

BBMB Graduate Course Offerings 2020-2021

*Offered Fall 2020

Courses primarily for graduate students, open to qualified undergraduates. Experimental Courses are designated with an "X" after the course number. An experimental course must be offered and taught at least once before it will be added to the ISU course catalog.

***BBMB 504:** Amino Acids and Proteins. (2-0) Cr. 2. F. Prereq: [CHEM 332](#) or equivalent.
Review of amino acids and proteins, including atomic interactions, thermodynamics, structure and properties of amino acids, post-translational modifications, protein expression, purification and analysis, protein secondary, tertiary and quaternary structure, protein folding, oxygen transport and hemoglobin, models for equilibrium binding, elementary reactions and enzyme kinetics, biosynthesis of amino acids: pathways and mechanisms.

Instructor: Hargrove (8/17/2020-10/9/2020)

***BBMB 505:** Bioenergetics and Metabolism. (2-0) Cr. 2. F. Prereq: CHEM 211, CHEM 332; a previous course in biochemistry is strongly recommended

Examination of catabolic pathways involved in the oxidation of organic and inorganic molecules, and energy metabolism involving inputs from light or other non-light sources. Central metabolism and glycolysis, fermentation, aerobic and anaerobic respiration, photosynthesis.

Also offered online as [BBMB 505 XW](#) (F.S.) Standard instate tuition and a College Delivery Fee applies.

Instructor: Myers (10/05/2020-11/25/2020)

***BBMB 506:** Membrane Biochemistry. (2-0) Cr. 2. Prereq: [CHEM 332](#) or equivalent

Analysis of the structure, function, and synthesis of membranes. Bacterial and eukaryotic membrane characteristics. Membrane transport and signaling mechanisms. Analysis of the structure and function of lipids and membrane proteins.

offered online as [BBMB 506 XW](#) (F.S.) Standard instate tuition and a College Delivery Fee applies.

Instructor: Underbakke

***BBMB 507:** Biochemistry of Nucleic Acids. (2-0) Cr. 2. S. Prereq: [CHEM 332](#) or equivalent

Analysis of the chemical structure, function, synthesis, and metabolism of nucleic acids. Chemical characterization of nucleotides, polynucleotides, DNA, and RNA. Analysis of transcription, translation, and the genetic code.

offered online as [BBMB 507 XW](#). (F.S.) Standard instate tuition and a College Delivery Fee applies.

Instructor: Nelson

***BBMB 510:** Molecular Biology and Biochemistry of RNA. (2-0) Cr. 2. Alt. F., offered even-numbered year. Prereq: [BIOL 313](#), [BBMB 405](#), BBMB 502, [BBMB 506](#) and 507 or [GEN 409](#), or equivalent

Biochemical processes that define structure and function of nucleic acids. Emphasis on the molecular processes that take place during synthesis, processing, and function of different RNA species; review of recent advances in RNA research.

Meets Cell biology specialty area requirement.

Instructor: MacIntosh

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BBMB 512X: Principles of Glycobiology. (2-0) Cr. 2. Alt. S., offered odd-numbered year. Prereq: 3 credits in Organic Chemistry.

Structure, synthesis, and functions of glycans, glycoproteins, glycolipids, and glycosylated secondary metabolites in prokaryotic and eukaryotic organisms. Fundamental role of glycans in living organisms along with the most advanced techniques used for their characterization. Biotechnological applications of glycans and glycoconjugates for human needs.

Meets Cell biology specialty area requirement.

Instructor: Zabotina

BBMB 530: Prokaryotic Diversity and Ecology (Dual-listed with BBMB 430). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years. Prereq: [MICRO 302](#), [MICRO 302L](#)

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

Meets Cell biology specialty area requirement.

Instructor: Bobik

BBMB 531X: Plant Biochemistry. (2-0) Cr. 2. F. Prereqs: BBMB 301 or equivalent.

In-depth exploration of plant biochemistry with a focus on the unique aspects of plants versus heterotrophic organisms. Analysis of unique pathways, metabolic trafficking between unique organelles and tissues, and techniques for their characterization.

Also offered online as [BBMB 531 XW](#). Standard instate tuition and a College Delivery Fee applies

Meets Bio-organic mechanism specialty area requirement

Instructor: Peters

BBMB 532: Enzyme Kinetics and Mechanisms. Cr. 2. Alt. S., offered odd-numbered years.

Prereq: [BBMB 504](#)

Advanced concepts of enzyme kinetics and catalysis. Experimental methods for determining kinetic and chemical reaction mechanisms. Enzyme structure/function relationships and the role of dynamics in catalysis.

Meets Bio-organic mechanisms specialty area requirement.

Meets Physical biochemistry specialty area requirement

Instructor: Nelson

BBMB 542 A-G are cross-listed courses offered for 1 credit each that focuses on a specific lab technique and is usually taught in a core instrumentation service facility of the Office of Biotechnology by faculty/staff.

***BBMB 542A:** Introduction to Molecular Biology Techniques: DNA Techniques. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S. Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

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BBMB 542B: Introduction to Molecular Biology Techniques: Protein. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS. Prereq: Graduate classification

Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

BBMB 542C: Introduction to Molecular Biology Techniques: Cell Techniques. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S. Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

BBMB 542D: Introduction to Molecular Biology Techniques: Plant Transformation. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S. Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only.

***BBMB 542E:** Introduction to Molecular Biology Techniques: Proteomics. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F. Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

BBMB 542F: Introduction to Molecular Biology Techniques: Metabolomics. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F. Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

BBMB 542G: Introduction to Molecular Biology Techniques: Genomic. (Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S. Offered on a satisfactory-fail basis only.

BBMB 549X: Nuclear Magnetic Resonance Spectroscopy. (Cross-listed with CHEM 549X). (3-0) Cr. 3. F. Prereq: any one of the following: CHEM 324, CHEM 325, BBMB 461, BBMB 561.

Theoretical principles of NMR, practical aspects of experimental NMR, solution and solid state NMR, methodologies for molecule characterization, protein structure determination, NMR relaxation, and recent advances.

Instructors: Bruce Fulton (BBMB), Aaron Rossini (Chemistry)

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BBMB 551X: Computational Biochemistry. (2-0) Cr. 2. Alt. S., offered even-numbered years. Prereq: BBMB 404 or equivalent.

Biological and structural databases, molecular visualization, sequence comparisons, homology searches, sequence motifs, construction of phylogenetic trees, structure comparisons, protein structure predictions, RNA structure predictions, molecular docking, metabolic pathways .

Meets Physical biochemistry specialty area requirement

Instructor: Jernigan

***BBMB 553X.** Current Research in Chemical and Physical Biology. (2-0) Cr. 2. Alt. F., offered even-numbered years. Prereqs: BBMB 404 or equivalent.

Principles and applications of chemical and physical methods to analyze biological structures and function ranging from cells to individual biomolecules. Synthetic and biosynthetic strategies, cell surface engineering, single molecule and super-resolution spectroscopy and imaging, membrane biophysics, and use of nuclear magnetic resonance.

Meets Physical biochemistry specialty area requirement

Instructor: Shin

BBMB 561: Molecular Biophysics. (Dual-listed with BBMB 461). (2-0) Cr. 2. S. Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.

Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

Instructors: Honzatko, Moss and Roche

BBMB 561L: Laboratory in Molecular Biophysics. (1-3) Cr. 2. S. Prereq: Credit or enrollment in BBMB 461/BBMB 561

Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy as applied to macromolecules.

Instructor: Honzatko, Moss and Roche

***BBMB 569:** Bioinformatics III (Structural Bioinformatics). (Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. F. Prereq: BCB 567, BBMB 316, GEN 409, STAT 430

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

Meets Physical biochemistry specialty area requirement.

Instructor: Jernigan, Song (Com S)

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BBMB 590: Special Topics. Cr. arr. By arrangement.

BBMB 593: Workshop in Biochemistry and Biophysics. Cr. 1. Repeatable. F.S. Prereq: Permission and signature of course administrator required.

Workshops in selected topics in biochemistry and biophysics. Credit in this course does not meet the requirement for advanced graduate electives in Biochemistry. Spring only: BBMB Undergraduate Research Symposium participation. Scheduled class meetings are required in addition to attending the symposium.

Instructor: MacIntosh for Stupka Symposium, Spring semester

Courses for graduate students:

BBMB 615: Molecular Immunology. (Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years. Prereq: BBMB 405 or BBMB 506 and BBMB 507

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

Meets Cell biology specialty area requirement.

Instructor: Andreotti

BBMB 645: Molecular Signaling. (2-0) Cr. 2. Alt. S., offered odd-numbered years.

Prereq: BBMB 405 or BBMB 420; or BBMB 506 and BBMB 507

Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, and nuclear receptors. Discussion includes a variety of cell surface receptors and their hormone; growth factor and extracellular matrix activators; protein kinases; caspase and transcription factor downstream signals; lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and research proposal writing.

Meets cell biology specialty area requirement.

Instructor: Nilsen-Hamilton

BBMB 661: Current Topics in Neuroscience. (Cross-listed with GDCB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years. Prereq: NEURO 556 (or comparable course) or permission of instructor

Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

Meets Cell biology specialty area requirement.

Instructor: J. Johansen

***BBMB 675:** Nucleic Acid Structure and Function. (2-0) Cr. 2. Alt. F., offered even-numbered years.

Prereq: BBMB 405 or BBMB 506 and BBMB 507

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In-depth discussion of nucleic acid properties, structures and structure/function relationships. Interactions between nucleic acids and proteins will be emphasized.

Meets Cell biology specialty area requirement.

Instructor: Shogren-Knaak

BBMB 676: Biochemistry of Gene Expression in Eucaryotes (Cross-listed with MCDB). (2-0) Cr. 2. Alt. S., offered even-numbered years. Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511

Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

Meets Cell biology specialty area requirement.

Instructor: Nilsen-Hamilton

***BBMB 681:** Advanced Seminar. Cr. 1. Repeatable. F.S. Prereq: Permission of instructor
Student presentations.

Instructor: Shin

***BBMB 682:** Departmental Seminar. Cr. R. F.S. Prereq: Permission of instructor
Faculty, staff and invited guest research seminar.

Instructors: Thornburg, K. Johansen

BBMB 696: Research Seminar. (Cross-listed with AGRON, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable. Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

Instructor: Howell

BBMB 698: Seminar in Molecular, Cellular, and Developmental Biology. (Cross-listed with GDCB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.

Student and faculty presentations.

Instructor: J. Johansen

***BBMB 699:** Research. Cr. arr. Repeatable. F.S. Prereq: Permission of instructor
Rotation Students Section/Reference#: **Section I, Reference #2038040**

Graduate Studies Course

***GR ST 565.** Responsible Research Conduct (1-0) Cr. 1. F.S.

Prereq: Graduate classification

Ethical and legal issues facing researchers in the sciences and engineering.