT or BBCE) and are from backgrounds that are underrepresented in the biomedical sciences. Other graduate students in their first year of graduate school will be allowed to take this class, with permission of the instructor

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BIOCHM 8090: Research in Biochemistry
Research in biochemistry for qualified students, with counsel of faculty. Includes preparation of dissertation. Graded on a S/U basis only.

Credit Hour: 1-99
Prerequisites: Consent of Director of Graduate Studies required

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BIOCHM 8200: Principles and Research Practices in Biochemistry
This course is to be taken by first year graduate students, and focuses on professional skills and basic principles and research practices applicable to Biochemistry and broadly to other STEM fields to provide first year students with background information to help launch their graduate careers. Key topics covered include understanding research experimental design, critical evaluation of the literature (library and online resources), best practices in publication, grant writing, and communicating science

through both written and oral scientific presentations. Graded on A-F basis only.

Credit Hours: 2

BIOCHM 8240: Introduction to Graduate Biochemistry I
(same as TR_BIOSC 8500). Introduction to biochemistry for life science graduate students. Core course for Biochemistry students. This course is designed for first-year graduate students in Biochemistry. This course has two goals: (1) to provide the students with a core knowledge of fundamental biochemistry and biology that is the underpinning of current biomedical and basic research; (2) to provide students with the tools that will allow them to read, understand and critically analyze the primary biochemical and biomedical literature. To this end, the course covers aspects of biochemistry, cell biology, virology, immunology, molecular biology and physiology. The course is taught using a combination of faculty lectures and primary research articles.

Credit Hours: 3
Prerequisites: Undergraduate organic chemistry plus undergraduate biochemistry or molecular biology, their equivalent or permission of instructor

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BIOCHM 8260: Macromolecular Systems Integration
To introduce graduate students to biochemistry at the graduate level with particular emphasis on genomics/gene expression and replication; proteomics/cell signaling and metabolism. Course graded on A-F basis only.

Credit Hours: 4
Prerequisites: BIOCHM 8240

BIOCHM 8362: Introduction to Plant Metabolism
(same as PLNT_SCI 8362, BIO_SC 8362). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis in plant biology. This course examines the basic concepts and techniques used to understand plant metabolism. Graded on A-F basis only.

Credit Hours: 2

BIOCHM 8365: Introduction to Molecular Cell Biology
(same as BIO_SC 8365, PLNT_SCI 8365). This course is part of a series that aims to provide a solid conceptual foundation in interdisciplinary plant biology for graduate students with a research emphasis on plant biology. This course examines the basic concepts and techniques used to understand molecular cell biology. Graded on A-F basis only.

Credit Hours: 2

BIOCHM 8432: Enzymology and Metabolic Regulation
A basic introduction to the study of enzymes and their role in intermediary metabolism. Topics include enzyme kinetics, mechanisms of enzymatic catalysis and control of metabolic pathways.

Credit Hours: 3
Prerequisites: BIOCHM 7272

BIOCHM 8434: Signaling in Molecular Cell Biology
The objective of this course is to provide important foundations in cellular signaling in the context of biochemistry and cell biology for first and second year graduate students. The course focuses on cell-to-cell communication and intracellular signaling via different classes of cell surface receptors using specific receptor paradigms from human, other animals, plants, yeast and E.coli. Primary literature will be used for in-class discussions and homework assignments to highlight key experiments and introduce students to relevant experimental techniques. Graded on A-F basis only.

Credit Hours: 3
Recommended: BIO_SC 2300, BIOCHM 4270

BIOCHM 8450: Rotation Research
Introductory laboratory research. Graded on A-F basis only. Normally 1 hour per advisor per semester, two-1 hour sections can be taken per semester.

Credit Hour: 1-2

BIOCHM 9001: Topics in Biochemistry
Experimental courses, highly specialized topics taught infrequently or courses taught by visiting professors.

Credit Hour: 1-9

BIOCHM 9087: Seminar in Biochemistry
Review of current literature; individual presentation of research or classical science topics. In addition to the weekly class sessions, for certain sections, students will be required to attend Department of Biochemistry's weekly seminar (or other Instructor approved seminar) and to provide written reflection. For these sections of BIOCHM 9087 students will register for 2 credit hours to accommodate the increased class time and require work load (additional assignments).

Credit Hour: 1-2

BIOCHM 9090: Research in Biochemistry
Research in biochemistry for qualified students, with counsel of faculty. Includes preparation of dissertation. Graded on a S/U basis only.

Credit Hour: 1-99

BIOCHM 9200: Structural Biology for the Life Sciences
This team-taught course offers a survey of structural biology methods and applications used in modern life sciences research. Topics include navigating the Protein Data Bank, introductions to the major macromolecular structure determination methods of cryo-electron microscopy and X-ray crystallography, practical structural bioinformatics, and how to critically assess structural information. The course is geared toward graduate students in the life sciences and does not require previous experience/knowledge of any of the methods to be covered. Anticipating a diverse audience, the course begins with an introduction to protein structure to help students gain the necessary foundation for the rest of the course. The course will include traditional lectures, but will also incorporate discussions and student presentations, as a goal of the course is for students to learn how to read and present papers. Teamwork will be emphasized, as this is an essential skill for working in a research laboratory. A laptop is required for in-class data analysis. Graded on A-F basis only.

Credit Hours: 3
Recommended: Graduate Standing; BIOCHM 4270 or equivalent

BIOCHM 9432: Molecular Biology II
(same as MICROB 9432, BIO_SC 9432) Detailed experimental analysis of eukaryotic cellular and molecular biology relevant to cellular and viral gene expression, post-transcriptional and post-translational modifications and genome replication. Models for developmental genetic analysis and genetic determinants controlling developmental processes utilizing the current literature will be examined.

Credit Hours: 4

BIOCHM 9462: Hormone Action
(same as PIBS 9462). A lecture course with weekly assigned readings. Topics will include: a description of selected polypeptide, steroid and other hormones and their biological effects; receptors; second messengers; protein phosphorylation in hormone mediation; growth factors; cellular oncogenes.

Credit Hours: 2
Prerequisites: BIOCHM 7272

BIOCHM 9468: Molecular Biology of Plant Growth and Development
(same as BIO_SC 9468). Molecular biology of plant hormones, signal transduction, environmental signals.

Credit Hours: 3