

## COLLEGE OF VETERINARY MEDICINE

### ADMINISTRATION

Donald F. Smith, dean

Robert O. Gilbert, associate dean

Alfonso Torres, associate dean for veterinary public policy and director, NYS Animal Health Diagnostic Laboratory

Hollis N. Erb, secretary of the college

Katherine M. Edmondson, assistant dean for learning and instruction

Robert F. Gilmour Jr., associate dean for research and graduate education

Claude M. Johnson, assistant dean for alumni affairs and development

Bonita S. Voiland, assistant dean for hospital operations

Gene R. Wheeler, assistant dean for finance and administration

Douglas F. Antczak, director, James A. Baker Institute for Animal Health

Carol S. Gary, director of student financial planning

Erla Heyns, director, Flower Sprecher Veterinary Library

Mary Beth Jordan, director of human resources

Douglas D. McGregor, director of leadership and training initiatives

Joseph A. Piekunka, director of admissions

Jai Sweet, director of student services and multicultural affairs

### DEPARTMENT CHAIRS

Biomedical Sciences: M. Kotlikoff

Clinical Sciences: R. Hackett

Microbiology and Immunology: D. Russell

Molecular Medicine: G. Weiland, acting chair

Population Medicine and Diagnostic Sciences: Y. Grohn

### THE COLLEGE

The College of Veterinary Medicine offers a professional program that requires four years of full-time academic and clinical study of the normal and abnormal structure and function of the animal body and the diagnosis, treatment, and prevention of animal disease.

Graduates of the college receive the Doctor of Veterinary Medicine (D.V.M.) degree, which is recognized by licensing boards throughout the world. Graduates generally enter private practice or academia, or become engaged in one of an increasing number of biomedical activities.

Admission requires a minimum of three years of college work, including specific prerequisite courses and experience.

Applications must be filed approximately one year before the proposed matriculation date. The competition for admission is keen, since there are many more qualified applicants than can be admitted.

Graduate programs in veterinary research and postdoctoral training in clinical specialties are open to doctors of veterinary medicine and some highly qualified holders of baccalaureate degrees and lead to the degree of Master of Science or Doctor of Philosophy.

More detailed information is available electronically at the web site of the College of Veterinary Medicine, [www.vet.comell.edu/](http://www.vet.comell.edu/).

Note: 500- and 600-level courses are open only to veterinary students except by written permission from the instructor.

The College of Veterinary Medicine's professional curriculum comprises courses (designated with the prefix "VTMED") in two categories: foundation courses and distribution courses.

### The Professional Curriculum

#### FOUNDATION COURSES

Foundation courses are interdisciplinary and represent approximately 70 percent of the professional curriculum. In Foundation courses I, III, and IV (VTMED 510, 530, 540), students work in small groups under the guidance of a faculty tutor. Case-based exercises are used to facilitate the understanding of basic science concepts within the context of clinical medicine. In some courses, three to four 2-hour tutorial sessions are scheduled each week. These are complemented by lectures, laboratories, and discussion sessions or other organized learning opportunities specific to the individual course. Faculty are available to respond to questions that arise as a result of the case-based exercises.

Tutorial sessions and all other organized learning programs are usually scheduled during the mornings, thereby reserving the afternoons for independent study. By learning in a clinical context, students are better able to integrate material from the basic and clinical sciences and are encouraged to develop an understanding of the clinical reasoning process from the beginning of the curriculum. The tutorial-based educational format creates an atmosphere that requires students to be involved actively in their learning and allows them to develop skills in communication, information retrieval, and analysis.

Note: Courses listed in brackets [ ] are approved courses that are not offered during the 2004–2005 academic year.

#### **VTMED 510 The Animal Body (Foundation Course I)**

Fall. 12 credits. Limited to first-year veterinary students. Letter grades only. A. J. Bezuidenhout and staff.

This course is designed to enable students to understand the principles of veterinary anatomy at the gross, microscopic, and ultrastructural levels. Developmental anatomy is emphasized to the extent that it reflects determination of adult form and species differences. Radiologic and related imaging techniques are used throughout the course to assist in the understanding of normal structural anatomy. Understanding of the anatomic basis of common surgical procedures is achieved during the various dissection procedures. The course is based on tutorials with significant emphasis on practical laboratories. Lectures and modules complement student learning.

#### **VTMED 517 Animals, Veterinarians, and Society: Part A (Foundation Course VIIa)**

Fall. 1.5 credits. Limited to first-year veterinary students. Letter grades only. A fee is charged for the course guide. Live animals are used in course instruction. N. L. Irby.

This course complements and augments material learned in VTMED 510 (Block I—The Animal Body). The class is divided into small groups and each group meets for 4–5 hours each week during the first 11 weeks of the fall semester. Using the dog, cat, horse, and cow as models for learning how to perform a physical examination, this laboratory course teaches the skills of observation, auscultation, palpation, and percussion as well as related basic diagnostic procedures. The body systems are examined sequentially and follow the order of study in Block I.

#### **VTMED 520 Cell Biology and Genetics (Foundation Course II)**

Fall and spring. 8 credits. Limited to first-year veterinary students. Prerequisite: VTMED 510 The Animal Body. Letter grades only. R. A. Levine and staff.

Foundation course II is designed to develop an appreciation of the molecular and cellular basis of animal health and disease. Students will gain an understanding of the molecular mechanisms that regulate cell function, the molecular signaling processes that form the basis of integrated function and the response to disease, and the mechanisms underlying inherited traits and genetic disease. Emphasis is placed on defining and characterizing normal cell function and on understanding how mutations in specific genes promote disease. Students become familiar with the common molecular procedures being used to develop new diagnostic and therapeutic tools to maintain health and combat disease. The course is divided into two parts separated by a midterm exam. The first part is made up of three sections: Principles of Cell Biology, Cell Signaling, and Medical Genetics. The second half of the course builds upon and expands these principles, using examples from veterinary medicine including specific genetic diseases, wound repair, and cancer. In both parts, clinical cases are used to illustrate the concepts presented.

**VTMED 521 Neuroanatomy and Clinical Neurology**

Spring. 3 credits. Limited to first-year veterinary students. Letter grades only. A. deLahunta.

Neuroanatomy and Clinical Neurology is a vertically integrated course that includes dissection of the central nervous system of the dog and horse, the anatomic basis for the diagnosis of diseases of the nervous system, and the differential diagnosis of those diseases. Clinical cases with pertinent lesions are demonstrated with each system using videotapes of clinical patients to demonstrate the clinical signs produced by the various diseases. Pattern recognition of characteristic neurologic disorders is emphasized. Slides of gross and microscopic lesions are used to demonstrate the clinical and neuroanatomic relationships and to stress characteristic features of representative conditions. The goal of the course is to make the student competent in interpreting neurologic signs to make an accurate neuroanatomic diagnosis, establishing a reasonable differential diagnosis, and planning and interpreting ancillary procedures.

**VTMED 527 Animals, Veterinarians, and Society: Part B (Foundation Course VIIb)**

This course begins in the last part of fall semester and finishes at the end of winter session. 1.5 credits. Limited to first-year veterinary students. Prerequisite: VTMED 517, Animals, Veterinarians, and Society: Part A. Letter grades only. A fee is charged for the course guide. The lectures consist of one 2-hour session each week, and the laboratories require 10 hours spread throughout the course. Live animals are used in course instruction. N. L. Irby.

This course consists of both lectures and laboratory sessions. Lectures partially complement materials learned in VTMED 520 (Block II—Cell Biology and Genetics), but for the most part focus primarily on veterinary medical ethical issues related to animal use, animal welfare, genetics counseling, and clinical day-to-day ethics. The laboratory portion of the course reviews basic equine and bovine husbandry skills and reviews the small-animal physical examination.

**VTMED 530 Function and Dysfunction: Part I (Foundation Course IIIa)**

Spring. 9 credits. Limited to first-year veterinary students. Prerequisite: VTMED 520, Cell Biology and Genetics. Letter grades only. Live animals are used on a limited basis for demonstration or noninvasive procedures. R. Rawson and staff.

This course is designed to develop students' understanding of how an animal maintains itself as a functional organism; how the maintenance of function is achieved through the integration of different organ systems; how tissue structure relates to tissue function; how injury alters structure and leads to dysfunction, manifested as clinical signs; how organ function can be assessed; and how organ function can be modulated pharmacologically. The course incorporates aspects of physiology, biochemistry, cell biology, histology, pathology and histopathology, clinical pathology, and pharmacology.

**VTMED 531 Function and Dysfunction: Part II (Foundation Course IIIb)**

Fall. 7 credits. Limited to second-year veterinary students. Prerequisite: VTMED 530, Function and Dysfunction: Part I. Letter grades only. R. Rawson and staff. A continuation of VTMED 530, Function and Dysfunction: Part I.

**VTMED 537 Animals, Veterinarians, and Society: Part C (Foundation Course VIIc)**

Spring. 1 credit. Limited to first-year veterinary students. Prerequisite: VTMED 527, Animals, Veterinarians, and Society: Part B. Letter grades only. A fee is charged for the course guide. Live animals will be used in course instruction. N. L. Irby.

The primary focus of this course is to introduce students to communication skills and techniques necessary for effective communication with clients. In addition, students will be introduced to the human-animal bond and its implications for veterinary medicine, animal death, and grief counseling. This course gives students the opportunity to practice interviewing clients while refreshing their physical-exam skills. The opportunity to gain an appreciation of the role of animal husbandry in veterinary medicine will be provided through a milking experience at the college's dairy barn.

**VTMED 540 Host, Agent, and Defense (Foundation Course IV)**

Fall. 12 credits. Limited to second-year veterinary students. Prerequisite: VTMED 531, Function and Dysfunction: Part II. Letter grades only. D. Bowman (course leader) and others.

This course is divided into six sections: the host response, intracellular environment, extracellular environment, somatic environment, external environment, and surrounding environment. Using this approach, students develop an understanding of the host response to insult, a familiarity with groups of important pathogens, an understanding of how pathogens manipulate the host and how the host defends itself against attacks, and an understanding of the roles played by the external environment and human intervention in the epidemiology of infectious organisms.

**VTMED 547 Animals, Veterinarians, and Society: Part D (Foundation Course VIId)**

Fall. 1 credit. Limited to second-year veterinary students. Prerequisite: VTMED 537, Animals, Veterinarians, and Society: Part C. Letter grades only. A fee is charged for the course guide. N. L. Irby.

This course complements and augments material learned in VTMED 540 (Block IV—Host, Agent, and Defense). The course emphasizes veterinary public health. Topics include animal bites, routes of disease transmission, rabies control programs, zoonotic diseases, and preventive health care programs including vaccination protocols in large and small animals. One rotation in the Community Practice service is required of each student.

**VTMED 550 Animal Health and Disease: Part I (Foundation Course V)**

Spring. 10 credits. Limited to second-year veterinary students. Prerequisite: VTMED 540, Host, Agent, and Defense. Letter grades only. R. Hackett.

This course integrates the clinical sciences of medicine, surgery, anesthesiology, radiology, and theriogenology, which are themselves integrated subjects, with systems pathology and relevant aspects of applied pharmacology. The course is presented on a systems basis, moving from clinical signs of alteration in function, to pathophysiology of clinical signs, to strategies for diagnosis and treatment. Specific examples are used to establish a cognitive framework and knowledge of the most important diseases. This course provides a sound foundation for clinical rotations in Foundation Course VI. It builds on the strengths developed in earlier courses by an increased exposure to case examples in a more directed way, taking advantage of the diversity of skills and special knowledge of both faculty and students. A variety of educational techniques are used, including lectures in which interaction is encouraged, laboratories, demonstrations, case discussions, and autotutorials.

**VTMED 551 Animal Health and Disease: Part II (Foundation Course V, continued)**

Fall. 20 credits. Limited to third-year veterinary students. Prerequisite: VTMED 550, Animal Health and Disease: Part I. Letter grades only. R. Hackett and staff. A continuation of VTMED 550, Animal Health and Disease: Part I.

**VTMED 552 Small Animal Clinical Oncology**

Spring. 1 credit. Prerequisite: VTMED 540, Host, Agent, and Defense. Third- and fourth-year veterinary students. Letter grades only. K. M. Rassnick.

This course presents the common cancers affecting small animals. Emphasis is placed on biological behavior and patient management. Surgery, chemotherapy, and radiation therapy as important methods to treat cancers in small animals are discussed. Course format includes lectures. Attendance is required.

**VTMED 553 Veterinary Diagnostic Imaging**

Spring. 1.5 credits. Prerequisite: VTMED 540, Host, Agent, and Defense. Third- and fourth-year veterinary students. Letter grades only. P. Scrivani.

The course is designed to emphasize the relevance of a solid foundation in veterinary anatomy as it is clinically applied to diagnostic imaging. Additionally, the course is designed to provide students with an understanding of the strengths and limitations of diagnostic imaging by discussing interpretation principles, pitfalls and interpretations, and measurements obtained through lectures, laboratory exercises, weekly quizzes, and reading assignments. Integration of these objectives culminates in weekly laboratory exercises where students must make or evaluate decisions regarding patient management based on evaluation of clinical signs and imaging examinations. The "Roentgen-Sign" approach to diagnostic imaging interpretation is used as a model.

**VTMED 557 Animals, Veterinarians, and Society: Part E (Foundation Course VIe)**

Spring. 1 credit. Limited to second-year veterinary students. Prerequisite: VTMED 547 Animals, Veterinarians, and Society: Part D. Letter grades only. A fee is charged for the course guide. Live animals are used in course instruction. N. L. Irby.

This is a laboratory course that provides a basic instruction to clinical skills students will need when they start their clinical rotations in the Cornell University Hospital for Animals. There is a brief review of the physical examination of the dog, horse, and cow. Clinical procedures include but are not limited to ear examination and treatment, IM and SQ injections, fluid administration, naso- and orogastric tube placement, urinary catheterization, and IV catheterization.

**VTMED 558 Animals, Veterinarians and Society: Part F (Foundation Course VIII)**

Fall. 1.5 credits. Limited to third-year veterinary students. Prerequisite: VTMED 557, Animals, Veterinarians, and Society: Part E. Letter grade only. A fee is charged for the course guide. Live animals are used in course instruction. N. L. Irby.

This course complements material learned in VTMED 551 (Foundation Course V—Animal Health and Disease). The course examines governmental regulation of the veterinary profession, including proper drug usage, extra label drug use (FDA), controlled substances (DEA), professional liability and malpractice insurance, professional and unprofessional conduct, hazardous materials in the workplace (OSHA), and environmental issues (EPA). Also included are sessions relating to the control and prevention of the spread of animal diseases and the role of USDA and specifically APHIS in these regulatory functions. The laboratory component consists of one night in the Equine and Farm Animal Hospital.

**VTMED 560 Ambulatory and Production Medicine I**

Fall, winter, spring, and summer. Credit variable (either 1 or 2 credits). Required component of Clinical Rotations (Foundation Course VI). Letter grades only. M. E. White and staff.

A total of four weeks of Ambulatory and Production Medicine are required. VTMED 565 is taken during the clinical rotations in the third or fourth year. VTMED 560 is also generally taken during the third or fourth year; however, first- and second-year students are encouraged to take one or two weeks of this course over winter recess or during the summer if slots are available. A lottery is done to assign first- or second-year students to the available slots. See VTMED 565 for course description.

**VTMED 561 Community Practice Service: Medicine**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. W. E. Hornbuckle and staff.

The Community Practice Medicine Service is structured to provide supervised clinical experience in the practice of companion small-animal medicine. The course is conducted in the Companion Animal Hospital of the Cornell University Hospital for Animals. Students interact directly with clients presenting their pets for primary medical care. Under the supervision of the clinical faculty and staff, the students are expected to formulate and carry out plans for the diagnostic evaluation and medical management of these patients. After review, students explain their plans to the clients and provide follow-up care and management of these patients.

**VTMED 563 Small-Animal Medicine**

Fall, spring, winter, and summer. 4 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. S. C. Barr, S. A. Center, J. F. Randolph, K. W. Simpson, and R. Goldstein.

The Small-Animal Medicine Service is structured to provide supervised clinical experience in the practice of companion small-animal medicine. The course is conducted in the Companion Animal Hospital of the Cornell University Hospital for Animals. Students interact directly with clients presenting their pets for primary or referral medical care. Under the supervision of the clinical faculty and staff, the students are expected to formulate and carry out plans for the diagnostic evaluation and medical management of these patients.

**VTMED 564 Small-Animal Surgery Service**

Fall, winter, spring, and summer. 4 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. H. J. Harvey and small-animal surgery faculty.

A clinical service rotation, this course exposes the student to the practice of surgery under hospital conditions. Students participate in the diagnostic techniques; planning of therapy; and daily care of dogs, cats, and exotic species under the direction of a faculty veterinarian. Students assist experienced surgeons in the operating room and, with house-officer supervision, are responsible for patients undergoing elective ovariectomy or castration. Client communications and the basics of efficient practice are emphasized.

**VTMED 565 Ambulatory and Production Medicine II**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. M. E. White and staff.

A clinical rotation in which students accompany ambulatory clinicians on farm and stable calls and learn the skills and procedures necessary for operation of a modern veterinary practice offering primary care to large-animal clients. Routine herd-health visits are conducted for cattle, horses, sheep, goats, and swine. Reproductive evaluations (including pregnancy and fertility examinations), nutritional evaluation, and disease prevention are stressed. Herd-health programs also include vaccinations, parasite control, mastitis prevention, and routine procedures. With appropriate herds, analysis of computerized performance data is conducted and discussed with the owner. In addition to assisting with routine scheduled work, students participate in diagnosis and medical or surgical treatment of ill or injured animals. This includes rotating assignments for night and weekend duty.

**VTMED 566 Large-Animal Medicine Service**

Fall, winter, spring, and summer. 3 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. D. Ainsworth, T. Divers, G. Perkins, and M. Flaminio.

Students assigned to this service assist the faculty and house staff of the Large-Animal Medicine Service in the diagnosis and care of patients. The goal of this course is for students working on this service to acquire

knowledge and skills in history taking, physical examination, election and completion of appropriate ancillary tests, diagnosis, treatment, and patient care. Daily rounds and discussions are used to monitor patient progress and further educate students.

**VTMED 567 Large-Animal Surgery Service**

Fall, winter, spring, and summer. 4 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. A. J. Nixon and staff.

This clinical rotation is structured to provide supervised clinical experience in the practice of large-animal surgery. Under the direction of faculty and house staff, students participate in the diagnosis, surgical treatment, and care of patients presented to the Equine and Farm Animal Hospital. Training through patient care is supplemented by formal rounds and didactic instruction.

**VTMED 568 Anesthesiology Service**

Fall, winter, spring, and summer. 3 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. R. D. Gleed, J. W. Ludders, L. P. Posner, A. A. Smith, and staff.

This course is designed to provide clinical experience in the use of anesthetics in small companion animals, horses, and some food animals. The students participate in selecting suitable anesthetic techniques for patients in the Cornell University Hospital for Animals and then implement those techniques under the supervision of faculty and residents. The goal is for students to learn the skills and thought processes necessary to perform safe anesthesia in a modern veterinary practice.

**VTMED 569 Dermatology Service**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. W. H. Miller and D. W. Scott.

During this clinical rotation, students participate in the diagnosis and management of skin disorders in small and large animals. Patients are examined by appointment and through consultation with other hospital services.

**VTMED 570 Ophthalmology Service**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. R. C. Riis, T. Kern, and N. Irby.

This course combines clinical experience with beginning skills in diagnostic ophthalmology. Students learn how to apply the ophthalmic diagnostic tests. A competent ocular examination is the goal of this rotation. Confidence in using direct and indirect ophthalmoscopes, slit lamps, tonometers, gonioscopes, conjunctival cytology, and surgery comes with the practice provided by this rotation. Students are required to review the introductory orientation videotapes in the autotutorial center titled *Ocular Examination I and II* before the start of the rotation. This rotation provides surgical experience and consultations. A high percentage of the consultations are referral cases that usually challenge the service. Adequate routine case material is presented to prepare most students for practice.

**VTMED 571 Pathology Service**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. S. P. McDonough and staff.

This course involves the hands-on diagnostic necropsies of most mammalian species that are presented to the pathology necropsy room and of avian species that are admitted to the avian and aquatic-animal medicine necropsy room. Students work in groups of three to five for the two-week rotation. Necropsies are performed under the guidance of pathology faculty and residents. Students prepare written reports of necropsies performed, review microscopic hematology and cytology slides, perform urinalyses, and discuss case studies.

**VTMED 572 Radiology Service**

Fall, winter, spring, and summer. 2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. N. L. Dykes and staff.

A two-week clinical experience in the imaging section of the Cornell University Hospital for Animals. Students use radiographic, CT, ultrasonographic, and nuclear-medicine imaging techniques to evaluate animal patients under treatment in the hospital. Students obtain and interpret radiographic studies with guidance from radiology faculty and technical staff. Autotutorial teaching films are used to familiarize students with radiographic examples of common diseases of large- and small-animal species. Small-group discussions are scheduled to present and discuss the teaching files and current cases. The safe use of X-ray-producing equipment and radioisotopes is discussed.

**VTMED 573 Fourth-Year Seminar**

Fall and spring. 1 credit. Required component of Clinical Rotations (Foundation Course VI). First-, second-, and third-year students and all staff members are also invited and encouraged to attend. S-U grades only. F. H. Fox, chair of the Senior Seminar Committee.

The aim of this course is to give the student the responsibility and opportunity of selecting and studying disease entity on the basis of a case or series of cases, or to conduct a short-term, clinically oriented research project under the direction of a faculty member. In either case, an oral report is presented at a weekly seminar. A written report is also submitted at the time of the seminar. All participants are encouraged to foster an atmosphere in which discussion, exchange of ideas, and the airing of controversial opinions might flourish.

**DISTRIBUTION COURSES**

Distribution courses comprise 30 percent of the curriculum and are usually scheduled during the first half of each spring semester. During the first two years, many of the distribution courses are oriented to the basic sciences. During years three and four, students have additional distribution course offerings from which to choose. Some emphasize clinical specialties, whereas others integrate basic-science disciplines with clinical medicine and are co-taught by faculty representing both areas. Students from different classes have the opportunity to take many of these courses together.

Grades: grading options for distribution courses are either letter or S-U.

**VTMED 601 Anatomy of the Carnivore**

Spring. 3 credits. Prerequisite: VTMED 510, The Animal Body or permission of instructor. First-, second-, third-, and fourth-year veterinary students; others by permission. Letter grades only. A. J. Bezuidenhout.

Carnivore anatomy is studied by detailed systematic and regional dissection of the cat, with comparison to the dog. Student dissection is supplemented with prosections, radiographs, palpation of live cats, and exercises focusing on surgical approaches. There are opportunities to dissect other carnivores, such as the ferret and the fox, depending on availability of specimens. The lectures augment the laboratory dissection and introduce the student to functional morphological comparative features in the Order Carnivore. Students do an independent research project on the carnivore species of their choice and give an oral presentation on this to the class.

**VTMED 602 Anatomy of the Horse**

Spring. 3 credits. Prerequisite: VTMED 510, The Animal Body or permission of instructor. First-, second-, third-, and fourth-year veterinary students; others by permission. Letter grades only. K. Haussler.

This course is organized as a traditional anatomy course that relies primarily on students learning the anatomy of horses through hands-on dissection laboratories augmented by lectures and highlighted by clinical correlations. An understanding of anatomy that provides the foundation for surgery and is directly relevant to clinical practice is emphasized in the regional approach to dissection. Most lectures emphasize structural-functional correlations that are unique or important in the horse. Microscopic anatomy is integrated into the course in selected areas to lay a foundation for the later study of pathology or when it reinforces concepts of structure and function that are difficult to understand by a study of the gross anatomy alone (i.e., hoof). Student dissection cadavers are supplemented by skeletal materials, radiographs, models, preserved predissected specimens, and fresh specimens when they are available.

**VTMED 603 Anatomy of the Ruminant**

Spring. 3 credits. Prerequisite: VTMED 510, The Animal Body or permission of instructor. First-, second-, third-, and fourth-year veterinary students; others by permission. Letter grades only. J. Hermanson.

The regional anatomy of several ruminant species is covered using dissection laboratories, lectures, and large-group discussions. Functional consequences of structural modifications and anatomical features relevant to clinical practice are emphasized. Microscopic anatomy is correlated with gross anatomy when appropriate to relate structure to function and to provide a foundation for later study in pathology. Student dissection material is supplemented by skeletal materials, radiographs, models, predissected specimens, and postmortem specimens. Students are required to complete an independent study project on a relevant subject of their choice. Assessment includes written and practical examination.

**VTMED 605 Comparative Anatomy: Pattern and Function**

Spring. 3 credits. Prerequisite: VTMED 510, The Animal Body. First-, second-, third-, and fourth-year veterinary students; others by permission. Letter grades only. I. A. Mizer.

The goal of this course is to study anatomical variability among amniote (mammals, birds, and reptiles) and anamniote (amphibian and fish) species. This is accomplished by relating the anatomy of major organ systems in each species to a common basic pattern and considering the differences in a functional perspective. Five major systems are explored (integumentary, locomotory, cardiorespiratory, digestive, and urogenital) in a variety of species as available.

**VTMED 606 Advanced Clinical Neurology**

Spring. 1 credit. Prerequisite: VTMED 521, Neuroanatomy and Clinical Neurology. Third- and fourth-year veterinary students. Letter grades only. A. deLahunta.

The objective of this course is to further the experience and confidence of the student in the diagnosis and understanding of clinical neurological disorders. It continues the student's correlation of anatomy, physiology, and pathology in the diagnosis of diseases of the nervous system and the understanding of their pathogenesis. Neurological disorders that are not covered in the foundation course are considered here. The course is based entirely on case examples that are presented on videotapes and slides.

**VTMED 607 The Literature and Subject Matter of Natural History**

Spring. 1 credit. Minimum enrollment 10; maximum 20. Third- and fourth-year veterinary students. S-U grades only. H. E. Evans.

This course is an introduction to natural history literature. Materials relating to the earth sciences and the biology of plants and animals from around the world are shown and discussed. Students are required to show and discuss a book that concerns natural history in a country of their choice and submit a one-page book report for duplication. (A recommended reference text for this course is *The Cambridge Illustrated Dictionary of Natural History* by R. J. Lincoln and G. A. Boxshall, 1990.)

**VTMED 609 Anatomy and Histology of Fish**

Spring. 2 credits. Minimum enrollment 4; maximum enrollment 6. First-, second-, third-, and fourth-year veterinary students; others by written permission of instructor. S-U grades optional. P. R. Bowser.

This course provides an overview of the diversity of anatomy and histology of fish. Students participate in lecture, discussion, and laboratory exercises to review the major organ systems. Extensive use of library resources for assigned readings is expected. Each student prepares a term project and makes one oral presentation.

**VTMED 610 Veterinary Aspects of Avian Biology**

Spring. 1.5 credits. Minimum enrollment 10; maximum enrollment 60. First-, second-, third-, and fourth-year veterinary students; others by permission. Letter grades only. G. V. Kollias.

An introduction to avian biology for veterinary students. The course includes lectures and laboratories involving avian anatomy.

physiology, and natural history. Emphasis is on the development of a strong foundation in avian biology that will be applied in VTMED 616, Diseases of Birds, and VTMED 652, Avian Medicine and Surgery.

**VTMED 613 AQUAVET I: Introduction to Aquatic Veterinary Medicine**

Four weeks of full-time instruction at Woods Hole, Massachusetts, immediately after the spring term. 4 credits. Maximum enrollment 24 students from Cornell University, the University of Pennsylvania, and other U.S. colleges and schools of veterinary medicine. Available, by a competitive application process, to veterinary and graduate students. S-U grades only. Course fee required. P. R. Bowser.

The course is sponsored by Cornell University, the University of Pennsylvania, and three marine-science institutions at Woods Hole: the Marine Biological Laboratory, Woods Hole Oceanographic Institution, and Northeast Center of the National Marine Fisheries Service. It is designed to introduce veterinary students to aquatic-animal medicine. The marine environment is described and visited on field trips in the Woods Hole area. Specific aspects of the comparative anatomy, physiology, nutrition, microbiology, pathology, and medicine of a variety of marine and freshwater species are discussed. Some emphasis is placed on systems of aquaculture. The specific diseases of a few selected species are presented as examples, including the diseases of a crustacean, a shellfish, a finfish, and marine mammals. The course is taught by an invited faculty of 35 individuals who are leaders in their respective fields of aquatic-animal medicine. Students present seminars on appropriate topics.

**VTMED 614 AQUAVET II: Comparative Pathology of Aquatic Animals**

Two weeks of full-time instruction at Woods Hole, Massachusetts, immediately after the spring term. 2 credits. Prerequisites: formal course work in diseases of aquatic animals or appropriate experience and permission of instructor. Maximum enrollment 18. S-U grades optional. Course fee required. Available, by a competitive application process, to veterinary and graduate students. P. R. Bowser.

This course is sponsored by Cornell University, the University of Pennsylvania, and three marine-science institutes at Woods Hole: the Marine Biological Laboratory, Woods Hole Oceanographic Institution, and Northeast Center of the National Marine Fisheries Service. It is an advanced course in the comparative pathology of aquatic invertebrates and vertebrates commonly used as laboratory animals. The material presented consists of discussions of the diseases of aquatic animals as well as extensive use of the microscope to examine the histopathology associated with these diseases. The course is taught by an invited faculty of 12 individuals who are leaders in their respective fields of aquatic-animal medicine.

**[VTMED 615 Veterinary Medicine in Developing Nations**

Spring. 2 credits. Maximum enrollment 20. First-, second-, third-, and fourth-year veterinary students; others by permission of instructor. S-U grades only. Offered even-numbered years, will be offered in 2006. K. A. Schat.

Veterinary medicine has an important role to play in developing nations in developing and providing economical sources of animal proteins for human consumption and protecting ecological resources. This seminar course provides interested veterinary students with information on and insight into the multitude of complex issues facing U.S. veterinarians working in developing nations.]

**VTMED 616 Diseases of Birds**

Spring. 2 credits. Minimum enrollment 10; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. G. V. Kollias and staff.

This course is designed to introduce second-, third-, and fourth-year veterinary students to a basic and practical knowledge of the most common infectious and noninfectious diseases affecting a variety of avian species. The course emphasizes the latest diagnostic and control approaches. The course format is a combination of didactic lectures and discussions.

**[VTMED 617 Basic Nutrition for Veterinary Students**

Fall. 1 credit. Prerequisite: Block III (VTMED 531). S-U grades only. F. A. Kallfelz, J. J. Wakshlag, and K. J. Hurley.

This course provides an introduction to nutrition, including basic concepts of the need for and metabolism of energy, protein, minerals, and vitamins in domestic animals. The functions of essential nutrients, including differences between nutrients needed in herbivores, carnivores, and omnivores, are discussed. Identification and use of various forages and concentrates for large animal feedings are included.]

**VTMED 622 Foreign Infectious Diseases of Animals**

Spring. 1 credit. Minimum enrollment 20. Second-, third-, and fourth-year veterinary students. Letter grades only. A. Torres.

This course describes the etiology, pathogenesis, clinical signs, gross pathology, differential diagnosis, methods of spread, reservoir hosts, and control of foreign animal diseases that present serious economic threats to the United States. The format is student-seminar presentations with each student responsible for presenting one seminar or writing a paper on the outcome of a foreign animal disease outbreak. The recent spread of FMD, West Nile virus, and BSE emphasizes the importance these diseases have to producers, consumers, and practicing veterinarians. Ordinarily the course also includes presentations by college faculty and research scientists working on foreign infectious diseases.

**VTMED 624 Feline Infectious Diseases**

Spring. 1 credit. Minimum enrollment 10; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. S. C. Barr.

The course consists of two 50-minute lecture periods a week for eight weeks. The letter grade is obtained entirely from the result of a written examination (usually multiple-choice format) given in the final period. The course emphasizes the clinical aspects of feline infectious diseases common to cats in North America and complements knowledge acquired in Blocks IV and V. The overall objective is to provide details about specific infectious diseases a future small-animal practitioner may need to know to effectively

diagnose and treat diseases. Etiology, epidemiology (prevalence and transmission), pathogenesis, clinical findings, diagnosis, pathologic findings, therapy prevention, and public health considerations are emphasized. Most lectures are presented from a clinician's point of view and therefore the material is oriented toward practical skills in managing clinical cases.

**VTMED 625 Osteoarthritis**

Spring. 1 credit. Minimum enrollment 6; maximum enrollment 16. Graduate and second-, third-, and fourth-year veterinary students. Letter grades only. G. Lust.

This course provides a basis at the molecular, cellular, and tissue levels for understanding the function of mammalian diarthrodial joints. It includes a description of a diarthrodial joint and the composition and metabolism of articular cartilage, subchondral bone, ligaments, meniscus, capsule, and synovium. The interrelationships of synovium, synovial fluid, articular cartilage, joint lubrication, biomechanical considerations, and enervation are considered. Canine hip dysplasia is a focus during the early class sessions. The osteoarthritis that is associated with canine hip dysplasia serves as a basis for discussion of the etiopathogenesis of the disease. Canine osteoarthritis is emphasized, but the disease in animal models such as mice, guinea pigs, rabbits, and sheep is mentioned. Therapies such as nonsteroidal anti-inflammatory drugs, glucocorticoids, and others may be discussed.

**VTMED 626 Epidemiology of Infectious Diseases**

Spring. 1 credit. Maximum enrollment 8. Second-, third-, and fourth-year veterinary students. Letter grades only. H. Mohammed and staff.

This course introduces the epidemiologic methods used in infectious disease investigations. The importance of surveillance systems in detecting modern epidemics and in the development of effective disease prevention and control strategies are also discussed. An emphasis is placed on understanding the relationships between the host, the agent, and the environment as they relate to disease causation. The course explores contemporary epidemiologic methods applicable to old diseases that remain real or potential problems, newly emerging infectious diseases, and nosocomial infections. Selected diseases are discussed to clarify the role of epidemiology in understanding the pathogenesis of infectious processes in individuals and groups of animals. Students have the opportunity to apply the methods learned to actual disease problems and write an epidemiologic report that might lead to a publication in a peer-reviewed scientific journal.

**VTMED 628 Clinical Pathology**

Spring. 2 credits. Minimum enrollment 25; maximum enrollment 75. Second-, third-, and fourth-year veterinary students. Letter grades only. T. Stokol.

This six-week course addresses a range of issues related to laboratory medicine and interpretation of laboratory results. General topic areas include hematology, clinical chemistry and immunology, and urinalysis. The primary mode of instruction is student-driven small-group (untutored) exploration of case materials followed by faculty-moderated large-group discussions. Selected lectures and laboratory sessions supplement and expand



on issues generated by the case discussions. This course builds on concepts previously addressed in Blocks III and IV and also provides additional experiences in practical clinical pathology procedures and microscopy.

**[VTMED 630 Clinical Biostatistics for Journal Readers**

Spring. 1 credit. Minimum enrollment 4; maximum enrollment 12. First-, second-, third-, and fourth-year veterinary students; others by permission of instructor. Letter grade. H. N. Erb.

Students will become familiar with the statistical methods commonly used in veterinary clinical articles, become able to recognize obvious misuse of those methods, and become able to interpret the statistical results.]

**VTMED 631 Clinical Diagnostic Parasitology**

Fall and spring. 0.5 credit. Prerequisite: VTMED 551. Third- and fourth-year veterinary students. S-U grades only. TBA with M. K. Frongillo and D. D. Bowman.

This course provides a chance to perform diagnostic parasitology methods using samples obtained from ongoing clinic cases. Students attend eight 1-hour sessions as they rotate through the ambulatory, community practice, and pathology rotations. In the Ambulatory Service (four sessions with students), diagnostics concentrates on the laboratory examination of samples from large-animal cases that have been observed during the previous week. In the Community Practice Service, one hour concentrates on the examination of samples from ongoing cases, while a second hour consists of a discussion of the treatment of common endo- and ectoparasites. The two hours spent as part of the pathology rotation examine methods of recovering parasites from pathology specimens, including the examination of wet preparations and the digestion of tissues for parasite recovery. The course is considered to be a logical extension to the foundation course, Host, Agent, and Defense, and is expected to build on the didactic material presented in Large- and Small-Animal Parasitology.

**VTMED 632 Senior Seminar**

Fall and spring. 1 credit. First-, second-, and third-year veterinary students. S-U grades only. Must be completed in two consecutive terms (either fall to spring or spring to fall). R. O. Gilbert.

Attendance at 14 of the senior seminar sessions presented during the academic year constitutes acceptable completion of this course. This course does *not* fulfill the 1-credit Set VII minimum.

**VTMED 635 Introduction to the Professional Literature**

Spring. 1 credit. Minimum enrollment 6; maximum enrollment 20. First-, second-, third-, and fourth-year veterinary students. Letter grades only. S. Whitaker.

This course introduces veterinary students to the professional and biomedical literature, including development of critical reading skills. Students become familiar with the broad range of professional and biomedical literature and are encouraged to develop a rigorous approach to journal and scientific article review. Secondary emphasis is on developing skills in library and bibliographic search techniques and strategies for personal information management, as well as exploring the use of veterinary-related on-line information.

**VTMED 637 Introduction to Community Practice Service**

Fall, winter, spring, and summer. 1 credit. First- and second-year veterinary students by permission of instructor. S-U grades optional. W. E. Hornbuckle.

This course introduces veterinary students to primary care small-animal clinical practice through direct exposure to the Community Practice Service of the Cornell University Hospital for Animals. Students observe and assist with restraint, examination, and routine treatment of pets and communication with clients. Successful completion requires satisfactory participation during 10 half-days of clinical service.

**VTMED 638 Veterinary Nutrition**

Spring. 2 credits. Minimum enrollment 10; maximum enrollment 90. Second- and third-year veterinary students; others by permission of instructor. Letter grades only. F. A. Kallfelz.

The first half of this course provides information on the requirements for and metabolic uses of the essential nutrients of large and small animals as well as on formulation and evaluation of practical rations for species of veterinary interest. These concepts are applied in discussion of life stage nutritional needs, including growth, adult maintenance, gestation, lactation, aging, performance, and production. The second half covers clinically relevant diseases of nutritional deficiency and excess, including obesity, as well as the role of nutrition in the management of diseases of the various organ systems—e.g., renal, lower urinary tract, cardiac, G-I, hepatic, and musculoskeletal system disease. Other topics include the role of nutrition in managing cancer and hypersensitivity disorders and in critical care, including enteral and parenteral nutrition. The course also includes an introduction to nutrition for exotic and zoo animals. This course is recommended for second- and third-year veterinary students.

**VTMED 640 Veterinary Aspects of Captive Wildlife Management**

Spring. 2 credits. Minimum enrollment 10; maximum enrollment 40. First-, second-, third-, and fourth-year veterinary students. Letter grades only. G. V. Kollias.

This course concentrates on principles of captive wildlife management, both clinical and nonclinical. Students are challenged to learn and integrate a variety of disciplines that are essential to managing wildlife successfully in a captive or semi-free-ranging environment. These disciplines include but are not limited to species-specific 1) behavior and behavioral requirements, 2) nutritional requirements and problems, 3) natural history, 4) zoonotic and toxicological problems, 5) manual restraint and anesthesia, 6) preventive medicine, and 7) medical and legal ethics. In even-numbered years the course emphasizes non-North American wildlife species (examples include African, Asian, Australian, and Central and South American species), and in odd-numbered years the course focuses more on the North American (native) wildlife species.

**VTMED 641 Approaches to Problems in Canine Infectious Diseases**

Spring. 1 credit. Minimum enrollment 10; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. S. C. Barr.

The course consists of two 50-minute lecture periods each week for eight weeks. The letter grade is obtained entirely from the result of a written examination (usually multiple-choice format) given in the final period. The course emphasizes the clinical aspects of the more common canine infectious diseases. The overall objective is to provide details about specific infectious diseases a future small-animal practitioner may need to know to effectively diagnose and treat these diseases. Clinical signs, presentation, clinicopathologic data, diagnostic choices, treatment plans, and prevention are emphasized. Most lectures are presented by clinical faculty and therefore the material is oriented toward practical skills in managing clinical cases.

**VTMED 642 Management of Fluid and Electrolyte Disorders**

Spring. 2 credits. Minimum enrollment 20; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. R. Rawson.

Students focus on clinical manifestations and the pathophysiologic mechanisms associated with fluid, electrolyte, and metabolic acid-base disturbances in domestic animals. The course is divided into segments dealing with salt and water imbalances, potassium abnormalities, metabolic acidosis, metabolic alkalosis, and mixed acid-base disturbances.

**VTMED 643 Fundamental Aspects of Embryo Transfer**

Spring. 1 credit. Maximum enrollment 16. Enrollment is done by lottery. Third- and fourth-year veterinary students or graduate students by permission of instructor. S-U grades only. Staff.

This course introduces the theory and practice of embryo transfer in domestic animals. Topics include background, advantages and disadvantages, superovulation, embryo recovery techniques, embryo culture and manipulation, embryo transfer techniques, registration of offspring, import and export, and related topics in assisted reproductive technologies. Students are exposed to practical techniques of embryo transfer in cattle, small ruminants, horses, and swine. The course consists of lectures, demonstrations, and laboratory classes during which students practice techniques of embryo recovery, evaluation, handling, and transfer.

**VTMED 644 Equine Surgical and Anesthetic Techniques**

Winter. 1 credit. Prerequisite: VTMED 602, Anatomy of the Horse. Minimum enrollment 3; maximum enrollment 21. Enrollment is done by lottery. Third- and fourth-year veterinary students. S-U grades only. S. Fubini (coordinator) and other large-animal surgeons.

This course consists of five laboratories performing surgical procedures on ponies and cadaver specimens. It is the intent of this course not to make the students proficient in these procedures but to familiarize them with some specialized surgical techniques and to make them more enlightened referring practitioners. The course, therefore, is intended for students anticipating equine practice after graduation. This course is offered during a one-week period over winter intersession.

**VTMED 645 Food-Animal Surgical and Anesthetic Techniques**

Winter. 1 credit. Prerequisite: VTMED 603, Anatomy of the Ruminant. Minimum enrollment 6; maximum enrollment 21. Third- and fourth-year veterinary students. S-U grades only. Enrollment is done by lottery. S. Fubini and other large-animal surgeons.

This course consists of five laboratories performing surgical procedures on sheep, calves, cadaver specimens, and adult cattle. It is the intent of this course not to make the students proficient in these procedures but to familiarize them with surgical techniques and to make them more enlightened referring practitioners. The course, therefore, is intended for students anticipating food-animal practice after graduation. This course is offered during a one-week period over winter intersession.

**VTMED 646 Llama Tutorial**

Fall, spring, summer. 1 credit. Prerequisite: VTMED 540. Second-semester second-, third-, or fourth-year veterinary students. S-U grades only. Independent study. M. C. Smith.

This autotutorial or group tutorial course covers common problems of llamas and alpacas. Participants are provided with study guides consisting of brief case descriptions and sample study questions. Reference is made to textbooks, journal articles, videotapes, and (if available) a teaching llama or alpaca to assist students in finding the answers to the questions efficiently. Grading is based on an oral exam.

**VTMED 647 Poisonous Plants**

Fall. 1 credit. First-, second-, third-, and fourth-year veterinary students; others by permission of instructor. S-U grades only. M. C. Smith.

Field trips demonstrate toxic plants growing in natural or cultivated settings. Lectures address economically important poisonous plants native to the United States. Information presented includes plant identification, natural habitat, toxic principles, clinical signs of toxicity, and treatment and prevention of poisoning in animals. Some of the major toxic principles found in plants and considered in detail in the course are nitrates, cyanide, oxalates, photodynamic agents, alkaloids, and mycotoxins.

**VTMED 648 Clinical Management of Native Wildlife**

Fall, spring, summer (credit given in fall). 1 credit. Enrollment not to exceed 30 students per semester. First-, second-, third-, and fourth-year veterinary students. Letter grades only. G. V. Kollias and staff.

This course introduces veterinary students to primary care for native wildlife and to wildlife issues that practicing veterinarians face on a daily basis. Students are responsible for the assessment, physical examination, and medical care of native wildlife presented to the Cornell University Hospital for Animals by the public and local wildlife rehabilitators. Student activities are directly supervised and assessed by faculty and residents on a daily basis. Successful completion of the course requires 40 hours of satisfactory supervised participation per semester in the clinic. Clinic times are appropriately scheduled throughout the semester. Students are required to submit two case summaries, or alternatives approved by the course leader, before the end of the semester and a log of their clinical hours.

**VTMED 649 Introduction to Equine Practice**

Spring. 0.5 credit. Maximum enrollment 30. First- and second-year veterinary students. Letter grades only. R. Hackett and C. Collyer.

This is an introductory course in equine husbandry intended for students with little or no experience working with horses. Lecture topics include horse breeds and colors, housing facilities and fencing, and overview discussions of the racing, showing, and breeding industries. Laboratories emphasize basic equine handling and restraint as well as feeds and bedding.

**VTMED 652 Avian Medicine and Surgery**

Spring. 2 credits. Minimum enrollment 20; maximum enrollment 40. Third- and fourth-year veterinary students. Letter grades only. G. V. Kollias and staff.

This course is designed to introduce third- and fourth-year veterinary students to the principles and practice of clinical avian medicine and surgery. The course is taught in a basic didactic lecture and discussion format with laboratories that reinforce concepts presented in the lectures. Live birds are used in some of the laboratories.

**VTMED 653 Advanced Equine Lameness**

Spring. 1.5 credits. Minimum enrollment 7; maximum enrollment 21. Third- and fourth-year veterinary students. Enrollment is done by lottery. S-U grades only. N. Ducharme, A. Nixon, M. Schramme, A. Yeager, D. Dykes, and staff.

This course is designed to help students understand the methodology and to develop the manual skills required for lameness examination in horses. Emphasis is on developing diagnostic skills. Specifically, students are expected to develop proficiency in the identification of clinical characteristics associated with recognized lamenesses and to localize the origin of the lameness. Teaching aids include video modules outlining various gait abnormalities. In addition, horses with specific gait abnormalities will be available for physical, radiographic, and ultrasonographic examination.

**VTMED 654 Equine Theriogenology**

Spring. Lec, 1 credit; lab, 0.5 credit. Lab minimum enrollment 12; maximum enrollment 24. Laboratory enrollment is done by lottery, if oversubscribed; concurrent enrollment in lecture is required. Third- and fourth-year veterinary students. Letter grades only. D. H. Volkman.

This course covers advanced aspects of equine reproductive physiology. Reproductive management of mares and stallions using natural and artificial breeding strategies is discussed. Diagnosis, treatment, and prevention of common reproductive disorders are stressed. The laboratory component builds on skills acquired during foundation courses and provides experience in techniques important in equine theriogenology.

**VTMED 655 Dairy Cow Theriogenology**

Spring. Lec, 1 credit; lab, 1 credit. Lab, minimum enrollment 12; maximum enrollment 24. Laboratory enrollment is done by lottery. Concurrent enrollment in Dairy Cow Theriogenology Lecture is required. Third- and fourth-year veterinary students. Letter grades only. D. Volkman and R. Gilbert.

This course offers lectures and labs that provide both theoretical and practical training

in current approaches to the veterinary aspects of dairy-cow reproductive care and management. The aim is to empower the student with entry-level, current knowledge and skills for the reproductive aspects of any modern dairy practice.

**VTMED 656 Special Problems in Equine Medicine**

Spring. 1.5 credits. Minimum enrollment 10; maximum enrollment 30. Enrollment is done by lottery. Third- and fourth-year veterinary students. S-U grades only. T. Divers and staff.

This course is intended for students anticipating equine practice. In-depth study of important diseases, review of recent literature, health management, and hands-on procedures or demonstrations are the core of this course.

**VTMED 657 Disorders of Large-Animal Neonates**

Spring. 1 credit. Minimum enrollment 10; maximum enrollment 100. First-, second-, third-, and fourth-year veterinary students. Letter grades only. G. Perkins.

This is an introductory neonatology course taught to first- to fourth-year veterinary students. The emphasis is on the medical and surgical problems of foals in the early neonatal period with some information presented about calves, small ruminants, and camelid neonates. Students will also spend several hours in the neonatal intensive care unit providing medical care of hospitalized patients under staff supervision.

**VTMED 659 Equine Soft-Tissue Surgery**

Spring. 1 credit. Minimum enrollment 6; maximum enrollment 24. Third- and fourth-year veterinary students. Enrollment is done by lottery. Letter grades only. R. Hackett and staff.

This course, intended for students anticipating equine practice after graduation, builds on material presented in the foundation courses to provide supplemental instruction in surgical disorders of the horse. Lectures are case based and emphasize disorders likely to be encountered in equine practice (colic, traumatic injuries, upper-respiratory-tract disorders, prepurchase examination). Laboratories emphasize diagnostic and therapeutic procedures in which an entry-level equine practitioner should be competent.

**VTMED 661 Surgical Pathology**

Spring, summer, fall. Variable 1-2 credits. Second-, third-, and fourth-year veterinary students with permission of instructor. Letter grades only. S. McDonough.

This one- or two-week course (approximately eight hours per day for one credit per week) provides hands-on experience in the Surgical Pathology Service of the Department of Biomedical Sciences. Working with the attending pathologist, students examine tissue specimens histologically, propose diagnoses, and discuss their interpretations. Students may enroll in this course only through the Office of Student Records *within the official add/drop period*. All requests to enroll must be accompanied by the Supplemental Enrollment Form indicating Dr. McDonough's approval of the enrollment and the amount of credit to be awarded. *Second-year students* should not enroll for any term other than summer *unless* they have actually reserved a January or spring-break slot through Dr. McDonough.

**VTMED 665 Medical and Surgical Problems of Dairy Cattle: Emphasis on the Individual Animal**

Spring. 1.5 credits. Minimum enrollment 6; maximum enrollment 28. Third- and fourth-year veterinary students. Letter grades only. S. Fubini and staff.

This course provides students who have a special interest in dairy practice the opportunity for in-depth discussions of special problems in bovine medicine and surgery. Emphasis is on case discussions, physical examination techniques, and ethical and practical matters. The course emphasizes individual cow treatment.

**VTMED 667 Special Problems in Small-Animal Medicine**

Spring. 1 credit. Minimum enrollment 10; maximum enrollment 40. Third- and fourth-year veterinary students. S-U grades only. K. Simpson (coordinator) and staff.

During the four-week course, students work through selected problems in small-animal medicine in two-hour weekly seminars. The focus is on the medical problems associated with cases using historic, clinical, clinical pathologic, and pathologic findings to elucidate basic pathophysiologic principles of disease. The overall objective is to give future small-animal practitioners skills in the approach to clinical problems with specific emphasis placed on history taking, clinical signs and examination skills, assessment of clinical pathology data and diagnostic materials (radiographs, ultrasounds), treatment plans, and prevention. The course expands knowledge gained in Foundation Course V and, under the instruction of a clinical faculty member, is aimed at facilitating the use of that knowledge into the practical skills of managing clinical cases.

**VTMED 668 Practice Management**

Spring. 2 credits. Number of sections will be determined by enrollment. Second-, third-, and fourth-year veterinary students. S-U grades only. M. Kraus, J. Ludders, J. Morrisey, and K. Cummings.

Course participants form a veterinary group practice that includes the specialties of each person's interest. Topics are presented and discussed in the staff meeting format of the practice. Topics include basic practice organization, leadership styles, career planning, communication skills, facility management, human resource management, maintenance of standards, marketing and merchandising, building and maintaining clients, practice growth, finances, computing systems and information management, money management, legal issues and insurance, professional relations and responsibility, and maintaining an acceptable quality of life, including stress management. Various practitioners and practice managers speak to the group about their very different successful practices, concentrating on management and organizational skills.

**VTMED 669 Sheep and Goat Medicine**

Spring. Lec, 1 credit; lab, 0.5 credit. Lab section requires concurrent enrollment in Sheep and Goat Medicine Lecture. Third- and fourth-year veterinary students. S-U grades only. M. C. Smith.

This course discusses diagnosis, treatment, and prevention of medical and surgical problems of individual small ruminants and of sheep and goat herds. Basic information on breeds, behavior, nutritional requirements,

and management systems is supplied. Economically important contagious or metabolic diseases are discussed in depth. The diagnostic evaluation and differential diagnoses for common clinical presentations such as skin disease, neurologic disease, lameness, and mastitis are considered. Herd monitoring of economically important parameters and necropsy diagnosis of abortions and neonatal losses are addressed. Breeding systems, pregnancy diagnosis methods, correction of dystocias, and common surgical procedures are discussed and demonstrated in laboratory sessions.

**VTMED 670 Drug Handling in the Body**

Spring. 0.5 credit. Maximum enrollment 60. Second-, third-, and fourth-year veterinary students. Letter grades only. R. A. Cerione and G. A. Weiland.

This course provides an in-depth consideration of the pharmacological principles of administration, adsorption, distribution, metabolism, and elimination of drugs. Emphasis is on the conceptual basis of the pharmacokinetic considerations in the therapeutic use of drugs. The course builds on the pharmacological and physiological principles introduced in Foundation Course III.

**VTMED 671 Autonomic Pharmacology**

Spring. 0.5 credit. Maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. G. A. Weiland.

This course provides an in-depth consideration of the pharmacological and physiological principles of autonomic pharmacology. Molecular, cellular, and organ-system mechanisms are emphasized. The course explores in more detail the fundamental pharmacological and physiological principles of the effects of drugs on autonomic organs introduced in Foundation Course III.

**VTMED 672 Antimicrobial Drug Therapy in Veterinary Medicine**

Spring. 1 credit. Second-, third-, and fourth-year veterinary students. Letter grades only. W. S. Schwark.

The objective of this course is to familiarize students with antimicrobial drugs used in veterinary practice. The course builds on fundamental pharmacological and microbiological principles covered in Foundation Courses III and IV and considers antibacterial, antifungal, antiparasitic, and anticancer drugs from the point of view of unique pharmacokinetic properties, indications for clinical use, and potential toxicities as the basis for rational use.

**VTMED 676 Clinical Ophthalmology**

Spring. 0.5 credit. Third- and fourth-year veterinary students. S-U grades only. R. Riis, N. Irby, and T. Kern.

The principles and practice of entry-level veterinary ophthalmology introduced in Block V, Introduction to Veterinary Ophthalmology, are supplemented by lectures and discussions that emphasize species differences, basic surgical decision-making, and recognition of ocular conditions appropriate for referral. One of the four class periods is devoted to laser ocular surgical techniques performed on cadaver tissues.

**VTMED 677 Dairy Production Medicine**

Fall. 2 credits. Minimum enrollment 6; maximum enrollment 14. Third- and fourth-year veterinary students. S-U grades only. C. Guard.

This is an intermediate course in the techniques and procedures used by veterinarians in modern dairy practice. Many of these activities fall outside the traditional boundaries of medicine, surgery, and theriogenology and might include housing, facilities, manure management, and employee education. Data analysis, disease and productivity monitoring, and evaluation of deviations from targeted performance are used to plan cost-effective interventions or corrections, followed by continued surveillance to monitor their effect. Students are introduced to the dominant software currently used in dairy management. Local dairy herds serve as additional laboratories for class projects.

**VTMED 678 Small-Animal Theriogenology**

Spring. 1 credit. Minimum enrollment 6; maximum enrollment 100. Third- and fourth-year veterinary students. Letter grades only. D. H. Volkman.

This is a distribution course in a lecture-based format designed to complement the knowledge gained in the theriogenology component of Foundation Course V, Animal Health and Disease. Content includes discussion of breeding management, infectious and noninfectious causes of infertility, and pathology of the male and female reproductive tracts, their diagnosis, and management. The emphasis of the course is on conditions affecting dogs and cats.

**VTMED 679 Clinical Pharmacology**

Spring. 0.5 credit. Third- and fourth-year veterinary students. S-U grades only. W. S. Schwark.

This course is offered after Blocks I-V and formal exposure to pharmacology course work is completed. The course is designed to familiarize students with drug use in the clinical setting and uses ongoing cases in the Cornell University Hospital for Animals as a teaching tool. Pharmacological concepts are emphasized, with a focus on the rationale for drug choice, alternative drug choices available, pharmacokinetic considerations, and potential drug interactions/toxicities. This course is offered at the time students are about to embark on their clinical rotations. It is designed to emphasize practical aspects of pharmacology in the clinical setting, using basic concepts obtained during formal course work. The onus is placed on the student to explain/rationalize drugs employed in clinical cases in the teaching hospital.

**VTMED 680 Behavior Problems of Horses**

Spring. 1 credit. Prerequisite: one semester of veterinary curriculum. First-, second-, third-, and fourth-year veterinary students. S-U grades only. K. A. Houpt.

The goal of this course is to give veterinary students the ability to treat the behavior problems of horses. History-taking, counseling, diagnostic tests, follow-up, the importance of cooperation with the referring veterinarian, prevention of behavior problems, training techniques of value to the practitioner, and socialization of foals are presented.



**VTMED 681 Behavior Problems of Small Animals**

Spring. 1 credit. Minimum enrollment 10. Prerequisite: one semester of veterinary curriculum. First-, second-, third-, and fourth-year veterinary students. S-U grades only. K. A. Houpt.

The goal of this course is to give veterinary students the ability to treat the behavior problems of cats and dogs. History-taking, counseling, and follow-up methods are presented. Each student has the opportunity to participate in three cases. Behavioral and pharmacological treatments for behavior problems are presented.

**VTMED 682 Topics in Veterinary Emergency and Critical Care Medicine**

Spring. 1 credit. Minimum enrollment 20. Third- and fourth-year veterinary students, all others need instructor approval. S-U grades optional. N. Dhupa.

This course provides an introduction to emergency and critical care medicine, covering one to three topics per week. Although all of the discussions center on small animal medicine, the same principles often apply to both small and large animal situations. Topics that might be covered include a selection from the following list: triage, shock, trauma, stabilization, cardiopulmonary resuscitation, respiratory emergencies, cardiac emergencies, heat stroke, toxicities, endocrine emergencies, acute renal failure, hematologic emergencies, transfusion medicine, respiratory monitoring, hemodynamic monitoring, acute abdomen, emergency surgical procedures, and sepsis.]

**VTMED 692 Current Concepts in Reproductive Biology (also BIOAP 757)**

Fall. 3 credits. Minimum enrollment 6. First-, second-, and third-year veterinary students or appropriate undergraduate/graduate training. Letter grades only. Lec, 2 hours each week; disc, 2 hours each week; T R 10:10-12:05. Offered odd-numbered years. J. Fortune, W. R. Butler, and staff.

This is a team-taught survey course in reproductive physiology/endocrinology. Lectures are given by a number of reproductive biologists on various aspects of male reproductive function (endocrine regulation, testis function, spermatogenesis, and sperm physiology/function); female reproductive function (endocrinology, ovarian development and function, oocyte physiology/function); fertilization and early embryo development; pregnancy; parturition; puberty; and reproductive technology. Students participate in the form of discussions and/or presentations.]

**VTMED 695 Genetic Basis of Eye Diseases**

Spring. 1 credit. Minimum enrollment 6; maximum enrollment 14. First-, second-, third-, and fourth-year veterinary students. Letter grades only. G. Aguirre.

This course covers the molecular and genetic basis of inherited eye diseases in domestic and laboratory animals. It is aimed at the professional student in the veterinary curriculum but is open to graduate-level students. The course is given in a combination lecture/seminar format, with students leading and actively participating in discussions. The students are expected to do assigned and independent outside research, both for class discussions and the paper.]

**VTMED 696 Fundamental Principles and Techniques of Small-Animal Anesthesia: Dogs, Cats, and Birds**

Spring. 1 credit. Minimum enrollment 15. Third- and fourth-year veterinary medical students. J. W. Ludders, R. D. Gleed, and L. P. Posner.

This course is designed for the veterinary student interested in small-animal practice. The course consists of lectures, case discussions, and development of anesthetic protocols for routine and complicated cases. Subjects to be covered include anesthetic management for elective and emergency surgery, management of the high-risk patient, fluid therapy, drug interactions, pain management, and the management of anesthesia-related complications, cardiopulmonary resuscitation, and post-anesthetic management. While fundamental concepts and recent advances in anesthesia are discussed, the practical application of anesthetic principles and techniques are a major objective of the course.]

**VTMED 697 Fundamental Principles of Large-Animal Anesthesia: Equine and Mixed Animal Practice**

Spring. 1 credit. Minimum enrollment 15. Third- and fourth-year veterinary medical students. R. D. Gleed, J. W. Ludders, and L. P. Posner.

This course is designed for the veterinary student interested in equine or mixed-animal practice. The course consists of lectures, case discussions, and development of anesthetic protocols for routine and complicated cases. Subjects to be covered include anesthetic management for elective surgery, field anesthesia, management of the high-risk patient, fluid therapy, drug interactions, pain management, and the management of anesthesia-related complications, cardiopulmonary resuscitation, and post-anesthetic management. While fundamental concepts and recent advances in anesthesia are discussed, the practical application of anesthetic principles and techniques is a major objective of the course.]

**VTMED 698 Special Projects in Veterinary Medicine**

Fall, winter, spring, summer. Variable 1-4 credits. Must be arranged with a College of Veterinary Medicine tenure-track faculty member. S-U grades optional.

This course provides the opportunity for students to work individually with a faculty member to pursue an area of particular interest and, typically, not part of the established curriculum. Specific course objectives and course content are flexible and reflect the scope and academic expertise of the faculty.

**VTMED 699 Research Opportunities in Veterinary Medicine**

Fall, winter, spring, summer. Variable 1-4 credits. Must be arranged with a College of Veterinary Medicine tenure-track faculty member. S-U grades optional.

This course provides the opportunity for individual students to work in the research environment of faculty involved in veterinary or biomedical research. Specific course objectives and course content are flexible and reflect the specific research environment. Research projects may be arranged to accumulate credit toward requirements in Distribution Sets I, II, III, IV, and V.

**VTMED 700 Theriogenology Service**

Spring. 2 or 4 credits. Prerequisite: VTMED 551. Maximum enrollment 5 per rotation. Third- and fourth-year veterinary students. Letter grades only. D. H. Volkmann and staff.

Two-week exposure to clinical procedures in theriogenology as provided by Cornell University Hospital for Animals patient load and augmented by teaching herd animals.

**VTMED 701 Cardiology Service**

Fall and spring. 2 credits. Prerequisite: VTMED 551. Minimum enrollment 1 per rotation; maximum enrollment 2. Third- and fourth-year veterinary students. Letter grades only. S. Moise.

The purpose of the cardiology rotation is to provide students with the opportunity to put into practice what they have learned in the foundation years. The management of the most common cardiac diseases is emphasized, including congestive heart failure, arrhythmias, and secondary cardiac diseases. All species are examined, large and small, although the majority are small animals. Diagnostics, including cardiovascular physical examination, electrocardiography, radiography, and echocardiography, are taught. The rotation includes clinical work, didactic teaching, and self-initiated digging for information.

**VTMED 702 Laboratory-Animal Medicine**

Fall and spring. 2 credits. Prerequisite: VTMED 551. Maximum enrollment 2 per rotation. Third- and fourth-year veterinary students. Letter grades only. M. Bailey and staff.

The practice of laboratory animal medicine requires a combination of preventive programs, clinical skills, knowledge of various species' biologies, familiarity with research methodology, and acquaintance with state and federal regulations. This course is offered as a two-week introduction to that specialty. Students accompany laboratory-animal veterinarians on clinical rounds of Cornell's research-animal housing and participate in laboratory diagnostic work. Review sessions are conducted on the biology, medicine, pathology, and husbandry of rodents, rabbits, and primates and on current legislation regulating the care and use of research animals. The course may include field trips to other institutions.

**VTMED 703 Clinical Wildlife, Exotic-, and Zoo-Animal Medicine**

Fall, winter, spring, summer. 2 credits. Prerequisite: VTMED 551. Maximum enrollment 3 per rotation (plus one intern or extern). Third- and fourth-year veterinary students. Letter grades only. G. V. Kollias and staff.

This course introduces students to primary medical care of nontraditional pet species, zoo animals, and native wildlife. Students, directly supervised by the attending clinician, are responsible for the assessment, physical examination, and medical management of exotic animal species presented to the Cornell University Hospital for Animals. Other opportunities available to assist in the development of clinical skills in wildlife-, zoo-, and exotic-animal medicine include the wildlife clinic cases, ongoing wildlife research and service projects, and trips to the Rosamond Gifford Zoo. Successful completion of the course requires satisfactory performance during this 14-day clinical rotation.

**VTMED 704 Quality Milk**

Fall or spring, 2 credits. Prerequisite: VTMED 551. Third- and fourth-year veterinary students. Letter grades only. R. Gonzalez, D. Wilson, and staff.

This course covers the causes, diagnosis, treatment, and prevention of bovine mastitis. The role of management practices is stressed. The course includes lectures, readings, discussions, laboratory exercises, and farm visits as part of the Quality Milk Production Services. Participants are expected to complete a case study on a dairy farm with udder-health problems and present their findings to the producer and farm personnel. Grading is on performance during the course and a final exam.

**VTMED 705 Special Opportunities in Clinical Veterinary Medicine**

Fall, spring, and summer. Prerequisite: VTMED 551. Third- and fourth-year veterinary students. S-U grades only.

This course provides opportunities for students finished with Foundation Course V to explore professional areas not available through the regular curriculum. Blocks of two to four weeks are usually spent at other teaching hospitals, research laboratories, or zoological facilities. Student proposals are submitted to the assistant dean for learning and instruction for review and approval. On-site supervisors of the block act as ex-officio faculty members and are required to evaluate each student formally.

**VTMED 707 Poultry Medicine and Production Rotation**

Fall, 2 credits. Prerequisite: VTMED 551 and VTMED 616, Diseases of Birds, is recommended. Third- and fourth-year veterinary students. K. A. Schat.

This course is a two-week rotation that takes place at the University of St. Hyacinthe or the University of Guelph in alternating years. The course provides students with an introduction in practical poultry medicine by a combination of lectures, discussions, and laboratory sessions including postmortem examinations. Students also visit hatcheries, broiler, layer, and turkey farms.

**VTMED 708 Clinical Oncology**

Fall and spring, 2 credits. Prerequisite: VTMED 551. Maximum enrollment 4 per rotation. Third- and fourth-year veterinary students. Letter grades only. K. M. Rassnick.

Management and prevention of cancer in companion animals represents a significant component of the practice of veterinary medicine. The focus of this clinical rotation is the development of a comprehensive set of skills necessary for a veterinarian to become an advocate for the client/patient with cancer. These skills include appropriate initial evaluation of animals with cancer; sensitive and effective client and referring-veterinarian communication; ability to access relevant information from numerous sources related to cancer management; and ability to understand and apply principles of surgical, medical, and radiation oncology as well as techniques specifically related to minimize pain and treatment-related effects in cancer patients.

**VTMED 709 Clinical Emergency and Critical Care Medicine: Small-Animal**

Fall, winter, spring, and summer. 2 credits. Third- and fourth-year veterinary students. S-U grades only. N. Dhupa.

Management of both emergent and critical cases represents a significant component of the practice of veterinary medicine. The focus of this clinical rotation will be the development of a knowledge base and a comprehensive set of skills necessary for a veterinarian to perform adequately in these areas, within a structured format. These skills will include the appropriate evaluate (triage) and stabilization of emergency patients, the management of post-operative and other critical patients, and sensitive and effective client communication. The participants will access relevant information from various sources related to emergency and critical care medicine and will understand and apply these principles to clinical cases. Participants will have patient care responsibilities in the Intensive Care and Intermediate Care units of the Cornell University Hospital for Animals and will work closely with technicians and clinicians to develop familiarity with technical and nursing procedures. Students will participate in the management of incoming emergency cases. The clinical emergency and critical care medicine rotation will be primarily an overnight rotation.

**VTMED 710 Animal Behavior Clinic**

Fall, winter, spring, and summer. 2 credits. Prerequisite: VTMED 681. Maximum enrollment 2 at one time. Third- and fourth-year veterinary students. S-U grades only. K. A. Houpt.

The students will participate fully in the Animal Behavior Clinic: answering telephone, mail, and e-mail inquiries, observing and taking charge of behavior cases. To answer inquiries, the student is expected to consult several behavioral textbooks or other sources. Taking charge of the cases includes reading the entire behavioral history, interviewing the owner, forming a diagnosis, conferring with Dr. Houpt or a behavioral resident as to the proper behavioral and pharmacological treatment, demonstrating behavior-modification techniques and writing a letter to the client. Follow-up calls to earlier cases may be made.

**VTMED 711 Herd Health and Biosecurity Risk Evaluation Using the NYS Cattle Health Assurance Program (NYSCHAP) Model**

Summer, fall, 2 credits. Prerequisites: VTMED 540 and VTMED 743. Minimum enrollment 5. Third- and fourth-year veterinary students, others by permission of the instructor. Letter grades only. K. Kaufman, F. L. Welcome, D. V. Nydam, and Diagnostic Lab faculty.

This course introduces students to the identification of disease risk and the evaluation of cattle operations, focusing on animal health, food safety, and the environment. It combines information on risk assessment, creation of herd plans, biosecurity, Johne's disease, standard operating procedures, global trade, and environmental issues. Additionally, two local farms are visited to give students the opportunity to implement knowledge gained in lectures.

**VTMED 712 Equine Specialty Rotation**

Fall, 2 credits. Prerequisite: VTMED 551. Minimum enrollment 5; maximum enrollment 10. Preference given to fourth-year veterinary students in the equine pathway. Letter grades only. N. G. Ducharme.

The objective of the rotation is to teach basic recognition and clinical skills for students interested in equine practice. These skills prepare students to be sent on related equine calls on their first day of work. The population of horses owned by Cornell is used for these practical skills. The emphasis of this elective is 80 percent hands-on and 20 percent discussion, rounds, and lectures. The rotation includes lectures and corresponding discussion groups to cover the scientific basis, controversies, industry-specific state of the art, and the clinical indications, contraindications, and potential complications of the various modalities.

**VTMED 720 Issues and Preventive Medicine in Animal Shelters**

Spring, 1 credit. Prerequisite: VTMED 540. Minimum enrollment 5; maximum enrollment 30. Third- and fourth-year veterinary students. Letter grades only. J. M. Scarlett and staff from the American Society for Prevention of Cruelty to Animals.

Veterinarians often work for or with animal shelters, serve on shelter boards of directors, act as community resources for issues relating to companion animal welfare, participate in spay and neuter programs, and influence the quality of the human-animal bond. This course addresses the history of the humane movement, role of the veterinarian in relation to shelters, preventive and palliative health management (including highlighting diseases of major concern), issues surrounding euthanasia, reasons for relinquishment, programs for behavior modification, and the legal concerns of shelters. These issues are addressed using lectures and large-group discussions.

**VTMED 721 Timely Topics in Veterinary Parasitology: Large-Animal**

Spring, 0.5 credit. Minimum enrollment 2. Third- and fourth-year veterinary students. S-U grades only. D. D. Bowman.

This course presents an in-depth look at one or a few parasites of special interest relative to large-animal medicine. The course presents details of taxonomy, biology, epidemiology, clinical presentation, and preventive and curative treatment. Efforts are made to discuss those aspects of the disease as it relates to the practical control of these and in-depth coverage of primary literature relating to the parasite being discussed. Topics vary annually. The course is presented in a lecture/discussion format.

**VTMED 722 Timely Topics in Veterinary Parasitology: Small-Animal**

Spring, 0.5 credit. Minimum enrollment 2. Third- and fourth-year veterinary students. S-U grades only. D. D. Bowman.

This course presents an in-depth look at one or a few parasites of special interest relative to small-animal medicine. The course presents details of taxonomy, biology, epidemiology, clinical presentation, and preventive and curative treatment. Efforts are made to discuss those aspects of the disease as it relates to the practical control of these and in-depth coverage of primary literature relating to the parasite being discussed. Topics vary annually. The course is presented in a lecture/discussion format.

**VTMED 723 Bacteria and Fungi in Veterinary Medicine**

Spring. 2 credits. Minimum enrollment 8; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. Letter grades only. D. P. Debbie.

This course provides an overview and listing of important bacterial and fungal diseases of domestic animals (cow, horse, sheep, pig, goat, dog, cat) in preparation for medicine courses. The etiology, pathogenesis, host response, and prevention are emphasized. Avian, zoonotic, and exotic (foreign animal) bacterial and fungal diseases are covered in less detail because they are covered in other courses. The course also provides insight into diagnostic procedures for bacterial and fungal diseases such as available tests, what samples to take, how to handle samples, and how diagnostic procedures are performed.

**VTMED 726 Reptile Medicine and Surgery**

Spring. 1 credit. Minimum enrollment 10; maximum enrollment 40. Third- and fourth-year veterinary students. Letter grades only. G. V. Kollias.

This course is designed to introduce third- and potentially fourth-year veterinary students to the principles and practice of reptile medicine and surgery. The course is taught in a basic lecture and discussion format.

**VTMED 730 Vaccines: Theory and Practice**

Spring. 1 credit. Prerequisite: introductory course in immunology or VTMED 540 or VETMI 315. Minimum enrollment 10; maximum enrollment 40. Second-, third-, and fourth-year veterinary students and graduate students; others by permission of instructor. Letter grades only. Grades based on a final examination and one term report. Offered odd-numbered years. T. Clark.

This course provides an overview of vaccines used in clinical practice as well as an in-depth look at vaccine development. Emphasis is placed on the most recent advances in vaccine design and delivery, including the use of recombinant DNA techniques for targeting specific immunological responses. Lectures touch on vaccines commonly used in veterinary practice and address in detail the use of carriers, adjuvants, and immunostimulants; attenuated pathogens; recombinant subunit vaccines; viral and bacterial vectors for vaccine delivery; synthetic antibodies; and genetic immunization with "naked" DNA.

**VTMED 732 Veterinary Clinical Toxicology**

Spring. 1.5 credits. Second-, third-, and fourth-year veterinary students. S-U grades optional. TBA and K. Earnest-Koons.

This course provides veterinary students with a solid introduction to concepts and principles of toxicology and how they are applied in the clinical setting. Students learn about specific common toxicants, clinical signs in affected animals, and treatment protocols for the toxicants in question. Students also gain an understanding of the clinical approach to suspected or unknown toxicoses, sample collection and handling, and resources available for clinical toxicologic problems. The course is conducted with two 1-hour lectures per week and one hour-long large-group discussion per week. Grades are based on weekly quizzes, a final exam, and oral participation.

**VTMED 733 Selected Infectious Diseases of Swine**

Spring. 1.5 credits. Minimum enrollment 6; maximum enrollment 80. Second-, third-, and fourth-year veterinary students. S-U grades optional. K. Earnest-Koons.

This course provides veterinary students with a solid introduction to concepts and principles of swine infectious diseases and how they are treated in the clinical setting. Students learn about specific infectious diseases, clinical signs in affected animals, and treatment protocols for the diseases in question. Students also gain an understanding of the clinical approach to suspected or unknown infectious agents, sample collection and handling, and resources available for infectious disease diagnosis. The course is conducted with two 1-hour lectures per week and one hour-long large-group discussion per week. The class meets three days per week for one hour each. Grades are based on weekly quizzes, a final exam, a short paper and/or oral presentation.

**VTMED 735 Special Topics in Ambulatory and Production-Animal Medicine**

Fall, winter, spring, and summer. Variable 1-2 credits. Prerequisite: VTMED 560 and approval of instructor. Limited to second-, third-, and fourth-year veterinary students. Letter grades only. M. E. White and staff.

This course provides specialized experiences in the Ambulatory and Production Medicine Service. The course consists of participation in scheduled and emergency farm calls and completion of projects designed to provide experience in herd problem solving, records analysis, and implementing herd-health programs. Clinical service assignments are planned to meet individual student goals. Examples of focus areas available include livestock production medicine, dairy reproductive examinations, small-ruminant medicine, and equine ambulatory practice.

**VTMED 736 Veterinary Diagnostic Imaging**

Spring. 1.5 credits. Prerequisite: VTMED 540, Host, Agent, and Defense. Class of 2005 DVM students only. Letter grades only. P. Scrivani.

The course is designed to emphasize the relevance of a solid foundation in veterinary anatomy as it clinically applies to diagnostic imaging. Additionally, the course is designed to provide students with an understanding of the strengths and limitations of diagnostic imaging by discussing interpretation principles, pitfalls and interpretations, and measurements obtained through lectures, laboratory exercises, weekly quizzes, and reading assignments. Integration of these objectives culminates in weekly laboratory exercises during which students must make or evaluate decisions regarding patient management based on evaluation of clinical signs and imaging examinations. The "Roentgen-Sign" approach to diagnostic imaging interpretation is used as a model.

**[VTMED 737 Principles of Pathology**

Spring. 1.5 credits. Minimum enrollment 6; maximum enrollment 40. Second-, third-, and fourth-year veterinary students. Letter grades only. S. McDonough.

Principles of Pathology is intended for students who wish to strengthen and broaden their knowledge of the pathologic basis of disease. Fundamental biologic processes as revealed by gross and microscopic pathologic changes are emphasized. Molecular

mechanisms are integrated into the discussion where appropriate. General pathologic processes are organized into a logical and uniform system to facilitate comprehension and learning with particular attention paid to definition and proper usage of terminology. The course includes two lectures per week and a one-hour large-group discussion. The large-group discussion allows students to apply general knowledge gained in lecture to a specific problem.]

**VTMED 738 Veterinary Parasitology**

Spring. 2.5 credits. First-, second-, third-, and fourth-year veterinary students. Letter grades only. D. D. Bowman.

This course provides a basic introduction to animal parasites of veterinary importance, concentrating mainly on the biology, control, and diagnosis of protozoan and metazoan parasites. Emphasis is given to parasites representative of significant disease processes or of significant clinical importance to veterinarians. The course elaborates on the biology and pathogenesis of these major pathogens with the ultimate goal being to maximize the recognition of the major disease manifestations induced by the different groups of organisms. Laboratories stress certain aspects of some important parasite groups.

**VTMED 739 Viruses in Veterinary Medicine**

Spring. 1.5 credits. Maximum enrollment 90. Second-, third-, and fourth-year veterinary students. Letter grades only. C. R. Parrish and J. Baines.

This course is designed to supplement the information provided in the foundation courses, particularly Foundation Courses IV and V. The objective is to provide, in a survey form, an overview of the major groups of viruses that infect animals and to give a summary of the diseases that they cause. The diseases that are most commonly encountered in veterinary practice are given the greatest amount of the available time, and diseases that are less frequently seen are given less detailed coverage. The properties of the viruses, their general pathogenic mechanisms, diagnostic methods, and some specific examples are covered.

**VTMED 740 Veterinary Perspectives on Pathogen Control in Animal Manure**

Spring. 2 credits. Third- and fourth-year veterinary students. Letter grades only. D. D. Bowman.

This course presents an in-depth look at the management of pathogens in animal manures. It reviews the pathogens involved, the role of governing agencies, the survival of pathogens in the field, and methods of pathogen destruction. The course discusses commercial methods of manure processing for the control of these pathogens for the protection of other animals and the human population. The course concludes with class discussions with major stakeholders representing the dairy, beef, pork, and poultry industries and their understanding of the problem as it relates to veterinary students.

**VTMED 741 Microbial Safety of Animal-Based Foods**

Spring. 1 credit. Minimum enrollment 10; Maximum enrollment 20. Second-, third-, and fourth-year veterinary students. Letter grades only. B. L. Njaa and M. Wiedmann.

This class will meet for two hours once a week for eight weeks. In the first two weeks, the instructor will provide an overview of

food-safety issues relevant to the veterinary profession. The following four weeks will be dedicated to student presentations on selected food-borne pathogens and food-safety issues. In the final two weeks, lectures and discussion led by the instructors will focus on emerging new issues in food safety and on farm-to-table technologies and approaches that can be used to assure the safety of animal-based foods.

#### **VTMED 742 Dairy Business Management and Health Economics**

Spring, 2 credits. Minimum enrollment 8; Maximum enrollment 26. Second-, third-, and fourth-year veterinary students. Letter grades only. C. Guard and L. Warnick.

This course will help veterinary students understand basic principles of dairy economics and business management and develop specific skills used by veterinarians in health economic decision making. Three main topic areas will be covered. The first will be an overview of dairy economics from regional, national, and global perspectives. The second part of the course will present the terminology and concepts used in dairy business financial analyses and economic decision making. The last section will focus on dairy health economics, including the application of economic tools to decisions related to disease treatment, health maintenance, and productivity.

#### **VTMED 743 Interaction with the Animal Health Diagnostic Laboratory for Investigating Herd Problems**

Spring, 1 credit. Minimum enrollment 5. Third- and fourth-year veterinary students; others by permission of the instructor. Letter grades only. D. V. Nydam and others.

This seminar course uses an interactive format and multiple experts from their fields to introduce future veterinarians how best to use the services of a diagnostic laboratory when investigating herd problems. The course will combine logistical and factual matters such as appropriate sample submission, tests available for various pathogens, and relative test interpretation with practical case-based discussion of the various diagnostic modalities. Topics will include virology (e.g., BVD), bacteriology (e.g., *Salmonella*), parasitology (e.g., *Cryptosporidium*), serology (e.g., *Johnes Disease*), molecular techniques (e.g., *E. coli*), herd-level test interpretation, and outbreak investigation.

#### **VTMED 744 Veterinarians and Food-Animal Production Systems: An Introduction**

Spring, 1 credit. Minimum enrollment 5. First- and second-year veterinary students; others by permission. Letter grades only. D. V. Nydam and invited speakers.

This seminar course uses an interactive format and multiple experts from their fields to introduce future veterinarians to various food-animal production systems, how veterinarians interact with them, and the synergy between these systems and veterinarians in society. Each week the production structure of the dairy, beef, swine, poultry, or aquaculture industry, veterinarians' role in them, and career opportunities and expectations will be discussed. The offering is intended for first- or second-year students so that they can plan appropriately to take additional courses or set up externships in the following years.

#### **VTMED 745 Dynamics of Dairy Herd Health and Management**

Spring, 1 credit. Third- and fourth-year veterinary students. Letter grades only.

Y. T. Grohn and L. D. Warnick.

Competitive pressure, increasing input costs, and comparatively stagnant milk and salvage values require dairy producers to become more efficient. The current trend of increasing herd size also drives changes in management. Veterinarians are called upon to advise dairy producers not only in matters of herd health but increasingly in matters of productivity and management decision making. Identifying opportunity areas to improve productivity and ultimately profitability requires veterinarians to recognize and solve complex and interdependent milk production, reproduction, and health issues. The goal of this course is to teach students the dynamic relationships of herd-performance parameters with dairy-herd health and management. This is done with a combination of lectures and computer exercises. The following topics are addressed: 1) how often production diseases occur and when, 2) how they are interrelated, 3) the impact of disease on milk production, reproductive performance, and risk of culling, and 4) how to use this information in production medicine. The format of this eight-week course (two days per week) is a lecture one day and hands-on work with computer software for data management and analysis.

#### **VTMED 746 Fish Health Management**

Spring, 1.5 credit. Minimum enrollment 8; maximum enrollment 16. First-, second-, third-, and fourth-year veterinary students; others by written permission of instructor. S-U grades optional. P. R. Bowser.

A lecture and laboratory course providing an overview of the aquatic environment and the important infectious and noninfectious diseases of fish. Diseases covered will be those important diseases encountered in commercial aquaculture, aquarium systems, and natural waters. The laboratory is designed to provide students with a knowledge base and hands-on diagnostic experience in diseases of fish. Students also will maintain and manage aquarium systems during the course to gain an appreciation for the science behind the operation of those systems. The laboratory will require time outside the normal scheduled class sessions (to be scheduled by the students) for management of the aquarium systems. Each student also will make a presentation on a topic in aquatic-animal health during the course.

#### **VTMED 747 Exotic Small Mammals as Pets**

Spring, 1.5 credits. Students enrolled in VTMED 703 are encouraged to enroll. Maximum enrollment 80. Third- and fourth-year veterinary students and graduate students. Letter grades only. J. K. Morrissey.

This course concentrates on the husbandry, clinical presentation, diagnosis, and treatment of common diseases of nontraditional small mammals that are kept as pets. These species include ferrets, rabbits, guinea pigs, chinchillas, rats, mice, hamsters, gerbils, hedgehogs, sugar gliders, and other animals. Grading is by letter and based on a midterm and final examination.

#### **VTMED 748 Canine and Feline Medical Genetics**

Spring, 2 credits. Prerequisites: VTMED 520, 530, and 531. Minimum enrollment 10; maximum enrollment 40. S-U grades optional. V. N. Meyers-Wallen.

This course covers the genetic and pathophysiologic mechanisms underlying inherited diseases in dogs and cats that may be encountered in small-animal practice. Specific disorders of clinical importance are presented in a lecture format to illustrate the distribution, diagnosis, and control of inherited diseases in individuals and populations. Ethical considerations regarding treatment, prevention, and control measures are discussed.

#### **VTMED 749 Anaerobic Infections of Animals**

Spring, 1 credit. Prerequisite: VTMED 540. Minimum enrollment 10; maximum enrollment 80. S-U grades only.

P. L. McDonough and staff.

This course presents anaerobic infections in clinical context as an adjunct to the material covered in Block IV. Students gain an understanding of the diversity and biology of anaerobic bacteria and the niches that they occupy in the animal and avian body. A basic, clinically oriented taxonomy is presented, and students learn about the virulence and pathogenesis of the major anaerobes that they will encounter in clinical practice. The clinical signs of anaerobic infections, laboratory identification and susceptibility testing, and the use of specimen transport media are also covered. Treatment of common infections, including wound care, is covered and vaccines currently available are discussed in detail. In the second four weeks of the course, students learn about the major clinical syndromes caused by anaerobes (e.g., myositis, tetanus, botulism, periodontal disease, foot rot, and jejunal hemorrhage syndrome). The format consists of two one-hour lectures per week for eight weeks (one lecture period is spent in the laboratory looking at demonstrations for the identification of anaerobes and clinical gram stains).

#### **VTMED 750 Managing Infectious Diseases in Small Animal Populations**

Spring, 1 credit. Prerequisite: VTMED 720 strongly recommended. Minimum enrollment 3; maximum 20. Third- and fourth-year veterinary students. Letter grade only. J. M. Scarlett.

This course is intended as a sequel to the Issues and Preventive Medicine in Animal Shelters course offered in the C Distribution block. In light of the time constraints in the Issues course, the principles of prevention and control to specific diseases (e.g., ringworm, kennel cough) commonly encountered in small animal populations are not discussed. This course encourages students to apply principles of infectious disease, epidemiology, and preventive medicine to infectious disease problems in small animal populations, with a particular emphasis on disease problems in shelters. Mention of modification to fit other small animal populations (e.g., catteries, kennels) will be made.



## Biomedical Sciences

### **VTBMS 346 Introductory Animal Physiology (also BIOAP 311) (Undergraduate)**

Fall. 3 credits. Prerequisites: BIOG 105, BIOG 106, or BIOG 101, BIOG 102, BIOG 103, BIOG 104, BIOG 107, BIOG 108; CHEM 207, CHEM 208, or CHEM 206, or CHEM 215, CHEM 216; MATH 106, MATH 111 or MATH 191 or AP credit for any of the above; or one year of college-level biology, chemistry, and mathematics. S-U grades optional. E. R. Loew.

A general course in animal physiology emphasizing principles of operation, regulation, and integration common to a broad range of living systems from the cellular to the organismal level. Structure-function relationships are stressed along with underlying physical-chemical mechanisms.

### **VTBMS 600 Special Projects in Anatomy**

Fall, spring. 1 credit per 2.5-hour period. By permission of instructor. S-U grades only. Biomedical science staff.

### **VTBMS 628 Graduate Research in Animal Physiology (also BIOAP 719; Graduate)**

Fall, spring. 1-3 credits. By written permission of department chairperson and faculty mentor who will supervise the work and assign the grade. S-U grades optional.

Similar to BIO G 499 but intended for graduate students who are working with faculty members on an individual basis.

### **VTBMS 700 Predictions of Form or Phylogeny**

Fall. 1 credit. By permission of instructor. S-U grades optional. J. W. Hermanson.

Form and function are often discussed as a correlated entity in biology. This seminar group starts with the question, Does form really predict function? This is addressed initially with respect to the analysis of paleobiology but then encompasses examples of experimental functional morphology. In particular, there is a growing body of experimental data demonstrating that diverse functions can be achieved with nearly identical morphologies, and that the functional diversity may better be explained by behavior or environmental factors. Might these observations refute current theories about the origin of flight in extinct organisms (i.e., the cursorial or ground-up theory of flight versus the arboreal gliding theory of flight evolution)? Specific topics pursued are selected by participants in this course. Participation is open to interested graduate students, advanced undergraduate students, and veterinary students.

### **VTBMS 701 Mouse Pathology and Transgenesis**

Spring. 1 credit. Maximum enrollment 12 students. Graduate students, pathology residents, interns and post-docs, and third- and fourth-year veterinary students. Prerequisite: basic course in histology (BIOAP 416 or equivalent) is strongly recommended. Letter grades only. A. Nikitin and staff.

Introductory course on contemporary mouse pathobiology explains principles and methods of pathology and transgenesis. In addition to coverage of development, anatomy, histology and pathology of organs and systems, the course focuses on systematic evaluation of

new genetically modified mice, with particular attention to such topics as experimental design, validation of mouse models, and identification of novel phenotypes. This course includes supervised mouse necropsy.

### **VTBMS 713 Cell Cycle Analysis (also TOX 713 and TOX 698)**

Spring. 1 credit. S-U grades only. A. Yen. This one-credit module presents a brief historical review of the cell cycle; a summary of cell cycle regulatory processes; and practical methods for cell cycle analysis, including mathematical representations. Topics include growth control of bacterial cell cycle, including chemostats, mammalian cell tissue culture, cell synchronization, flow cytometry, age-density representation, G1 regulation, labile regulatory protein models, cell transformation, regulation by growth factors and the cytoskeleton, cyclin/E2F/RB regulatory model, practical examples for analysis of cell cycle phase durations, cell cycle phase specific growth factor sensitivity, timing of RB protein phosphorylation within the cell cycle. The objective of the course is to present graduate students with methods for cell cycle analyses that will be used in their research.

### **VTBMS 720 Special Problems in Physiology (Graduate)**

Fall, spring. 1-3 credits. By permission of instructor. Laboratory work, conferences, collateral readings, and reports. Adapted to the needs of students. S-U grades optional.

### **VTBMS 788 Seminar in Surgical Pathology**

Fall, spring. 1 credit. Intended for residents in anatomic pathology; third- and fourth-year veterinary students may attend. Letter grades only. B. A. Summers and staff.

The major objective of this discussion and seminar course is to introduce the residents to the discipline of surgical pathology. Selected material from the Surgical Pathology Service is prepared in advance for independent review by the residents. The material is presented in a slide-seminar format by the residents under the review of the faculty. Emphasis is placed on pathogenesis, etiology, and pathologic descriptions of the lesions. In addition, appropriate guest lecturers cover specific areas of interest and special topics not encountered in the departmental service programs.

## Clinical Sciences

### **VETCS 299 Research Opportunities in Clinical Sciences**

Summer. 6 credits. Prerequisites: one year of basic biology (scores of 5 on Biology Advanced Placement Examination of the College Entrance Examination Board or BIO G 100 level). Letter grades only. A minimum of 120 hours of laboratory time is expected per 3 course credits. Clinical science faculty.

This is a mentored research apprenticeship program designed to give laboratory experience to qualified unmatriculated high school students (participating in Cornell Summer College). Students will be placed in a research laboratory with a designated project under the direct supervision of a research associate (upper-level graduate student, post-doc, or faculty member). Students will be graded on preparation, participation in laboratory academic life, and appropriate acquisition of techniques. At the end of the six-week session, students will be expected to

give brief (15- to 20-minute) oral presentations on their work and submit manuscripts in a form suitable for publication. The faculty director of the laboratory will have ultimate responsibility for evaluating the student's work and assigning the grade.

### **VETCS 700 Pathophysiology of Gastrointestinal Surgery**

Fall. 1.5 credits. S-U grades only. Offered every third year. N. G. Ducharme. Normal anatomy and physiology of the gastrointestinal system in carnivores, herbivores, and ruminants is presented initially. This is followed by in-depth discussion of the pathophysiological mechanisms and sequelae of gastrointestinal obstructions including reperfusion injury, peritonitis, adhesions, and short bowel syndrome. The emphasis of this course is development of advanced understanding of surgically relevant gastrointestinal problems that lead to appropriate decision making.

### **VETCS 701 Pathophysiology of Orthopedic Surgery (Graduate)**

Spring. 1.5 credits. Prerequisites include D.V.M., M.D., or equivalents or approval of instructor. S-U grades only. Offered every third year. E. J. Trotter.

This course provides specialized training in the anatomic, physiologic, and pathologic process of musculoskeletal diseases in animals and humans, with special emphasis on surgical diseases of tendons, bones, and joints.

### **[VETCS 702 Pathophysiology of Cardiopulmonary Surgery (Graduate)]**

Fall. 1.5 credits. Prerequisite: D.V.M. degree or equivalent. S-U grades only. Offered every third year. Next offered 2005. R. P. Hackett, S. L. Fubini, and N. G. Ducharme.

Using lectures and group discussions, the objective of this course is to explain the pathophysiology of various cardiovascular diseases (cardiac arrest, cardiac arrhythmia under anesthesia) and airway disease (thoracic and upper-airway disease). As a basis for these abnormalities, cardiopulmonary hemodynamics and biomechanical aspects of ventilation are reviewed. The emphasis is placed on understanding these mechanisms and outlining the surgeon's response to them.]

### **[VETCS 703 Surgical Principles and Surgery of the Integumentary System (Graduate)]**

Spring. 1.5 credits. For graduate D.V.M.s (or equivalent) in residency or graduate training programs. S-U grades only. Offered every third year. Next offered 2006. S. Fubini and V. Cook.

This course is designed for surgery residents and graduate students. It is largely discussion format and examines surgical principles and surgery of the integumentary system.]

### **[VETCS 704 Pathophysiology of Urogenital Surgery (Graduate)]**

Fall. For graduate D.V.M.s or equivalent in residency or graduate training programs. 1.5 credits. S-U grades only. Offered every third year. Next offered 2006. S. Fubini and V. Cook.

This course is designed to review and discuss urogenital surgical procedures in animals and the rational basis for them. Pathophysiology will be stressed. Some classes will consist of reprints with discussion.]

**VETCS 705 Animal Pain and Its Control**

Spring, 2 credits. By permission of instructor. S-U grades optional. Offered odd-numbered years. R. D. Gleed, J. W. Ludders, P. F. Moon, and L. P. Posner. This course is open to third- and fourth-year veterinary medical students, interns, residents, graduate students, and postdoctoral associates who are interested in the fundamental and applied concepts of pain in animals. The course emphasizes the physiologic and pathophysiologic mechanisms involved in pain perception by animals, their responses (physiological and behavioral) to pain, and the pharmacologic mechanisms underlying analgesic therapy. The subject material is presented through lectures, group discussions, group readings, and group evaluation of analgesic protocols.

**[VETCS 706 Pathophysiology of Neurologic Surgery (Graduate)]**

Spring, 1.5 credits. Prerequisite: D.V.M., M.D., or equivalent or approval of instructor. S-U grades only. Offered every third year. Next offered 2006. A. J. Nixon and E. J. Trotter.

This course provides specialized training in neurosurgical techniques and application and discusses pathophysiologic implications of neurosurgical and neurologic diseases.]

**VETCS 710 Advanced Veterinary Anesthesiology I**

Fall, 1 credit. Prerequisite: VTMED 568, Veterinary Anesthesiology, or permission of instructor. Third- and fourth-year veterinary students, graduate students, interns, and residents. S-U grades only. L. P. Posner, R. D. Gleed, and J. W. Ludders.

The content of this course is designed for preparation for the American College of Veterinary Anesthesiology examinations. However, the course is also suitable for interns and for residency training in other areas such as surgery and internal medicine. Speakers are from both inside and outside the college. Topics cover the basic sciences as they apply to anesthesiology such as physics and engineering, applied pharmacology, physiology, and pathology. Clinically oriented lectures are also given concerning specific anesthetic techniques and species-specific differences in response to anesthetic drugs.

**VETCS 711 Advanced Veterinary Anesthesiology II**

Spring, 1 credit. Prerequisite: VTMED 568, Veterinary Anesthesiology or permission of instructor. Third- and fourth-year veterinary students, graduate students, interns, and residents. S-U grades only. L. P. Posner, R. D. Gleed, and J. W. Ludders.

The content of the course is designed for preparation for the American College of Veterinary Anesthesiology examinations. However, the course is also suitable for interns and for residency training in other areas such as surgery and internal medicine. Speakers are from both inside and outside the college. Topics cover the basic sciences as they apply to anesthesiology such as physics and engineering, applied pharmacology, physiology, and pathology. Clinically oriented lectures are also given concerning specific anesthetic techniques and species-specific differences in response to anesthetic drugs.

**Microbiology and Immunology****VETMI 299 Research Opportunities in Microbiology and Immunology**

Summer, 6 credits. Prerequisites: one year of basic biology (scores of 5 on Biology Advanced Placement Examination of the College Entrance Examination Board or BIO G 100 level). Letter grade only.

A minimum of 120 hours of laboratory time is expected per three course credits. Microbiology and Immunology faculty.

This is a mentored research apprenticeship program designed to give laboratory experience to qualified unmatriculated high school students (participating in Cornell Summer College). Students will be placed in research laboratory with designated project under the direct supervision of a research associate (upper-level graduate student, post-doc, or faculty member). Students will be graded on preparation, participation in laboratory academic life, and appropriate acquisition of techniques. At the end of the six-week session, they will be expected to give brief (15- to 20-minute) oral presentations on their work and submit manuscripts in a form suitable for publication. The faculty director of the laboratory will have ultimate responsibility for evaluating the student's work and assigning the grade.

**VETMI 315 Basic Immunology (also Biological Science 305; Undergraduate)**

Fall, 3 credits. Strongly recommended: basic courses in microbiology, genetics, and biochemistry. S-U grades optional. J. A. Marsh.

This course is a survey of immunology, with emphasis on the cellular and molecular bases of the immune response. More information is available at the BIOG 305 courseinfo web site.

**VETMI 331 General Parasitology (also BIOMI 331; Undergraduate)**

Spring, 2 credits. Prerequisites: zoology or biology; any of the following courses: BIOES 261, 264, 267, 274, 275, 278; BIOG 101, 102, 103, 104, 106, 107, 108, 109, 110, 170, 202, 207; BIOMI 192, 290 or equivalent courses. Letter grades only. D. D. Bowman.

An introduction to the basic animal parasites, stressing systematics, taxonomy, general biology, ecological interactions, and behavior of non-medically important groups. Introduces the major animal parasites, protozoan, nematode, plathyhelminth, acanthocephalan, annelid, and arthropod.

**[VETMI 404 Pathogenic Bacteriology and Mycology (also BIOMI 404)]**

Spring, 2 or 3 credits (3 credits with lecture and seminar). Prerequisites: BIOMI 290 and 291. Seminar is required of graduate students and open to undergraduates with permission of instructor. Maximum enrollment for seminar portion, 15 students. Letter grades only. D. P. Debbie.

This is a course in medical microbiology, presenting the major groups of bacterial and mycotic pathogens important to human and veterinary medicine. The course emphasizes infection and disease pathogenesis. Topics include disease causality; interactions of host, pathogen, and environment, including immunity to bacteria and fungi; and principles of antimicrobial therapy and drug resistance. A companion seminar addresses the current and classic literature related to microbial

pathophysiology on the cellular and molecular levels.]

**VETMI 409 Principles of Virology**

Fall, 3 credits. Prerequisites: BIOMI 290 and 291 or permission of the instructor. Recommended: BIOMI 408, BIOBM 330-332, BIOBM 432. G. Whittaker and S. Lazarowitz.

The course covers the principles of virology, focusing mainly on animal viruses but also including plant viruses and bacteriophage. Topics include the classification of viruses, virus entry, genome replication and assembly, and virus pathogenesis. Particular emphasis is placed on virus-host cell interactions and common features between different viral families.

**VETMI 431 Medical Parasitology (also BIOMI 417; Undergraduate)**

Fall, 2 credits. Prerequisites: zoology or biology; any of the following courses: BIOES 261, 263, 264, 267, 274, 275, 278; BIOG 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 170, 202, 207; BIOMI 192, 290, 398, or equivalent course. Letter grades only. D. D. Bowman.

This course is a systematic study of arthropod, protozoan, and helminth parasites of public health importance, with emphasis on epidemiologic, clinical, and zoonotic aspects of these parasitisms.

**VETMI 605 Special Projects in Microbiology (Undergraduate)**

Fall, spring, 1-3 credits. By permission of instructor. Prerequisite: a good background in microbiology or immunology. Preferably, students should have background in pathogenic microbiology and immunology. S-U grades only. Microbiology staff.

The course normally provides an opportunity for the student to work in a research laboratory or carry out a special project under supervision.

**VETMI 620 Research Fellowship in Microbiology and Immunology**

Fall, spring, 1-12 credits. By permission of instructor. S-U grades only. Faculty TBA. This course is offered by individual faculty members in the Department of Microbiology and Immunology for DVM students undertaking research in Research Fellowship. This course cannot be used to fulfill the formal course requirements for the DVM curriculum.

**[VETMI 700 The Biology of Animal and Plant Viruses (Graduate and Upper-level Undergraduate)]**

Fall, 2 credits. Letter grades only. Offered odd-numbered years. C. R. Parrish and virology faculty.

This course examines current topics in studies of animal viruses, including some comparisons with plant viruses where similar mechanisms apply. Selected topics are examined in depth, including the structures of viruses and their components, viral nucleic acids and replication strategies, details of the interactions between viruses and their host cell components and metabolism. Other topics include the evolution and selection of viruses, novel approaches to the prevention of virus infection, and methods for antiviral chemotherapy.]

**[VETMI 705 Advanced Immunology (also Biological Sciences 705; Graduate)]**

Spring. 3 credits. Prerequisite: VETMI 315 Basic Immunology or permission of instructor. Letter grades only. Offered even-numbered years. J. Marsh and staff. Coverage at an advanced level of molecular and cellular immunology.]

**VETMI 707 Advanced Work in Bacteriology, Virology, and Immunology (Graduate)**

Fall, spring. 1-3 credits. By permission of instructor. S-U grades optional. Microbiology staff.  
This course is designed primarily for graduate students with a good background in pathogenic microbiology and immunology. It may be elected by veterinary students who are properly prepared.

**VETMI 712 Seminars in Infection and Immunity**

Fall, spring. 1 credit. Required of all graduate students in the department of Microbiology and Immunology and the field of Immunology. S-U grades only. D. Russell.  
Invited speakers in immunology and infection biology acquaint students with current advances in the field.

**VETMI 719 Immunology of Infectious Diseases (also Biological Sciences 706; Graduate)**

Spring. 2 credits. Prerequisite: VETMI 315 Basic Immunology or permission of instructor. S-U grades optional. Offered odd-numbered years. E. Y. Denkers and staff.  
This graduate-level course focuses on molecular and cellular mechanisms underlying the immunity to infectious diseases caused by viral, bacterial, protozoan, and helminth pathogens. Topics include immune response initiation; antigen presentation pathways; Th1 and Th2 cytokines in protection and pathology; mechanisms of cytolysis; immune evasion strategies; vaccines. Lectures are based upon recent advances in the field and are accompanied by relevant readings from the current literature.

**VETMI 723 Current Topics in Immunology**

Fall, spring. 1 credit. S-U grades only. Immunology faculty.  
An immunology discussion group in which students present research papers from the contemporary scientific literature. Course is limited to graduate students. Registration each term is required of Field of Immunology graduate students.

**VETMI 737 Advanced Work in Animal Parasitology (Graduate)**

Fall, spring. 1-3 credits. For advanced undergraduate, graduate, and veterinary students. Letter grades only. D. D. Bowman and other faculty.  
This course is intended for advanced undergraduate, graduate and veterinary students with interests in parasitology research.

**VETMI 770 Advanced Work in Avian Diseases (Graduate)**

Fall, spring. 1-3 credits. By arrangement with instructor. Letter grades only. K. A. Schat.

**VETMI 772 Advanced Work in Aquatic Animal Diseases (Graduate)**

Fall, spring. 1-3 credits. By arrangement with instructor. S-U grades only. P. R. Bowser.

**VETMI 773 Advanced Work in Avian Immunology**

Fall, spring. Variable credit. Letter grades only. K. A. Schat.

**VETMI 783 Seminars in Parasitology (Graduate)**

Fall, spring. 1 credit. Open to veterinary students or graduate students; others by permission of instructor. S-U grades only. D. D. Bowman.

This is a seminar series designed to acquaint students with current research in the field of parasitology. The range of topics is determined, in part, by the interests of those participating and may include such topics as the ecology of parasitism, parasite systematics, wildlife parasitology, and parasitic diseases of plants and animals, including humans.

**Molecular Medicine****[VETMM 299 Undergraduate Research in Pharmacology]**

Summer. 3 to 6 credits (3 credits per 120 contact hours). Prerequisites: one year of basic biology (Score of 5 on Biology Advanced Placement Examination of the College Entrance Examination Board or BIOG 100 level.) Letter grades only. R. A. Cerione.

This is a mentored research apprenticeship program designed to give laboratory experience to qualified unmatriculated high school students (participating in Cornell Summer College) or Cornell underclassmen.

Students are placed in a research laboratory with a designated project under the direct supervision of a research associate (upper-level graduate student, post-doc, or faculty member). A minimum of 120 hours of laboratory time is expected per three course credits. Students are graded on preparation, participation in laboratory academic life, and appropriate acquisition of techniques. At the end of the six-week session, students are expected to give brief (15- to 20-minute) oral presentations of their work and submit a manuscript in a form suitable for publication. The faculty director of the laboratory has ultimate responsibility for evaluating the student's work and assigning the grade.]

**VETMM 470 Biophysical Methods (also A&EP 470 and BIONB 470)**

Spring. 3 credits. Prerequisite: permission of instructor. Letter grades only. W. Zipfel.  
This course is an overview of the diversity of modern biophysical experimental techniques used in the study of biological systems at the cellular and molecular level. Topics covered include methods that examine both structure and function of biological systems: light microscopy, fluorescence microscopy, Fourier optics and image processing, confocal and multiphoton microscopy, phase contrast, electron microscopy, X-ray diffraction and protein structure determination, multidimensional NMR, spectroscopy, calcium measurements, resonance energy transfer, membrane biophysics, electrophysiology, ion channels, action potentials, ligand-gated channels, fluctuation analysis, patch-clamp, molecular biology of ion channels, rapid kinetics, caged compounds,

transmitter release, capacitance measurements, amperometry, optical traps, and molecular force measurements. The course is intended for students of the engineering, physics, chemistry, and biological disciplines who seek an introduction to modern biophysical experimental methods. Due to the interdisciplinary nature of the course, students have diverse backgrounds. Therefore, a basic knowledge of and interest in physics and mathematics is expected, but strong attempts are made to give an intuitive understanding of the mathematics and physics involved. Some knowledge of physical chemistry, molecular and cell biology, or neurobiology is helpful. Depending on individual backgrounds all students find certain aspects of the course easy and other aspects demanding.

**VETMM 610 Cellular and Molecular Pharmacology**

Fall. 2 credits. By permission of the instructors. S-U grades optional. Offered even-numbered years. G. W. G. Sharp and field of pharmacology faculty.

This graduate-level course surveys the molecular and cellular aspects of receptor mechanisms, signaling pathways, and effector systems. Topics include drug-receptor interactions; ligand- and voltage-gated ion channels; G protein pathways; growth factor signaling; lipid signaling; calcium; nutrient and nitric oxide signaling; and mechanisms of receptor-mediated effects on neural excitability, electrical pacemakers, muscle contraction, and gene expression.

**[VETMM 611 Systems Pharmacology]**

Spring. 2 credits. By permission of the instructors. S-U grades optional. Offered even-numbered years. C. M. S. Fewtrell and field of pharmacology faculty.

This graduate-level course surveys system- and organ-related aspects of pharmacology. Topics include drug disposition; pharmacokinetics; autonomic pharmacology; central nervous system pharmacology; pharmacology of inflammation, allergy, and platelet function; cardiovascular, gastrointestinal and endocrine pharmacology; and chemotherapy, including antimicrobial agents and cancer chemotherapy.]

**[VETMM 700 Calcium as a Second Messenger in Cell Activation]**

Spring. 2 credits. By permission of instructor. Lecture-discussion. S-U grades only. Offered even-numbered years. C. M. S. Fewtrell.

This course focuses on regulation of intracellular calcium and techniques for studying calcium movements and distribution in cells. Topics include calcium channels and exchangers, calcium-binding proteins, and calcium stores; phosphatidylinositol turnover, release of calcium from intracellular stores, and activation of calcium influx; calcium gradients and oscillations; mechanisms of exocytosis and the proteins involved. Each topic is introduced with a lecture followed by discussion of recent papers from the literature.]

**VETMM 701 Organ-System Toxicology (also TOX 611)**

Fall. 1 credit. For graduate students in environmental toxicology. S-U grades only. Offered even-numbered years. W. S. Schwark.

This is a minicourse on molecular mechanisms involved in chemical toxicity. Specific examples of toxicity in organ systems

such as the nervous system, kidney, liver, respiratory tract, and cardiovascular system are considered.

**[VETMM 703 Receptor-Ligand Interactions (also BIONB 790-02)]**

Fall. 2 credits. By permission of the instructors. S-U grades optional. Offered odd-numbered years. G. A. Weiland and R. E. Oswald.

The course covers both the practical and theoretical tools for the study of ligand-receptor interactions, emphasizing the quantitative and physical chemical aspects of receptor theory. Topics discussed are basic methods of radioligand binding assays, including separation and measurement of bound and free ligand; characterization of receptor function; analysis of receptor structure: thermodynamic basis of the binding; methods of analyzing equilibrium binding; equilibrium binding for complex binding mechanisms; and kinetics of simple and complex binding mechanisms.]

**[VETMM 704 CNS Synaptic Transmission]**

Fall. 2 credits. Maximum enrollment 20 graduate students and undergraduate seniors by permission of instructor. S-U grades optional. Offered odd-numbered years. L. M. Nowak.

This is a survey course in vertebrate central nervous system physiology and pharmacology, that focuses on mechanisms of neuro-transmitter action at the membrane and cellular levels. Roles of selected neurotransmitters in normal brain and neurological disorders are covered. Topics are introduced in lectures and followed up by discussions of recent journal articles.]

**[VETMM 705 Chemistry of Signal Transduction]**

Fall. 2 credits. S-U grades optional. Offered odd-numbered years. R. A. Cerione.

This course focuses on the mechanisms of action of GTP binding proteins. Several receptor-coupled signaling systems are examined, including adenylyl cyclase, vertebrate vision, phosphatidylinositol lipid turnover, receptor systems regulating various ion channels, and receptors involved in cell growth regulation.]

**[VETMM 706 Growth Factor-Coupled Signaling (also BIOBM 734)]**

Fall. 0.5 credit. By permission of the instructor. S-U grades optional. Offered odd-numbered years. R. A. Cerione.

The general theme of this course is mitogenic signaling pathways. Receptor tyrosine kinases, src, ras, and ras-regulatory proteins are covered.]

**[VETMM 707 Protein NMR Spectroscopy (also BIOBM 730)]**

Spring. 2 credits. Prerequisites: CHEM 389 and 390 or CHEM 287 and 288 or permission of instructor. S-U grades optional. Offered odd-numbered years. R. E. Oswald and L. K. Nicholson.

The student acquires the tools necessary for in-depth understanding of multidimensional, multinuclear NMR experiments. Schemes for magnetization transfer, selective excitation, water suppression, decoupling, and others are presented. The application of these techniques to proteins for resonance assignments, structure determination, and dynamics characterization is studied.

**VETMM 709 Topics in Cancer Cell Biology**

Fall and spring. 0.5-1 credit per section. Letter grades only. Course offered in odd-numbered years. Students may select modules (sections) of interest to them. B. U. Pauli.

**[Section 1—Cell Adhesion Molecules, Signaling, and Cancer]**

Fall. J. Guan.

This one-credit module introduces the role of cell adhesion receptors in cancer. Emphasis is on the integrin and cadherin families of cell adhesion molecules and their roles in signal transduction and cancer. Topics include the structure and function of integrins, integrin interactions with cytoskeleton, intracellular signaling pathways in cell-matrix interactions, integrin-mediated signaling in cell migration, proliferation and survival, changes of integrins in tumors and metastasis, structure and function of cadherins, signaling mechanisms in cell-cell interactions in normal development and cancer.]

**[Section 2—Cell-Cycle Analysis (also TOX 713 and TOX 698)]**

Fall. A. Yen.

This one-credit module presents a brief historical review of the cell cycle; a summary of cell-cycle regulatory processes; and practical methods for cell-cycle analysis, including mathematical representations. Topics include growth control of bacterial cell cycle including chemostats, mammalian cell tissue culture, cell synchronization, flow cytometry, age-density representation, G1 regulation, labile regulatory protein models, cell transformation, regulation by growth factors and the cytoskeleton, cyclin/E2F/RB regulatory model, practical examples for analysis of cell-cycle phase durations, cell-cycle phase specific growth factor sensitivity, timing of RB protein phosphorylation within the cell cycle. The objective of the course is to present graduate students with methods for cell-cycle analyses that will be useful in their research.]

**Section 3—Principles of Metastasis**

Spring. B. U. Pauli.

This one-credit module discusses the following principles: the molecular basis of cancer progression leading to metastasis (clonal evolution of metastatically competent cancer cells: contribution of specific oncogenes and tumor suppressor genes); the routes of metastatic spread: the process of intravasation emphasizing the roles of matrix-degrading proteases (e.g., tissue metalloproteinases, plasmin, heparatinase, etc.) and angiogenesis; host effect on circulating cancer cells: immunological and hemodynamic considerations; organ-preference of metastasis: the roles of tumor cell/endothelial cell adhesion receptor/ligand pairs (e.g., polymeric fibronectin/DPP IV; b4 integrin/CLCA; CD44/hyaluran; cytokine-inducible CAMs); chemokines and chemokine receptors; extracellular matrix components; etc.; emergence of micrometastases: the roles of adhesion-and/or chemokine-mediated signaling in intravascular growth promotion of arrested cancer cells; and, animal model of metastasis and anti-metastasis treatment strategies.

**[Section 4—Angiogenesis in Normal Development, Cancer, and Other Diseases]**

Fall. B. U. Pauli.

Topics discussed in this one-credit module include vasculogenesis versus angiogenesis;

tumor angiogenesis: the angiogenic switch; molecular and cellular principles of tumor vessel formation; structure and function of tumor vessels (e.g., chaotic architecture and blood flow; high vascular permeability; altered endothelial surface markers; parakrine- and perfusion-driven tumor growth stimulus; role of hematopoietic stem cells in promoting tumor angiogenesis; angiogenesis in non-neoplastic disease; hypoxia-driven pathological angiogenesis and vascular remodeling; inflammation-induced angiogenesis and vascular remodeling (special emphasis: wound healing); and therapeutical perspectives: promises and problems.]

**[Section 5—Current Topics in Oncogenic Viruses]**

Fall. J. Casey.]

**[Section 6—Growth Factor-Coupled Signaling (also VETMM 706)]**

Fall. R. Cerione.

The general theme of this 0.5-credit module is mitogenic signaling pathways. Receptor tyrosine kinases, src, ras, and ras-regulatory proteins are covered.]

**VETMM 720 Patch-Clamp Techniques in Biology**

Spring. 2 credits. By arrangement with the instructor. S-U grades only. Taught daily during the second and third weeks of January. L. M. Nowak.

Students learn theoretical background for patch-clamp studies in morning lectures. The experimental techniques of conventional and permeabilized patch whole-cell recording and single-channel recordings in cell-attached and -excised membrane patches are taught in 15 hours of afternoon laboratory instruction per student. Lab training sessions are arranged individually throughout the spring term.

**VETMM 730 Graduate Research in Pharmacology or Molecular Medicine**

Fall, spring, and summer. 1-12 credits.

By permission of instructor. S-U grades only. This course is offered by individual faculty members in the Department of Molecular Medicine and the Graduate Field of Pharmacology for graduate students undertaking research toward M.S. or Ph.D. degrees. *This course cannot be used to fulfill the formal course requirements for the Field of Pharmacology.*

**VETMM 740 Special Projects and Research in Pharmacology**

Fall, spring, and summer. 1-3 credits each topic. By arrangement with the instructor. Letter grade or S-U option. Field of pharmacology faculty. *This course cannot be used to fulfill the formal course requirements for the Field of Pharmacology.*

This course enables students to undertake research in an area related to the research interests of a faculty member in the Graduate Field of Pharmacology. Topics include but are not limited to Mechanisms of Growth-Factor Action—R. A. Cerione; The Role of Calcium in Stimulus-Secretion Coupling—C. M. S. Fewtrell; Mechanisms of Neurotransmitter Release—M. Lindau; Central Nervous System Neurotransmitters—L. M. Nowak; Structure-Function of the Nicotinic Acetylcholine Receptor—R. E. Oswald.



**VETMM 760 Directed Readings in Pharmacology**

Fall, spring, and summer. 1-3 credits each topic. By arrangement with the instructor. Letter grade or S-U option. Reading and discussion. Field of pharmacology faculty. Individual members of the Graduate Field of Pharmacology offer directed readings and discussions on pharmacological topics to small groups or to individual students. Topics include but are not limited to Receptor Mechanisms—G. A. Weiland; Biochemical Neuropharmacology—G. A. Weiland; Amino Acid Neurotransmitters—L. M. Nowak; Stimulus-Secretion Coupling—C. M. S. Fewtrell; Cell Calcium—C. M. S. Fewtrell.

**Population Medicine and Diagnostic Sciences****[VTPMD 299 Undergraduate Research in Epidemiology**

Summer. 3 credits. Limited to undergraduate students. Letter grades only. Prerequisites are one year of basic biology (Score of 5 on Biology Advanced Placement Examination of the College Entrance Examination Board or BIOG 100 level). Permission of the instructor can be submitted for the prerequisite. J. Scarlett, H. Erb, Y. Grohn, L. Warnick, H. Mohammed, and Y. Schukken. This is a mentored research apprenticeship program designed to give laboratory experience in applied epidemiology to qualified unmatriculated high school students (participating in Cornell Summer College) or Cornell underclassmen.

Students are placed in a research laboratory with a designed project under the direct supervision of a research associate (upper-level graduate student, post-doc, or faculty member). A minimum of 120 hours of laboratory time is expected per three course credits. Students are graded on preparation participation in laboratory academic life and appropriate acquisition of techniques. At the end of the six-week session, students are expected to give a brief (15- to 20-minute) oral presentation on their work and submit a manuscript in a form suitable for publication. The faculty director of the laboratory has ultimate responsibility for evaluating each student's work and assigning the grade.]

**VTPMD 664 Introduction to Epidemiology (Graduate)**

Fall. 3 credits. Prerequisites: Statistics and Biometry 601 (College of Agriculture and Life Sciences) may be taken concurrently or by permission of instructor. S-U grades optional. H. N. Erb.

Lectures and discussion deal with the fundamentals of epidemiology. Topics include outbreak investigation, causal association, data quality, the design and ethical constraints of clinical trials, and infectious-disease epidemiology.

**VTPMD 665 Study Designs (Graduate)**

Spring. 2 credits. Prerequisites: VTPMD/VETCS 664 and Statistics and Biometry 601 (College of Agriculture and Life Sciences). S-U grades optional. H. O. Mohammed. Design and interpretation of cross-sectional, case-control, and cohort studies (including controlled clinical trial) are covered. Design issues include sample size, bias, and relative advantages and disadvantages.

The course objectives are 1) to know the difference between different epidemiologic study designs and relative advantages and disadvantages of each; 2) given a problem (usually a field situation), be able to design an appropriate epidemiologic study; 3) be able to effectively analyze and criticize published epidemiologic studies.

The course consists of lectures on the principles of epidemiologic study design and related issues (sample size calculations, validity and precision, and identification and minimizing of bias); basic analysis of epidemiologic data; and discussion of published epidemiologic studies. These studies include observational cohort studies (prospective and retrospective), cross-sectional studies, case-control studies, and hybrid studies (ambidirectional and other hybrid designs).

**VTPMD 666 Advanced Methods in Epidemiology (Graduate)**

Fall. 3 credits. Prerequisites: VTPMD/VETCS 665 and STBTRY 602 (College of Agriculture and Life Sciences). S-U grades optional. Y. T. Grohn.

Concepts introduced in VTPMD 664 and VTPMD 665 are further developed, with emphasis on statistical methods. Topics include interaction, effect modification, stratified analysis, matching and multivariate (logistic regression) methods, survival analysis, and strategies for the analysis of epidemiologic data.

**VTPMD 700 Special Projects in Diagnostic Endocrinology**

Fall, spring. 1-3 credits. Prerequisite: recommended AN SC 427. By permission of instructor. Letter grades only. Schanbacher and Lamb.

An independent study course. Students have the opportunity to research a particular topic in diagnostic/clinical endocrinology of animals.

**VTPMD 707 Clinical Biostatistics (Graduate)**

Spring. 2 credits. Minimum enrollment 2; maximum enrollment 15. For veterinary residents or graduate students. Letter grades only. Offered odd-numbered years. J. M. Scarlett, H. N. Erb and H. O. Mohammed.

This course explains the theory behind and interpretation of parametric and nonparametric statistical techniques commonly used in research/clinical medicine. Students analyze small data sets using a commercial statistical-software package.

**VTPMD 708 Epidemiology Seminar Series (Graduate)**

Fall, spring. 1 credit. S-U grades only. Epidemiology faculty. Advanced theoretical and analytical epidemiologic concepts and techniques are discussed.

**VTPMD 766 Graduate Research (Graduate)**

Fall, spring, summer. Credit and hours TBA. Must be registered in master's or Ph.D. program and obtain permission of the graduate faculty member concerned. S-U grades only. Epidemiology faculty. This course enables students outside the section of epidemiology to receive graduate research credits for projects with epidemiological components.

**VTPMD 769 Doctoral-Level Thesis Research**

Fall, spring, and summer. Credits and hours TBA. Must be registered in master's or Ph.D. program in epidemiology. S-U grades only. Epidemiology faculty. This course enables students in the section of epidemiology to receive graduate research credits for their doctoral research.

**VTPMD 799 Independent Studies in Epidemiology**

Fall, spring. 1-3 credits. H. N. Erb, Y. T. Grohn, H. O. Mohammed, and J. M. Scarlett.

The purpose of this course is to investigate an epidemiologic topic with one of the instructors. It provides experience in problem definition, research design, and the analysis of epidemiologic data.

**FACULTY ROSTER**

- Abou-Madi, Noha, D.V.M., U. of Montreal (Canada). Lecturer, Clinical Sciences  
 Aguirre, Gustavo D., Ph.D., U. of Pennsylvania. Alfred H. Caspary Professor, Clinical Sciences  
 Ainsworth, Dorothy M., Ph.D., U. of Wisconsin-Madison. Prof., Clinical Sciences  
 Alcaraz, Ana, D.V.M., U. of Autonoma Natl De Mexico. Lecturer, Biomedical Sciences  
 Antczak, Douglas F., Ph.D., U. of Cambridge (England). Dorothy Havemeyer McConville Professor of Equine Medicine, Microbiology, and Immunology  
 Appel, Max J., Ph.D., Cornell U. Prof. Emeritus, Microbiology and Immunology  
 Appleton, Judith A., Ph.D., U. of Georgia. Prof., Microbiology and Immunology  
 Baines, Joel, Ph.D., Cornell U. Assoc. Prof., Microbiology and Immunology  
 Balkman, Cheryl, D.V.M., Cornell U. Lecturer, Clinical Sciences  
 Barr, Stephen C., Ph.D., Louisiana State U. Prof., Clinical Sciences  
 Bell, Robin G., Ph.D., John Curtin School (Australia). Prof., Microbiology and Immunology  
 Beyenbach, Klaus, Ph.D., Washington State U. Prof., Biomedical Sciences  
 Bezuidenhout, Abraham J., D.V.M., U. of Pretoria. Senior Lecturer, Biomedical Sciences  
 Bloom, Stephen E., Ph.D., Penn State U. Prof., Microbiology and Immunology  
 Bowman, Dwight D., Ph.D., Tulane U. Prof., Microbiology and Immunology  
 Bowser, Paul R., Ph.D., Auburn U. Prof., Microbiology and Immunology  
 Casey, James W., Ph.D., U. of Chicago. Assoc. Prof., Microbiology and Immunology  
 Center, Sharon A., D.V.M., U. of California-Davis. Prof., Clinical Sciences  
 Cerione, Richard A., Ph.D., Rutgers U. Prof., Molecular Medicine  
 Chang, Yung Fu, Ph.D., Texas A&M. Prof., Population Medicine and Diagnostic Sciences  
 Clark, Theodore G., Ph.D., SUNY-Stony Brook. Assoc. Prof., Microbiology and Immunology  
 Collins, Ruth N., Ph.D., Imperial Cancer Research Center. Asst. Prof., Molecular Medicine  
 Cook, Vanessa L., Veterinary MB, Cambridge U. (U.K.). Lecturer, Clinical Sciences

- Cooper, Barry J., Ph.D., U. of Sydney (Australia). Prof. Emeritus, Biomedical Sciences/Administration
- Cummings, Kevin, D.V.M., Cornell U. Instructor, Clinical Sciences
- Debbie, Dorothy P., Ph.D., Stanford U. Lecturer, Microbiology and Immunology
- deLahunta, Alexander, Ph.D., Cornell U. James Law Professor of Veterinary Anatomy, Biomedical Sciences
- Denkers, Eric Y., Ph.D., U. of Wisconsin-Madison. Assoc. Prof., Microbiology and Immunology
- Dhupa, Nishi, B.V.M. Bachelors of Veterinary Medicine, U. of Nairobi. Veterinarian, Clinical Sciences
- Dietert, Rodney R., Ph.D., U. of Texas-Austin. Prof., Microbiology and Immunology
- Divers, Thomas J., D.V.M., U. of Georgia. Prof. Clinical Sciences
- Dobson, Alan, Ph.D., U. of Cambridge (U.K.). Prof. Emeritus, Biomedical Sciences
- Dubovi, Edward J., Ph.D., U. of Pittsburgh. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Ducharme, Normand G., D.V.M., U. of Montreal (Canada). Prof., Clinical Sciences
- Dykes, Nathan L., D.V.M., Cornell U. Lecturer, Clinical Sciences
- Earnest-Koons, Kathy, M.S., Penn State U. Lecturer, Microbiology and Immunology
- Erb, Hollis N., Ph.D., U. of Guelph (Canada). Prof., Population Medicine and Diagnostic Sciences
- Evans, Howard E., Ph.D., Cornell U. Prof. Emeritus, Veterinary and Comparative Anatomy, Biomedical Sciences
- Farnum, Cornelia, Ph.D., U. of Wisconsin-Madison. Prof., Biomedical Sciences
- Farrelly, John, D.V.M., Cornell U. Instructor, Molecular Medicine
- Fewtrell, Clare, D.Phil., U. of Oxford (England). Assoc. Prof., Molecular Medicine
- Flaminio, Maria Julia, Ph.D., Cornell U. Asst. Prof., Clinical Sciences
- Flanders, James A., D.V.M., U. of California-Davis. Assoc. Prof., Clinical Sciences
- Fortier, Lisa A., D.V.M., Colorado State U. Asst. Prof., Clinical Sciences
- Fortune, Joanne E., Ph.D., Cornell U. Prof., Biomedical Sciences
- Fox, Francis H., D.V.M., Cornell U. Prof. Emeritus, Clinical Sciences
- French, Tracy W., D.V.M., Purdue U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Fubini, Susan L., D.V.M., U. of Georgia. Prof., Clinical Sciences
- Gasteiger, Edgar L., Ph.D., U. of Minnesota. Prof. Emeritus, Biomedical Sciences
- Gelzer, Anna, D.V.M., U. of Bern, Switzerland. Lecturer, Clinical Sciences
- Gilbert, Robert O., B.V.Sc., U. of Pretoria (South Africa). Prof. and Assoc. Dean, Clinical Sciences and Administration
- Gilmour, Robert F., Jr., Ph.D., SUNY-Upstate Medical Center. Prof. and Assoc. Dean, Biomedical Sciences and Administration
- Gleed, Robin D., B.V.Sc., U. of Liverpool (England). Prof., Clinical Sciences
- Goldstein, Richard, D.V.M., Hebrew U. (Israel). Asst. Prof. Clinical Sciences
- Grohn, Jrjo T., Ph.D., College of Veterinary Medicine, Helsinki (Finland). Prof., Population Medicine and Diagnostic Sciences
- Guan, Jun-Lin, Ph.D., U. of California-San Diego. Prof., Molecular Medicine
- Guard, Charles L. III, Ph.D., Case Western Reserve U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Gunn, Theresa, Ph.D., U. of British Columbia, Vancouver. Asst. Professor, Biomedical Sciences
- Habel, Robert E., D.V.M., M.Sc., M.V.D., Cornell U. Prof. Emeritus, Anatomy
- Hackett, Richard P., Jr., D.V.M., Ohio State U. Prof., Clinical Sciences
- Hansel, William, Ph.D., Cornell U. Liberty Hyde Bailey Prof. Emeritus, Biomedical Sciences
- Hart, Robert, D.V.M., Michigan State U. Instructor, Clinical Sciences
- Harvey, H. Jay, D.V.M., Kansas State U. Assoc. Prof., Clinical Sciences
- Hausler, Kevin K., Ph.D., U. of California at Davis. Lecturer, Biomedical Sciences
- Henion, John D., Ph.D., SUNY at Albany. Prof. Emeritus, Analytical Toxicology, Population Medicine and Diagnostic Sciences
- Hermanson, John W., Ph.D., U. of Florida. Assoc. Prof., Biomedical Sciences
- Hesse, Matthias, Ph.D., Asst. Prof., Microbiology and Immunology
- Hornbuckle, William E., D.V.M., Oklahoma State U. Prof., Clinical Sciences
- Houpt, Katherine A., Ph.D., U. of Pennsylvania. Prof., Biomedical Sciences
- Huxtable, Clive R., Ph.D., U. of Sydney. Prof. (visiting), Biomedical Sciences
- Irby, Nita L., D.V.M., U. of Georgia. Lecturer, Clinical Sciences
- Josson, Anne, D.V.M., Univ. of Ghent. Instructor, Clinical Sciences
- Kallfelz, Francis A., Ph.D., Cornell U. James Law Prof. of Medicine, Clinical Sciences
- Kern, Thomas J., D.V.M., U. of Missouri. Assoc. Prof., Clinical Sciences
- King, John M., Ph.D., Cornell U. Prof. Emeritus, Biomedical Sciences
- Kollias, George V., Ph.D., U. of California-Davis. Jay D. Hyman Prof. of Wildlife Medicine, Clinical Sciences
- Korich, Jodi, D.V.M., Cornell U. Instructor, Clinical Sciences
- Kotlikoff, Michael I., V.M.D., Ph.D., U. of California-Davis. Prof., Biomedical Sciences
- Kraus, Marc, D.V.M., U. of Georgia. Lecturer, Clinical Sciences
- Krook, Lennart P., Ph.D., Royal Veterinary College at Stockholm (Sweden). Emeritus Prof., Pathology
- Lengemann, Fredrick W., Ph.D., U. of Wisconsin. Prof. Emeritus, Biomedical Sciences
- Levine, Roy A., Ph.D., Indiana U. Assoc. Prof., Molecular Medicine
- Lewis, Robert M., D.V.M., Washington State U. Prof. Emeritus, Biomedical Sciences
- Lin, David, Ph.D., U. of California at Berkeley. Asst. Prof., Biomedical Sciences
- Loew, Ellis R., Ph.D., U. of California-Los Angeles. Prof., Biomedical Sciences
- Lorr, Nancy, Ph.D., U. of Oregon. Lecturer, Biomedical Sciences
- Ludders, John W., D.V.M., Washington State U. Prof., Clinical Sciences
- Lust, George, Ph.D., Cornell U. Prof., Microbiology and Immunology
- Marquis, Helene, Ph.D., Texas A&M. Asst. Professor, Microbiology and Immunology
- Marsh, James A., Ph.D., Northwestern U. Prof., Microbiology and Immunology
- Maylin, George A., Ph.D., Cornell U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Maza, Paul S., D.V.M., Ross U. Lecturer, Biomedical Sciences
- McDonough, Patrick, Ph.D., Cornell U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- McDonough, Sean P., Ph.D., U. of California. Assoc. Prof., Biomedical Sciences
- McEntee, Kenneth, D.V.M., Cornell U. Prof. Emeritus, Biomedical Sciences
- McEntee, Margaret C., D.V.M., Cornell U. Assoc. Prof., Clinical Sciences
- McGregor, Douglas D., D.Phil., U. of Oxford (England). Prof., Microbiology and Immunology
- Menne, Stephan, Ph.D., U. of Essen (Germany). Asst. Prof., Clinical Sciences
- Meyers-Wallen, Vicki N., Ph.D., U. of Pennsylvania. Assoc. Prof., Biomedical Sciences
- Miller, William H., Jr., V.M.D., U. of Pennsylvania. Prof., Clinical Sciences
- Minor, Ronald R., Ph.D., U. of Pennsylvania. Prof., Biomedical Sciences
- Mizer, Linda, Ph.D., Ohio State U. Senior Lecturer, Biomedical Sciences
- Mohammed, Hussni, O., Ph.D., U. of California-Davis. Prof., Population Medicine and Diagnostic Sciences
- Moise, N. Sydney, D.V.M., Texas A&M. Prof., Clinical Sciences
- Morrisey, James, D.V.M., Cornell U. Lecturer, Clinical Sciences
- Naqi, Syed A., Ph.D., Texas A&M. Prof. Emeritus, Microbiology and Immunology
- Nikitin, Alexander, Ph.D., The Acad. Pavloc First Medical Institute. Asst. Prof., Biomedical Sciences
- Nixon, Alan J., B.V.Sc., U. of Sydney (Australia). Prof., Clinical Sciences
- Njaa, Bradley, D.V.M., U. of Saskatchewan. Asst. Prof., Biomedical Sciences
- Noden, Drew M., Ph.D., Washington U. Prof., Biomedical Sciences
- Noronha, Fernando M., D.V.M., U. of Lisbon (Portugal). Prof. Emeritus, Microbiology and Immunology
- Nowak, Linda M., Ph.D., U. of Michigan. Assoc. Prof., Molecular Medicine
- Osterrieder, Nikolaus, D.V.M., U. of Ludwig-Maximilians. Assoc. Prof., Microbiology and Immunology
- Oswald, Robert E., Ph.D., Vanderbilt U. Prof., Molecular Medicine
- Page, Rodney L., D.V.M., Colorado State U. Prof., Clinical Sciences
- Park, Edward, D.V.M., Cornell U. Instructor, Biomedical Sciences
- Parker, John, Ph.D., U. of Glasgow. Asst. Prof., James Baker Institute
- Parrish, Colin R., Ph.D., Cornell U. Prof., Microbiology and Immunology
- Pauli, Bendicht U., D.V.M., Ph.D., U. of Bern (Switzerland). Prof., Molecular Medicine
- Perkins, Gillian, D.V.M., U. of Prince Edward Island. Lecturer, Clinical Sciences
- Peters, Jeanine, D.V.M., U. of Georgia. Instructor, Biomedical Sciences
- Phemister, Robert D., Ph.D., Colorado State U. Dean Emeritus, Biomedical Sciences
- Posner, Lysa, D.V.M., Cornell U. Lecturer, Clinical Sciences
- Quaroni, Andrea, Ph.D., U. of Pavia (Italy). Prof. Emeritus, Biomedical Sciences
- Randolph, John F., D.V.M., Cornell U. Prof., Clinical Sciences
- Rassnick, Kenneth M., D.V.M., Cornell U. Asst. Prof., Clinical Sciences
- Rawson, Richard, Ph.D., Kansas State U. Sr. Lecturer, Biomedical Sciences
- Reimers, Thomas J., Ph.D., U. of Illinois. Prof. Emeritus, Population Medicine and Diagnostic Sciences

- Riis, Ronald C., D.V.M., U. of Minnesota. Assoc. Prof., Clinical Sciences
- Roberson, Mark S., Ph.D., U. of Nebraska at Lincoln. Assoc. Prof., Biomedical Sciences
- Russell, David G., Ph.D., Imperial College, London U. (England). Prof., Microbiology and Immunology
- Sacco, Tyson, Ph.D., U. of California. Lecturer, Biomedical Sciences
- Sack, Wolfgang O., D.V.M., Ph.D., U. of Edinburgh. Prof. Emeritus, Biomedical Sciences
- Scarlett, Janet M., Ph.D., U. of Minnesota. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Schat, Karel A., Ph.D., Cornell U. Prof., Microbiology and Immunology
- Schlafer, Donald H., Ph.D., U. of Georgia. Prof., Biomedical Sciences
- Schukken, Ynte H., Ph.D., U. of Utrecht. Prof., Population Medicine and Diagnostic Sciences
- Schwark, Wayne S., Ph.D., U. of Ottawa (Canada). Prof., Molecular Medicine
- Scidmore, Marci, Ph.D., Princeton U. Asst. Prof., Microbiology and Immunology
- Scott, Danny W., D.V.M., U. of California at Davis. Prof., Clinical Sciences
- Scott, Fredric W., Ph.D., Cornell U. Emeritus Prof., Microbiology and Immunology
- Scrivani, Peter V., D.V.M., Cornell U. Lecturer, Clinical Sciences
- Sellers, Alvin F., V.M.D., Ph.D., U. of Minnesota. Prof. Emeritus, Biomedical Sciences
- Sharp, Geoffrey W. G., D.Sc., U. of London (England). Prof., Molecular Medicine
- Shepard, Laura, D.V.M., Cornell U. Instructor, Biomedical Sciences
- Shin, Sang J., D.V.M., Seoul National U. (Korea). Assoc. Prof., Population Medicine and Diagnostic Sciences
- Short, Charles E., Ph.D., U. of Turku (Finland). Prof. Emeritus, Clinical Sciences
- Simpson, Kenneth W., Ph.D., U. of Leicester (England). Assoc. Prof., Clinical Sciences
- Smith, Alison, D.V.M., Iowa State U. Instructor, Clinical Sciences
- Smith, Donald F., D.V.M., U. of Guelph (Canada). Dean and Prof., Clinical Sciences
- Smith, Mary C., D.V.M., Cornell U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Stokol, Tracy, Ph.D., U. of Melbourne. Asst. Prof., Population Medicine and Diagnostic Sciences
- Suarez, Susan S., Ph.D., U. of Virginia. Prof., Biomedical Sciences
- Summers, Brian A., Ph.D., Cornell U. Prof., Biomedical Sciences
- Tapper, Daniel N., V.M.D., U. of Pennsylvania, Ph.D., Cornell U. Emeritus Prof., Biomedical Sciences
- Tennant, Bud C., D.V.M., U. of California-Davis. James Law Professor of Comparative Medicine, Clinical Sciences
- Todhunter, Rory J., Ph.D., Cornell U. Assoc. Prof., Clinical Sciences
- Torres, Alfonso, Ph.D., U. of Nebraska. Prof., Population Medicine and Diagnostic Sciences
- Travis, Alexander, Ph.D., U. of Pennsylvania. Asst. Prof., Biomedical Sciences
- Trotter, Eric J., D.V.M., U. of Illinois. Assoc. Prof., Clinical Sciences
- Volkman, Dietrich H., BVSc, U. of Pretoria (S. Africa). Assoc. Prof., Clinical Sciences
- Warnick, Lorin D., Ph.D., Cornell U. Assoc. Prof., Population Medicine and Diagnostic Sciences
- Wasserman, Robert H., Ph.D., Cornell U. James Law Prof. Emeritus Physiology/Biomedical Sciences
- Weiland, Gregory A., Ph.D., U. of California-San Diego. Assoc. Prof., Molecular Medicine
- Weiss, Robert, Ph.D., Baylor College of Medicine. Asst. Prof., Biomedical Sciences
- White, Maurice E., D.V.M., Cornell U. Prof., Population Medicine and Diagnostic Sciences
- Whittaker, Gary R., Ph.D., U. of Leeds (England). Asst. Prof., Microbiology and Immunology
- Winand, Nena J., D.V.M., Iowa State U., Ph.D., Cornell U. Asst. Prof., Molecular Medicine
- Wootton, John F., Ph.D., Cornell U. Prof., Biomedical Sciences
- Xin, Hong-Bo, Ph.D., Beijing Met U. Asst. Prof., Biomedical Sciences
- Yen, Andrew, Ph.D., Cornell U. Prof., Biomedical Sciences