

Biomedical Sciences

Professional Program of Study

For professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

A good foundation in anatomy, physiology, and pharmacology of animals is necessary to understand the mechanisms of animal disease processes and their treatment. Study of mammalian anatomy and physiology prepares students with a background in the structural and functional activities of cells, tissues, organs, and body systems relevant to veterinary medicine.

An understanding of drug action is essential for rational drug therapy. The general pharmacology courses provide students with a background in basic pharmacology to include pharmacodynamics, toxicology, and the clinical application of drugs. Special emphasis is placed on chemical agents and therapeutic practices specific to veterinary medicine.

Graduate Programs

The department offers Master of Science and Doctor of Philosophy degrees with a major in Biomedical Sciences and specializations in Anatomy, Physiology, Pharmacology, and Cell Biology. Up to 10 credits of dual-listed veterinary courses may be applied for major graduate credit. Departmental research facilities allow for training in experimental anatomy, pharmacology, and physiology. Graduate studies are supervised by faculty members recognized in their areas of expertise. Current areas of research include: Alzheimer's disease, aquatic animal health, calcium and mineral homeostasis, diabetes mellitus, glia-neuron signaling, neurophysiology of pain, neurotoxicology, physiology and pharmacology of nematode ion-channels, Parkinson's disease, pharmacology of schistosomiasis, pharmacology of salmonellosis, physiology and pharmacology of thalamic neurons, physiology of the retina, Spinal Muscular Atrophy, and study of neural stem cells. The objective of the department is to prepare graduate students for successful careers in biomedical research and professional service. The department is part of interdepartmental programs in neuroscience, toxicology, and molecular, cellular, and developmental biology. The combined Ph.D./DVM program is an option offered by the department.

Courses primarily for professional curriculum students:

B M S 329. Anatomy and Physiology of Domestic Animals.

(3-0) Cr. 3. S. *Prereq: BIOL 212, BIOL 212L*

Survey of body systems of domestic animals. Provides a medical science orientation particularly useful to students in a preveterinary medicine curriculum.

B M S 330. Principles of Morphology I.

(Dual-listed with B M S 530). (3-6) Cr. 5. F. *Prereq: First-year classification in veterinary medicine*

Anatomy of the dog.

B M S 331. Principles of Morphology II.

(Dual-listed with B M S 531). (2-6) Cr. 4. S. *Prereq: First-year classification in veterinary medicine. B M S 330*

Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 333. Biomedical Sciences I.

(Dual-listed with B M S 533). (5-3) Cr. 6. F. *Prereq: First-year classification in veterinary medicine*

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 334. Biomedical Sciences II.

(Dual-listed with B M S 534). (5-3) Cr. 6. S. *Prereq: First-year classification in veterinary medicine*

Microscopic anatomy of the immune system and integument. Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 335. Molecular and Cellular Basis of Disease.

(1-0) Cr. 1. F.

Descriptions of molecular and cellular biology especially as it pertains to veterinary medicine. Discussions of cellular components, cellular functions and anomalies thereof. Emphasis placed on divergences relevant to companion animals and livestock.

B M S 336. Veterinary Nutrition.

(2-0) Cr. 2. F.

Introduce basic biochemical aspects of metabolism and function of energy, protein, fat, minerals and vitamins in the diet. Determine nutrient requirements of food animals, pets, and horses under various physiological states. Understand fate of various nutrients in simple stomached animals, ruminants, and cecal fermenters. Discuss clinical nutrition problems specific to each species.

B M S 337. Neuroanatomy.

(Dual-listed with B M S 537). (2-2) Cr. 3. S. *Prereq: First-year classification in veterinary medicine*

Neuroanatomy of domestic animals.

B M S 339. Clinical Foundations I.

(Cross-listed with V C S). (0-2) Cr. 1. F. *Prereq: First-year classification in veterinary medicine*

Canine physical examination; basic behavior, animal handling and restraint; medical record keeping.

B M S 345. Case Study I.

(0-2) Cr. 1. F. *Prereq: First-year classification in veterinary medicine*

Clinical applications of basic sciences taught concurrently in the fall semester of the first year curriculum in veterinary medicine.

B M S 346. Case Study II.

(0-1) Cr. 1. S. *Prereq: First-year classification in veterinary medicine*

Clinical applications of basic sciences taught concurrently in the spring semester of the first year curriculum in veterinary medicine.

B M S 353. Topics in Molecular Veterinary Medicine.

(Dual-listed with B M S 553). (1-0) Cr. 1. S. *Prereq: Enrollment in or completion of B M S 354*

Receptor and signal transduction anomalies and their diagnosis in veterinary medicine.

B M S 354. General Pharmacology.

(Dual-listed with B M S 554). (Cross-listed with TOX). (3-0) Cr. 3. S. *Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405*

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 401. Intro to Aquatic Animal Medicine.

(Cross-listed with A ECL). (1-2) Cr. 1. S.

8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

B M S 403. Behavior of Domestic Animals.

(1-0) Cr. 1. Alt. S., offered 2012. *Prereq: Classification in veterinary medicine*

Normal and abnormal behavior of domestic animals.

B M S 415. Anatomy of Laboratory Animals.

(Dual-listed with B M S 515). (1-2) Cr. 2. Alt. S., offered 2012. *Prereq: One year of college biology*

Gross and microscopic anatomy of laboratory animals.

B M S 416. Avian Anatomy.

(Dual-listed with B M S 516). (1-2) Cr. 2. Alt. S., offered 2013. *Prereq: One year college biology*

Gross and microscopic anatomy of domestic, exotic, and pet birds.

B M S 421. Special and Applied Anatomy of the Horse.

(1-3) Cr. 2. F. *Prereq: B M S 330 or B M S 331 or AN S 316 or AN S 415, classification in veterinary medicine*

Special and applied anatomy of the horse. Nonmajor graduate credit.

B M S 443. Pharmacology and Therapeutics.

(Dual-listed with B M S 543). (3-0) Cr. 3. F. *Prereq: B M S 354*

Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 490. Independent Study.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 490H. Independent Study, Honors.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 496. International Preceptorship.

(0-40) Cr. 1-12. Repeatable. S. *Prereq:* Second-year classification in veterinary medicine

International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Courses primarily for graduate students, open to qualified undergraduates:

B M S 501. Selected Research Methods in Biomedical Sciences.

(0-8) Cr. 3. F.S.SS. *Prereq:* Graduate classification, permission of a BMS faculty member

Experience in biomedical techniques in selected BMS laboratories that include but is not limited to cytochemical methods, molecular biological techniques, extracellular and intracellular unit recording, microiontophoresis, microinjection, spectrophotofluorometric analysis of chemicals, use of radioisotopes, radioimmunoassay, Ca²⁺ imaging, confocal microscopy, fluorescence microscopy, and immunocytochemistry.

B M S 515. Anatomy of Laboratory Animals.

(Dual-listed with B M S 415). (1-2) Cr. 2. Alt. S., offered 2012. *Prereq:* One year of college biology and graduate classification

Gross and microscopic anatomy of laboratory animals.

B M S 516. Avian Anatomy.

(Dual-listed with B M S 416). (1-2) Cr. 2. Alt. S., offered 2013. *Prereq:* One year college biology

Gross and microscopic anatomy of domestic, exotic, and pet birds.

B M S 530. Principles of Morphology I.

(Dual-listed with B M S 330). (3-6) Cr. 5. F. *Prereq:* 10 credits in biological science and permission of the instructor

Anatomy of the dog.

B M S 531. Principles of Morphology II.

(Dual-listed with B M S 331). (2-6) Cr. 4. S. *Prereq:* B M S 530

Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 533. Biomedical Sciences I.

(Dual-listed with B M S 333). (5-3) Cr. 6. F. *Prereq:* First-year classification in veterinary medicine or graduate student status

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 534. Biomedical Sciences II.

(Dual-listed with B M S 334). (5-3) Cr. 6. S. *Prereq:* First-year classification in veterinary medicine or graduate student status

Microscopic anatomy of the immune system and integument. Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 537. Neuroanatomy.

(Dual-listed with B M S 337). (2-2) Cr. 3. S. *Prereq:* 10 credits in biological science and permission of the instructor

Neuroanatomy of domestic animals.

B M S 542. Introduction to Molecular Biology Techniques.

(Cross-listed with GDCB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542A. Introduction to Molecular Biology Techniques: DNA.

(Cross-listed with GDCB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

B M S 542B. Introduction to Molecular Biology Techniques: Protein.

(Cross-listed with GDCB, GDCB, EEOB, FS HN, HORT, NREM, NUTRS). 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.

B M S 542C. Introduction to Molecular Biology Techniques: Cell.

(Cross-listed with GDCB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S. *Prereq:* Graduate classification

Includes immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

B M S 542D. Introduction to Molecular Biology Techniques: Plant Transformation.

(Cross-listed with GDCB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S. *Prereq:* Graduate classification

Includes Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only.

B M S 542E. Proteomics. Includes two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. (F.)

(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542F. Techniques in Metabolomics. metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects.

(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542G. Introduction to Molecular Biology Techniques: Genomic.

(Cross-listed with GDCB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S. *Prereq:* Graduate classification

Offered on a satisfactory-fail basis only.

B M S 543. Pharmacology and Therapeutics.

(Dual-listed with B M S 443). (3-0) Cr. 3. F. *Prereq:* B M S 554

Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 553. Topics in Molecular Veterinary Medicine.

(Dual-listed with B M S 353). (1-0) Cr. 1. S. *Prereq:* Enrollment in or completion of B M S 554 and graduate classification

Receptor and signal transduction anomalies and their diagnosis in veterinary medicine.

B M S 554. General Pharmacology.

(Dual-listed with B M S 354). (Cross-listed with TOX). (3-0) Cr. 3. S. *Prereq:* B M S 549 and B M S 552; BBMB 404, BBMB 405

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 556. Cellular, Molecular and Developmental Neuroscience.

(Cross-listed with NEURO, GDCB). (3-0) Cr. 3. F. *Prereq:* BIOL 335 or BIOL 436; physics recommended

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

B M S 575. Cell Biology.

(Cross-listed with TOX). (3-0) Cr. 3. F. *Prereq:* 10 credits in biological science and permission of instructor

A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper.

B M S 590. Special Topics.

Cr. 1-7. Repeatable. F.S.SS. *Prereq:* Permission of instructor

B M S 590A. Anatomy.

Cr. 1-7. Repeatable. F.S.SS. *Prereq:* Permission of instructor

B M S 590B. Physiology.

Cr. 1-7. Repeatable. F.S.SS. *Prereq:* Permission of instructor

B M S 590C. Pharmacology.

Cr. 1-7. Repeatable. F.S.SS. *Prereq:* Permission of instructor

B M S 590D. Cell biology.

Cr. 1-7. Repeatable. F.S.SS. *Prereq:* Permission of instructor

B M S 599. Creative Component.

Cr. 1-3. F.S.SS. *Prereq: Enrollment in BMS graduate program, and permission of instructor.*

Creative component for non-thesis Master of Science degree.

Courses for graduate students:**B M S 688. Research Review.**

Cr. 1. Repeatable. F.S. *Prereq: Enrollment in BMS graduate program.*

A forum for B M S students to gain experience in the critical exchange of ideas through oral presentation and discussion of scientific information.

B M S 690. Advanced Topics.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 690A. Anatomy.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 690B. Physiology.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 690C. Pharmacology.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 690D. Cell biology.

Cr. 1-5. Repeatable. F.S.SS. *Prereq: Permission of instructor*

B M S 698. Seminar.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*

B M S 698A. Seminar: Attendance.

Cr. R. Repeatable. F.S. *Prereq: Enrollment in BMS graduate program.*

B M S 698B. Seminar: Attendance and Presentation.

(1-0) Cr. 1. Repeatable. F.S.SS. *Prereq: Enrollment in B M S graduate program.*

Attendance and presentation required. Offered on a satisfactory-fail basis only.

B M S 699. Research.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*

B M S 699A. Research: Anatomy.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*

B M S 699B. Research: Physiology.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*

B M S 699C. Research: Pharmacology.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*

B M S 699D. Research: Cell biology.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in BMS graduate program.*