VTTP 605 Systemic Veterinary Physiology I
Credits 5. 5 Lecture Hours. Aspects of cellular physiology, physiology of excitable membranes, physiology of body fluids, neurophysiology, and the physiology of smooth, cardiac and skeletal muscle; provides a basic understanding of mammalian physiology essential as a framework for advanced graduate studies. Prerequisite: Graduate classification.

VTTP 606 Systemic Veterinary Physiology II
Credits 5. 5 Lecture Hours. In-depth study covering cardiovascular, respiratory, renal physiology, gastrointestinal and endocrine physiology; provides a basic understanding of mammalian physiology essential as a framework for advanced graduate studies. Prerequisite: VTTP 605.

VTTP 610 Physiology I
Credit 1. 1 Lecture Hour. Basic cellular physiology for continued exploration into human and animal physiology; excitable membranes, regulation of homeostasis, body fluid maintenance. May be repeated four times for credit. Prerequisites: VTTP 610; graduate classification in the life sciences; approval of instructor.

VTTP 612 Physiology II
Credit 1. 1 Lecture Hour. Physiology of the mammalian endocrine systems required for continued exploration into human and animal endocrine physiology; molecular, cellular, and hormonal regulation, and their integration leading to diabetes and obesity. May be repeated four times for credit. Prerequisites: VTTP 612; graduate classification in the life sciences; approval of instructor.

VTTP 619 Food Toxicology II
Credits 3. 3 Lecture Hours. Public health implications of toxic factors in foods, their source, nature, occurrence and distributions; emphasis on mycotoxins including their isolation, detection, identification and toxicology; study of state-of-the-art food safety research techniques. Prerequisite: Graduate classification.

VTTP 623 Biomedical Physiology I
Credits 4. 3 Lecture Hours. 2 Lab Hours. Human physiological principles, review of cellular physiology, and development of an understanding of the nervous system and muscle, cardiovascular, and renal physiology; clinical applications related to organ systems. Prerequisites: Graduate classification; BICH 410 and VIBS 305 recommended.

VTTP 624/VIBS 624 Endocrinology
Credits 4. 3 Lecture Hours. 3 Lab Hours. Neuroendocrine control of puberty menstruation, ovulation, pregnancy, labor, lactation, female reproductive cycles, male reproductive functions, thyroid and parathyroid, adrenal and kidney, diabetes, obesity, sleep, memory, learning and aging, and their endocrine disorders; overview on biosynthesis, transport and signaling of peptide and neuropeptide hormones, steroids and prostaglandins. Prerequisite: Graduate classification. Cross Listing: VIBS 624/VTTP 624.

VTTP 625 Pharmacology
Credits 3. 3 Lecture Hours. Introduction to pharmacokinetics and pharmacodynamics; survey of major pharmaceutical classes; uses, mechanisms of action and adverse reactions of selected agents. Prerequisites: Graduate classification; VTTP 423 or approval of instructor.

VTTP 626 Systemic Physiology and Disease
Credits 4. 3 Lecture Hours. 2 Lab Hours. Investigation of functional changes during disease process and basic concepts related to the abnormal function and change in various organ systems in the face of disease; application of the knowledge of basic anatomy and physiology in understanding a loss or a change in normal structure and function of the body using common diseases and disorders centering on functional changes to etiology, clinical manifestations, diagnostic tests, treatment and complications. Prerequisite: Graduate classification.

VTTP 627 Applied Biomedical Physiology
Credits 4. 3 Lecture Hours. 2 Lab Hours. Human physiology focused on fluid balance and acid-base balance; development of an understanding of physiology as it applies to the cardiovascular, autonomic, renal, respiratory, gastrointestinal, endocrine, reproductive system; clinical applications related to organ systems. Prerequisite: Graduate classification.

VTTP 628 Pharmacology I
Credits 5. 4 Lecture Hours. 2 Lab Hours. Pharmacokinetics, pharmacodynamics, CNS pharmacology, autonomic pharmacology, antineoplastic agents, immunopharmacology, recombinant products, fluid and electrolyte therapy, diuretics, pharmacology of the integument. Prerequisite: Approval of instructor.

VTTP 630 Pharmacology/Toxicology
Credits 3. 2 Lecture Hours. 2 Lab Hours. Management and treatment of toxicosis, antidotal pharmacology, toxic plants, mycotoxins, chemical toxicants, metals, euthanasia. Prerequisite: Approval of instructor.

VTTP 638 Analysis of Genomic Signals
Credits 3. 2 Lecture Hours. 2 Lab Hours. Overview of current high throughput technology for data acquisition and analysis of genomic signals (e.g., mRNA or proteins); emphasis on microarray technology, methods for analyzing microarray data, and approaches to model the underlying phenomena from the systems biology perspective. Prerequisites: BIOL 451 or GENE 320/BIMS 320/BIMS 320/GENE 320 or equivalent; STAT 651 or equivalent; or approval of instructor.

VTTP 645 Practice of Evaluating Human Health Risks of Chemicals
Credits 2. 2 Lecture Hours. Basic principles of toxicology and environmental health with real-life examples of how diverse types of information are integrated for the purpose of judging what chemical exposures may pose a risk to human health. Prerequisites: BICH 601, BICH 602, VTTP 625, or similar; VTTP 673, VTTP 670 or similar; and VIBS 641 or approval of instructor.
VTTP 652 Fetal and Embryo Physiology  
Credits 3. 3 Lecture Hours. Introduction to the physiologic processes driving embryonic development and pregnancy; focus on embryo implantation, establishment of the placenta, development of the fetal circulatory systems and the molecular processes governing embryo differentiation and development; special emphasis on the major organ systems affected by pediatric disease and on the actions of teratogens. **Prerequisites:** Graduate classification.

VTTP 654 Molecular Endocrinology  
Credits 3. 3 Lecture Hours. Structure-function relationships of hormones, their receptors and biologic activities. **Prerequisites:** VTPP 653 or BIOL 649 and BICH 410 or equivalent or approval of instructor.

VTTP 655 Vascular Physiology  
Credits 4. 4 Lecture Hours. Structure and function of blood vessels and vascular beds; molecular and cell biology of endothelium and vascular smooth muscle; microcirculation; capillary exchange; regulation of blood flow by local, neural and humoral signals. **Prerequisites:** MPHY 901 or approval of department head.

VTTP 657 Cardiovascular Physiology  
Credits 4. 3 Lecture Hours. 3 Lab Hours. Physiological considerations of the circulatory system including general and integrative aspects of the heart and blood vessels. **Prerequisites:** Approval of instructor.

VTTP 659 Gamete and Embryo Physiology  
Credits 3. 2 Lecture Hours. 2 Lab Hours. Physiology of gametes and preimplantation embryos in livestock and laboratory animals; oocyte growth and maturation in-vivo and in-vitro, fertilization in-vivo and in-vitro, embryo transfer, cryopreservation, nuclear transfer, chimera formation, gene transfer.

VTTP 670 Advanced Toxicology  
Credits 3. 3 Lecture Hours. Detailed overview of organ-specific effects of toxic substances, organ/tissue-oriented modules that will review basic anatomy and physiology, site-specific metabolism of xenobiotics, mechanisms of toxicity and experimental systems that are used to study toxic effects. **Prerequisites:** BICH 601, BICH 602, VTPP 625, or equivalent; VTPP 673 or equivalent; or approval of instructor.

VTTP 673 Metabolic and Detoxication Mechanisms  
Credits 3. 3 Lecture Hours. Fate of foreign compounds; their inhibitory and antagonistic action toward normal metabolic processes of the animal body. **Prerequisites:** BICH 603, approval of instructor and department head.

VTTP 676 Genetic and Molecular Toxicology  
Credits 3. 3 Lecture Hours. Mechanisms of toxicant-induced target organ toxicity with emphasis on molecular control of mammalian and cell growth differentiation. **Prerequisite:** Graduate course in cell biology and biochemistry.

VTTP 677 Fluorescence Detection: Steady State, Time Resolved and Imaging  
Credits 4. 4 Lecture Hours. Fluorescence spectroscopy and confocal/multiphoton microscopy in research; intro of pharmacology, life science, and physical science students to fluorophores, anisotropy, ligand binding, energy transfer, cytometry, lifetime imaging, correlation spectroscopy, immunocytochemistry, and image analysis with an emphasis on instrumental/sample artifacts, fluorescence application, literature evaluation, and communication of rationales to other scientists. **Prerequisite:** General chemistry and biology course.

VTTP 681 Seminar  
Credit 1. 1 Lecture Hour. Review and discussion of current scientific work in physiology and related subjects. **Prerequisite:** Approval of department head.

VTTP 685 Directed Studies  
Credits 1 to 4. 1 to 4 Other Hours. Problems in physiology, pharmacology or toxicology. **Prerequisite:** Approval of instructor.

VTTP 689 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours. Selected topics in an identified area of veterinary physiology and pharmacology. May be repeated for credit. **Prerequisite:** Approval of instructor.

VTTP 690 Theory of Research  
Credits 3. 3 Lecture Hours. Theory and design of research related to current biomedical problems especially those involving study of animal disease; philosophical perspectives underlying historical advances in research pertaining to the study, prevention and treatment of disease. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Graduate classification. **Cross Listing:** NRSC 690 and VIBS 690.

VTTP 691 Research  
Credits 1 to 23. 1 to 23 Other Hours. Original investigations in veterinary physiology, pharmacology or toxicology to be submitted by writing of thesis or dissertation as partial fulfillment for MS or PhD degree. **Prerequisite:** Approval of department head.

VTTP 910 Physiology I  
Credits 6. 5 Lecture Hours. 2 Lab Hours. Introduction to physiology: cell physiology, cell signaling, cell cycle, body fluids, translocation of materials, membrane potentials, neurophysiology, autonomic nervous system, thermoregulation, cardiovascular, and muscle physiology. **Prerequisite:** Enrollment in first year of professional curriculum.

VTTP 912 Physiology II  
Credits 5. 4 Lecture Hours. 2 Lab Hours. Respiration, renal physiology, acid-base physiology, reproductive physiology, molecular biology and gastrointestinal physiology. **Prerequisite:** Enrollment in the first year of professional DVM curriculum.
VTPP 914 Professional & Clinical Skills I
Credits 3. 1 Lecture Hour. 6 Lab Hours. Professional & Clinical Skills I. Integration and reinforcement of foundational knowledge offered in concurrent courses through critical thinking exercises, professional skills application activities (ethics/contextual decision-making, leadership, skills for well-being, personal/practice financial literacy, core communication skills) and application of technical skills; opportunities for learning include didactic, hands-on and case-based interactions utilizing simulation, models, animals, actors and case scenarios; part I of a VI part series. Prerequisite: Enrollment in the first year of professional DVM curriculum.

VTPP 924 Pharmacology
Credits 3 to 5. 3 to 4 Lecture Hours. 0 to 2 Lab Hours. Drug disposition, pharmacodynamics, drug regulations, critical appraisal of evidence about use of drugs, drugs that affect respiratory, reproductive, gastrointestinal, endocrine, immune, urinary, integumentary, cardiovascular, musculoskeletal, and nervous systems, and drugs for pain, anti-inflammatories, antineoplastics, antibiotics, and other antiinfectives in animals. Prerequisite: Enrollment in the second year of professional DVM curriculum.

VTPP 925 Pharmacology/Toxicology II
Credits 3. 5 Lecture Hours. 2 Lab Hours. Antimicrobials, endocrine pharmacology, eicosanoids, antiinflammatory agents, respiratory pharmacology, anticoagulants and hematinsics, GI pharmacology, cardiovascular pharmacology. Prerequisite: Enrollment in the second year of professional curriculum.

VTPP 926 Pharmacology/Toxicology III
Credits 3. 2 Lecture Hours. 2 Lab Hours. Management and treatment of toxicoses, antidotal pharmacology, toxic plants, mycotoxins and mycotoxicoses, chemical toxicants, metals, euthanasia. Prerequisite: Enrollment in the second year of professional curriculum.

VTPP 948 Didactic Elective in Veterinary Physiology and Pharmacology
Credits 1 to 12. 1 to 12 Lecture Hours. Elective course in physiology and pharmacology for professional students who wish to supplement required curriculum. May be repeated for credit. Prerequisite: Enrollment in the fourth year of professional curriculum.

VTPP 985 Directed Studies
Credits 1 to 4. 1 to 4 Other Hours. Directed, individual study of selected problems in physiology, pharmacology or toxicology. May be repeated for credit. Prerequisite: Approval of instructor and department head.

VTPP 989 Special Topics In...
Credits 1 to 4. 1 to 4 Other Hours. Selected topics in an identified area of veterinary physiology and pharmacology. May be repeated for credit.