

## NEW YORK STATE COLLEGE OF VETERINARY MEDICINE

### ADMINISTRATION

Donald F. Smith, dean

Robert O. Gilbert, associate dean for clinical programs and professional service

Douglas D. McGregor, associate dean for research and graduate education

Hollis N. Erb, secretary of the college

Katherine M. Edmondson, assistant dean for learning and instruction

Gene R. Wheeler, assistant dean for administration

Gloria R. Crissey, college registrar

Nita L. Irby, director of student support services

Carol S. Peterson, director of financial aid

Joseph A. Piekunka, director of admissions

John E. Saidla, director of continuing education

### DEPARTMENT CHAIRS

Anatomy: C. Farnum

Clinical Sciences: M. White

Diagnostic Laboratory: D. Lein

Microbiology and Immunology: R. Avery

Pathology: B. Cooper

Pharmacology: G. Sharp

Physiology: J. Wootton

### 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, academia, or become engaged in one of the increasing number of other 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 contained in the Catalog of the College of Veterinary Medicine, which may be obtained by writing to the college.

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

The College of Veterinary Medicine has revised its professional curriculum; the new course requirements apply to the class that matriculated in the fall of 1993 and to subsequent classes. Courses in the revised professional curriculum are designated with the prefix "VTMED," and consist of two categories of courses: foundation courses and distribution courses.

### The Professional Curriculum

#### FOUNDATION COURSES

In foundation courses I, II, III, IV, and V (VTMED 510, 520, 521, 530, 531, 540, 550, and 551), 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. On average, 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 situating 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 1998-99 academic year.

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

Fall. 12 credits. Limited to first-year veterinary students. Letter grades only. S. S. Suarez (course leader) and others.

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 credit. Limited to first-year veterinary students. Letter grades only. A fee of approximately \$10 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is the correlate for VTMED 510 The Animal Body. This is a laboratory-based course that teaches the physical examination of four species (dog, cat, cow, and horse). The class is divided into smaller groups and each group meets for two hours each week during the first eleven weeks. The skills of auscultation, percussion, palpation, and observation are taught along with clinically related diagnostic procedures.

#### VTMED 520 Genetics and Development (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 (course leader) and others.

This course emphasizes cellular and genetic control mechanisms operating during mammalian development and adulthood. Four basic processes—cell proliferation, cell movement, cell differentiation, and morphogenesis—are essential to all living systems but may be regulated differently in embryonic and mature cells and tissues. Tutorial cases are used to initiate explorations of the mechanisms that regulate these processes in embryonic, normal adult, and transformed (cancer) cell populations. Tutorial sessions are complemented by lectures, laboratories, minicase discussions, and modules.

#### VTMED 521 Neuroanatomy and Clinical Neurology

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

Fundamentals of functional neuroanatomy and diseases of the nervous system are taught so that each student is competent in the diagnosis of clinical neurologic disorders of domestic animals. This is a vertically integrated course that includes dissection of the central nervous system of the dog, 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. Films and videotapes of clinical patients are used to demonstrate the clinical signs produced by the various diseases. Slides of gross and microscopic lesions are used to emphasize the clinical and neuroanatomic relationships and to stress characteristic features of representative conditions.

**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 credit. Limited to first-year veterinary students. Prerequisite: VTMED 517 Animals, Veterinarians, and Society: Part A. Letter grades only. A fee of approximately \$7.00 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is the correlate for VTMED 520 Genetics and Development. It enters into a study of ethical issues related to animal use, animal welfare, animal genetics, clinical application of genetics, genetics counseling, and clinical day-to-day ethics. The course meets for one 2-hour session each week.

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

Spring. 9 credits. Limited to first-year veterinary students. Prerequisite: VTMED 520 Genetics and Development. Letter grades only. D. Robertshaw (course leader) and others.

This course is designed to develop students' understanding of how an animal maintains itself as a functional organism; how this is achieved through the integration of different functional 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 it 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. D. Robertshaw (course leader) and others.

A continuation of VTMED 530 Function and Dysfunction: Part I.

**VTMED 537 Animals, Veterinarians, and Society: Part C1 (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 of approximately \$9.00 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is the correlate for VTMED 530 Function and Dysfunction: Part I. The central goal of this course is to provide students with the interpersonal skills and techniques necessary to communicate effectively with clients. In addition, students will be provided an opportunity to study the human-animal bond, animal death, and grief counseling. This course also provides opportunities to practice client interviewing skills and to participate in a home or farm visit.

**VTMED 538 Animals, Veterinarians, and Society: Part C2 (Foundation Course VIIc, continued)**

Fall. 1 credit. Limited to second-year veterinary students. Prerequisite: VTMED 537 Animals, Veterinarians, and Society: Part C1. Letter grades only. A fee of approximately \$6.00 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is the correlate for VTMED 531 Function and Dysfunction, Part II. This course provides for understanding the importance of the medical record, the diversity of clients, employees, and society in general, and a session on alternative medicine and its various practices. Studying how to critically read and evaluate clinical studies and journal articles is also provided.

**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. J. T. Blue (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 538 Animals, Veterinarians, and Society: Part C2. Letter grades only. A fee of approximately \$12.00 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is the correlate for VTMED 540 Host, Agent, and Defense. This course will emphasize maintaining health in both individuals or populations of animals and humans. Topics will include animal bites, nosocomial infections, rabies control programs, vaccines and vaccine reactions, zoonotic diseases, and integrated health maintenance programs.

**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. D. M. Ainsworth.

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 will be 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 will be used to establish a cognitive framework and knowledge of the most important diseases. This course will provide a sound foundation for clinical rotations in Foundation Course VI. It builds upon 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 will be 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. D. M. Ainsworth (course leader) and others.

A continuation of VTMED 550 Animal Health and Disease: Part I.

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

Spring. Limited to second-year veterinary students rolling over into fall semester for the then third-year veterinary students. 1 credit. Prerequisite: VTMED 547 Animals, Veterinarians, and Society: Part D. Letter grade only. A fee of approximately \$14.00 is charged for the course guide. J. E. Saidla (course leader) and others.

This course is a correlate with Foundation\* Course V, Animal Health and Disease. The course will examine governmental regulation of the veterinary profession, including proper drug usage, extra label drug use (FDA), controlled substances (DEA), substance abuse, professional liability and malpractice insurance, professional and unprofessional conduct, hazardous materials in the workplace (OSHA), and environmental issues (EPA). Also included will be sessions relating to controlling and preventing the spread of animal diseases and the role of USDA and specifically APHIS in these regulatory functions.

**VTMED 561 Community Practice Service-Medicine**

2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. W. E. Hornbuckle (coordinator) and others.

The Community Practice-Medicine Service is structured to provide supervised clinical experience in the practice of small companion animal medicine. The course is conducted in the Small Animal Clinic of the Veterinary Medical Teaching Hospital. Students interact directly with clients presenting their pet 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 562 Community Practice Service-Surgery and Anesthesiology**

2 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. H. J. Harvey (coordinator) and others.

Basic principles of anesthesiology and surgery are emphasized in the clinical rotation. Under direct staff supervision, students will anesthetize and perform surgical procedures on patients presented to the Small Animal Clinic for neutering and minor elective procedures. Students will be responsible for all aspects of patient care during their hospital stay and will be expected to fully participate in client communications. Ordinarily, this course will precede Anesthesiology Service and Small Animal Surgery Service (soft tissue component).

**VTMED 563 Small Animal Medicine**

Fall, spring, winter, and summer.

4 credits. Required course open to second-semester third-year and all fourth-year veterinary students; not open to others. Letter grades only. S. C. Barr, S. A. Center, J. F. Randolph, K. W. Simpson, (coordinator).

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 Small Animal Clinic of the Companion Animal Hospital. 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. After review, students explain their plans to the clients and provide follow-up care and management of these patients.

**VTMED 564 Small Animal Surgery Service**

Fall, winter, spring, and summer.

4 credits. Required of all third- and fourth-year veterinary students; not open to others. Letter grades only. E. J. Trotter (coordinator) 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 ovariohysterectomy or castration. Client communications and the basics of efficient practice are also emphasized.

**VTMED 565 Ambulatory Medicine Service**

Fall, winter, spring, and summer.

4 credits. Required component of Clinical Rotations (Foundation Course VI). Letter grades only. C. L. Guard (coordinator) and others.

A clinical service 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 such as castration and dehorning. 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. W. C. Rebhun (coordinator) and others.

Students assigned to this service will assist the faculty and house staff of the Large Animal Medicine service in the diagnosis and care of patients admitted to the service. It is hoped that students working on this service will 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. R. P. Hackett (coordinator) and others.

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 Large Animal Clinic. Training through patient care is supplemented by formal rounds and by 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 (coordinator), P. F. Moon and others.

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 Veterinary Medical Teaching Hospital and then implement those techniques under the supervision of residents and faculty. The goal is for students to learn the skills 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 (coordinator) and others.

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 (coordinator), Rebhun, Kern.

This course combines clinical experience with beginning skills in diagnostic ophthalmology. Students learn how to apply the ophthalmic diagnostic tests. The feeling of performing a good 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 practice introduced in this rotation. Students are required to review the introductory orientation videotapes in the Autotutorial Center entitled "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. B. A. Summers (coordinator) and others.

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 (coordinator) and others.

A two-week clinical rotation in the Radiology Section of the Veterinary Medical Teaching Hospital. Students will use radiographic, CT, ultrasonographic, and nuclear medicine imaging techniques to evaluate animal patients under treatment in the Veterinary Medical Teaching Hospital. With guidance of radiology faculty and technical staff, students obtain and interpret radiographic and ultrasonographic studies. Two 3-hour laboratory sessions are given to allow hands-on experience in patient positioning and radiographic technique. An autotutorial teaching film file is 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 current cases. Radiation safety aspects regarding the veterinary practitioner are emphasized.

**VTMED 573 Fourth-Year Seminar**

Fall and spring. 1 credit. Required of all fourth-year veterinary students. 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 give the student the responsibility and opportunity of conducting a short-term, clinically oriented research project under the direction of a faculty member. In either case, an oral report will be presented at a weekly seminar. A written report will also be 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 will emphasize clinical specialties, whereas others will integrate basic science disciplines with clinical medicine and will be 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. Letter grade. Prerequisite: VTMED 510 The Animal Body or permission of instructor. Letter grades only. C. E. Farnum

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, and exercises focusing on surgical approaches. There are opportunities for dissection of other carnivores, such as the ferret and the fox. The lectures augment the laboratory dissection, and introduce the student to functional morphological comparative features in the Order Carnivora. Students do an independent research project on the carnivore species of their choice, and make an oral presentation on this to the class.

#### **VTMED 602 Anatomy of the Horse**

Spring. 3 credits. Letter grade. Prerequisite: VTMED 510 The Animal Body or permission of instructor. M. S. Hackett.

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 will be emphasized in the regional approach to dissection. Structural-functional correlations that are unique or important in the horse will be the area of emphasis for most lectures. Microscopic anatomy will be 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 will be supplemented by skeletal materials, radiographs, models, preserved pre-dissected specimens and fresh specimens when they are available.

#### **VTMED 603 Anatomy of the Ruminant**

Spring. 3 credits. Letter grade. Prerequisite: VTMED 510 The Animal Body or permission of the instructor. M. S. Hackett.

The regional anatomy of several ruminant species will be covered using dissection laboratories, lectures, and large-group discussions. Functional consequences of structural modifications and anatomical features directly relevant to clinical practice will be emphasized. Microscopic anatomy will be correlated with gross anatomy when appropriate to relate structure to function and to provide a foundation for later study in pathology. Student dissection material will be supplemented by skeletal materials, radiographs, models, predissected specimens, and postmortem specimens. Students will be 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. Letter grades. Prerequisite: VTMED 510 The Animal Body. L. A. Mizer.

The goal of this course is to remove the confusion surrounding anatomical variability among amniote species (mammals, birds, and reptiles). This is accomplished by reducing the anatomy of major organ systems in each species to a common basic pattern and relating the differences to functional and historical considerations. Six major systems will be explored (integumentary, locomotory, neurosensory, cardiorespiratory, digestive, and urogenital) in a variety of species as available.

#### **VTMED 606 Advanced Clinical Neurology**

Spring. 1 credit. Letter grade. Prerequisite: VTMED 521 Neuroanatomy and Clinical Neurology. 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 their 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 will be considered here. The course is entirely based on case examples that are presented on videotapes or 16mm film and slides.

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

Spring. 1 credit. S-U grade. H. E. Evans.

This course is an introduction to classic and current literature. Materials relating to the earth sciences and the biology of plants and animals from around the world will be shown and discussed. Students will be required to show and discuss a book that concerns natural history in a country of their choice. A recommended 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: 5; maximum enrollment: 10. Veterinary students or written permission of the instructor. S-U or letter grade. P. R. Bowser.

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

#### **VTMED 610 Introduction to Avian Biomedicine**

Spring odd-numbered years. 2 credits. Letter grade. Minimum enrollment: 10; maximum enrollment: 60. G. V. Kollias.

An introduction to avian biology for veterinary students. The course will include lectures and laboratories involving avian evolution, anatomy, physiology, and ecology. Emphasis will be 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 611 Fish Health Management**

Spring, weeks 8-14. 1 credit. Minimum enrollment: 8; maximum enrollment: 16. Veterinary students or written permission of instructor. S-U or letter grade. P. R. Bowser.

This course will present a summary of important diseases of fin fishes. Diseases covered will be those of importance in commercial aquaculture as well as those encountered by the tropical fish hobbyist. The course is designed to provide the students with a knowledge base and hands-on diagnostic experience in diseases of fish.

#### **VTMED 612 Management of Aquarium Systems**

Spring, weeks 1-7. 1 credit. Minimum enrollment: 8; maximum enrollment: 16. Veterinary students or written permission of instructor. S-U or letter grade. P. R. Bowser.

This is a lecture and laboratory course dealing with procedures and practices involved in management of aquarium systems. Topics include water quality, types of aquarium filtration systems, fish health, fish nutrition, and general fish biology. A portion of the course will require independent work in aquarium system management.

#### **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. By permission of the instructor and special application procedure. S-U grade 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 thirty-five 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. Maximum enrollment: 18. Prerequisites: formal course work in diseases of aquatic animals or appropriate experience and permission of the instructor. Special application procedure required. S-U or letter grade. Course fee required. 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 will consist 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 twelve individuals who are leaders in their respective fields of aquatic animal medicine.

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

Spring. Offered alternate years. Offered spring 1999. 2 credits. Maximum enrollment: 20. Primarily for veterinary students; others by permission of instructor. Letter grade. K. A. Schat.

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

#### **VTMED 616 Diseases of Birds**

Spring. 2 credits. Second-, third-, and fourth-year veterinary students. Enrollment 10 minimum; 80 maximum. S. Naqi and G. V. Kollias.

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

#### **VTMED 618 Adaptation of Animals to the Environment**

Spring 1999. Letter grades. D. Robertshaw.

The course will examine the physiological adaptations of animals to their environment in addition to methods of acclimatization to novel environments. The course will focus on environmental parameters that exist in harsh environments and include heat, cold, altitude and xeric conditions. Thus the physiological mechanisms of thermoregulation in mammals, birds and ectotherms will be examined together with their responses to low food and water availability. The knowledge obtained will help in understanding the consequences of translocation of both wild and domestic animals and provide a rational basis for animal housing and the provision of appropriate habitats for zoological gardens. The degree of environmental adaptation will also be examined in terms of animal production from a basic science standpoint.

#### **VTMED 619 Pathogenesis of Viral Disease**

Spring, alternate years. Given during 8-week distribution period, January-March. 2 credits. Letter grades. Open to veterinary students. Strongly recommended prerequisite: Immunology. Microbiology faculty.

Course content and objectives: the course will focus on the balance between host defense against viral infections and the mechanisms by which viruses perpetuate themselves in

human and animal populations. In the process, the mechanisms of cell and animal infection, spread between cells, disease mechanisms, and the roles of the immune response in enhancing and suppressing disease will be explored. This will include a systems-based approach exploring the pathogenesis of disease in the CNS, gastrointestinal, hepatic, tegumentary, respiratory and urogenital systems. The basic principles of virus taxonomy, structure and replication will be included to introduce various viral groups and their special properties. Methods of intervention (vaccination, antiviral drugs) will also be covered. Lectures are derived from relevant current literature, the text, Nathanson's *Viral Pathogenesis*, 1997, and Field's *Virology*, third edition, 1996. Relevant materials will be placed on reserve in the veterinary library.

#### **VTMED 620 Molecular Biology and Immunology of Host-Parasite Interactions (also VTMI 702)**

Spring. 2 credits. Offered alternate years. Not offered spring 1999. Letter grade. E. J. Pearce.

The primary objective of this lecture course is to make the student aware of the most important areas of research in contemporary parasitology. Lectures will focus on a broad range of parasites, with an emphasis on those of medical importance. Recently published research articles and reviews will be used as the basis to explore the issues of host invasion, evasion of host defense mechanisms by parasites, vaccination against parasitic infections, chemotherapy, drug resistance, vector biology, and molecular diagnosis. Biological processes especially well understood through work on parasites, such as RNA editing and GPI-anchor biosynthesis and structure, will be covered in detail.

#### **VTMED 622 Foreign Infectious Diseases of Animals**

Spring. 1 credit. Minimum enrollment: 6. For second-, third-, and fourth-year veterinary students. Letter grade. D. H. Schlafer.

This course describes the etiology, pathogenesis, clinical signs, gross pathology, differential diagnosis, methods of spread, reservoir hosts, and control of foreign animal diseases that resemble indigenous infectious diseases and present serious economic threats to the United States.

#### **VTMED 625 Osteoarthritis**

Spring. 1 credit. Maximum enrollment: 16. Letter grade. 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 detailed composition and metabolism of bone, articular cartilage, ligaments, meniscus, capsule, and synovium. The interrelationship of synovium, synovial fluid, joint lubrication, articular cartilage, simple biomechanical considerations, and enervation are described to address joint function. A comprehensive discussion of the osteoarthritis that inextricably is associated with hip dysplasia in dogs serves as a basis for the etiopathogenesis of this disease. Osteoarthritis in joints of cats, dogs, horses, pigs, sheep, and cows also are discussed in detail as is osteochondrosis.

Consideration also is given to infectious arthritis and also human joint diseases such as

gout and pseudogout. The role of pain receptors, a brief discussion of therapy such as the role of nonsteroidal anti-inflammatory drugs, glucocorticoids, and mention of possible corrective surgery procedures are included.

#### **VTMED 626 Epidemiology of Infectious Diseases**

Spring. 1 credit. Second-, third-, and fourth-year veterinary students. Enrollment maximum 8. H. Mohammed and others.

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

#### **VTMED 627 Diseases of Antiquity**

Spring, distribution periods A and B only. 1 credit. Open to all veterinary students. Letter grade option only. J. Saidla.

This is a study of 30 human and animal diseases that have had profound effects on the course of human history from the beginning of recorded time through about 1920 AD. This course combines aspects of literature, medicine, and history and explores the interactions between demographics, commerce, imperialism, medical care, the environment and disease. Prevailing superstitions and religious views are considered in context with each illness and simultaneously occurring world events.

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

Spring. 1-1.5 credits. Minimum enrollment: 6; maximum enrollment: 20. Letter grade. H. N. Erb, J. Scarlett.

The student will become familiar with the statistical methods commonly used in veterinary clinical articles and will be able to recognize obvious misuse of those methods.

#### **VTMED 631 Clinical Diagnostic Parasitology**

Fall and spring, .5 credit. Limited to third- and fourth-year veterinary students. S-U grades only. D. D. Bowman and M. K. Frongillo.

This course will provide a chance to perform diagnostic parasitology methods using samples obtained from ongoing clinic cases. Students will attend eight one-hour sessions as they rotate through the ambulatory, community practice, and pathology rotations. In the ambulatory service (four sessions with students), diagnostics will concentrate on the laboratory examination of samples from large animal cases that have been observed during the prior week. In the Community Practice

Service, one hour will concentrate on the examination of samples from ongoing cases, while a second hour will consist of a discussion of the treatment of common endo- and ecto-parasites. The two hours spent as part of the pathology rotation will 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 upon the didactic material presented in Large and Small Animal Parasitology.

#### **VTMED 632 Senior Seminar**

Fall and spring. 1 credit. S-U grade.  
R. O. Gilbert.

Attendance at fourteen of the senior seminar sessions presented during the academic year constitutes acceptable completion of this course.

#### **VTMED 633 Introduction to Nontraditional Companion and Laboratory Animals**

Spring. 1 credit. No minimum or maximum enrollment. Letter grade only.  
J. E. Saidla (course leader) and others.

This course is both laboratory and lecture based and deals with a wide variety of nontraditional species that might be brought into a small animal practice other than a dog or cat. These can be either companion or laboratory animals and include rodents, lagomorphs, other small mammals, reptiles, amphibians, birds, fish, goats, sheep, potbellied pigs, primates, and llamas. Instruction in restraint and handling, breeding, husbandry, and general management information is provided for each species. This is followed, where practical, by laboratory sessions for observation, restraint, and physical examination.

#### **VTMED 634 Introduction to Large Animal Ambulatory Practice**

Fall, winter, spring, and summer. 1 credit.  
For first- and second-year veterinary students. Letter grade. C. L. Guard (coordinator).

This course introduces veterinary students to primary care large animal ambulatory practice and herd health management through direct exposure to the Large Animal Ambulatory and Production Medicine Clinic Service of the Veterinary Medical Teaching Hospital. Students observe and assist with restraint, examination and routine treatment of animals, and communication with clients. Successful completion requires satisfactory participation during five days of clinical service.

#### **VTMED 635 Introduction to the Professional Literature**

Spring. 1 credit. Minimum enrollment: 6; maximum enrollment: 20. Letter grade.  
D. F. Smith.

This course introduces veterinary students to the professional and biomedical literature, including development of critical reading skills. Students will become familiar with the broad range of professional and biomedical literature and will be encouraged to develop a rigorous approach to journal and scientific article review. Secondary emphasis is on developing skills in library and bibliographic search techniques.

#### **VTMED 637 Introduction to Community Practice Service**

Fall, spring, and summer. 1 credit.  
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 Veterinary Medical Teaching Hospital. Students observe and assist with restraint, examination and routine treatment of pets, and communication with clients. Successful completion requires satisfactory participation during ten half-days of clinical service.

#### **VTMED 638 Physiological Nutrition**

Spring. 1 credit. Minimum enrollment: 10; maximum: 90. For second-year veterinary students; others by permission of instructor. A. J. Reynolds.

This course will provide information on the evaluation and formulation of rations for large and small animals. These concepts will be applied in discussion on the nutrition requirements of these animals during maintenance, gestation, lactation, growth, stress, and aging. The course is recommended for all second-year veterinary students who do not have a strong background in ruminant, equine, canine, and feline nutrition. This course, or its equivalent, will be necessary for comprehension of clinical nutrition concepts in Foundation Course V.

#### **VTMED 639 Veterinary Dentistry (Distribution Course)**

Spring. 1 credit. Limited to second-, third-, and fourth-year students. Letter grade only. The number of sections will be determined by the class size as the laboratory is limited to 30 students per section. J. E. Saidla.

This is an introductory-level course in small animal dentistry. It is a laboratory course that meets for two hours, twice a week for 16 sessions. Basic concepts and practical topics in dental nomenclature, dental anatomy, oral/dental examination, routine dental care including prophylaxis, recordkeeping, genetics and breed differences, feline-specific dental disease, occlusion/malocclusion, periodontics, endodontics, restorative dentistry, and orthodontics are presented. Basic instrumentation and materials used in dentistry are stressed. The class will use prepared specimens for all sessions.

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

Spring, even years. 2 credits. Letter grade.  
G. V. Kollias.

This course will concentrate on principles of captive wildlife management, both clinical and nonclinical. Students will be challenged to learn and integrate a variety of disciplines that are essential to successfully managing wildlife 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.

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

Spring. 1 credit. Maximum enrollment: 80; minimum: 10. For second-, third-, and fourth-year veterinary students. Letter grade. S. C. Barr.

The course consists of two 50-minute discussion/lecture periods a week for seven weeks. In the 8th week, students will work through cases in canine infectious diseases using a specifically designed computer software program. The letter grade will be obtained entirely from the result of a written examination given in the final period. The course will emphasize the approach to clinical medical problems generally and infectious diseases specifically. 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 clinicopathology data and diagnostic materials (radiographs, ultrasounds), treatment plans, and prevention. The course expands knowledge gained in Foundation Course IV 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 encountered in practice. A basic level of computer literacy is advised but not required.

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

Spring. 2 credits. Minimum enrollment: 20. For second-, third-, and fourth-year veterinary students. Letter grade.  
D. F. Smith.

Students will 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. Third- and fourth-year students. S-U grades only. R. Gilbert.

This course provides an introduction to 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 Techniques in Equine Surgery**

Winter. 1 credit. Prerequisite: VTMED 602 Anatomy of the Horse. Limited to third- and fourth-year veterinary students. S-U grades only. S. L. 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 Techniques in Food Animal Surgery**

Winter. 1 credit. Prerequisite: VTMED 603 Anatomy of the Ruminant. Limited to third- and fourth-year veterinary students. S-U grades only. S. L. Fubini (coordinator) 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 those 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, and summer. 1 credit. Limited to third- and fourth-year veterinary students. S-U grade. M. C. Smith.

This autotutorial or group tutorial course covers common problems of llamas and alpacas. Each week, participants will be provided with a brief case description and a set of sample study questions. Reference will be made to textbooks, journal articles, videotapes, and (if available) a teaching llama 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. All years; students from other colleges by permission of the instructor. S-U grade. R. Hillman and M. 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, and summer (credit given for fall). 1 credit. All years. Letter grade. Enrollment not to exceed 42 students per semester. G. Kollias and staff.

This course introduces veterinary students to primary native wildlife care and to wildlife issues that face practicing veterinarians on a daily basis. Students are responsible for the assessment, physical examination, and medical care of native wildlife presented to the Veterinary Medical Teaching Hospital by the public and local wildlife rehabilitators. Student activities are directly supervised and assessed by faculty wildlife clinicians on a daily basis. Successful completion of the course requires 40 hours of satisfactory supervised participation per semester in the clinic. Clinic times will be appropriately scheduled throughout the semester. Students are **required** to submit three case summaries before the end of the semester.

**VTMED 649 Introduction to Equine Practice**

Spring. 0.5 credit. All years. Enrollment no minimum; maximum 18. 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 will include horse breeds and colors, housing facilities and fencing, and overview discussions of the racing, showing, and breeding industries. Laboratories will emphasize basic equine handling and restraint as well as feeds and bedding.

**VTMED 650 Veterinary Parasitology (Large Animal)**

Spring. Offered alternate years. 1 credit.

All students. Letter grade. D. Bowman.

This course provides a basic introduction to large animal parasites of veterinary importance, concentrating mainly on the biology, control, and diagnosis of protozoan and metazoan parasites. Emphasis will be given to parasites representative of significant disease processes or of significant economic importance to veterinarians, clients, and producers. The course will elaborate on the biology and pathogenesis of these major pathogens with the ultimate goal being to maximize the recognition of the major disease manifestations induced through examples of each of the different groups of organisms.

**VTMED 651 Veterinary Parasitology: Small Animals**

Spring (Jan.-Feb.—4 weeks, Apr.-May—4 weeks). 1 credit. Letter grade only. All years. D. Bowman.

This course provides a basic introduction to small-animal parasites of veterinary importance, concentrating mainly on the biology, control, and diagnosis of protozoan and metazoan parasites. Emphasis will be given to parasites representative of significant disease processes or of significant clinical importance to veterinarians and pet owners. The course will elaborate on the biology and pathogenesis of these major pathogens with the ultimate goal being to maximize the recognition of the major disease manifestations induced through examples of each of the different groups of organisms.

**VTMED 652 Avian Medicine and Surgery**

Spring (Mar.-May—8 weeks even years, or as advertised). 2 credits. Third- and fourth-year veterinary students. Enrollment: 20 minimum; 80 maximum. Letter grade only. G. Kollias and others.

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 will be taught in a basic didactic lecture and discussion format with laboratories that will reinforce concepts presented in the lectures.

**VTMED 653 Advanced Equine Lameness**

Spring (Apr.-May—4 weeks). 1.5 credits. Third- and fourth-year veterinary students. Enrollment: 7 minimum; 21 maximum. S-U grade only. N. Ducharme, A. Nixon, and others.

This course is designed to help students understand the methodology and to develop the manual skills required for lameness examination in horses. Emphasis will be on developing diagnostic skills. Specifically, the student will be expected to develop proficiency in the identification of clinical characteristics associated with recognized lamenesses and to localize the origin of the lameness. Teaching aids will 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 Current Therapy in Equine Reproduction**

Spring (Jan.-Feb.—4 weeks). 2 credits.

Lecture portion: 1 credit; laboratory portion: a) Jan-Feb 1/2 credit; b) Feb-Mar 1/2 credit. Enrollment: lecture, no limit; laboratory exercises, 12 minimum; maximum 24. Third- and fourth-year veterinary students. Letter grade only. P. Daels.

This course will cover aspects of physiology and therapy of equine reproduction. The purpose of the course is to prepare the student for equine broodmare practice.

**VTMED 655 Production Animal Theriogenology**

Spring (Mar.-Apr.—4 weeks). 2 credits.

Lecture portion: 1 credit; laboratory portion: 1 credit. Third- and fourth-year veterinary students. Enrollment: lecture, no limit; laboratory, 12 minimum, 24 maximum. R. Gilbert.

This course deals with specific reproductive conditions of production animals as well as reproductive management of production units. Content includes reproductive biology of production animals, economic considerations, and medical and surgical approaches to management of reproductive disorders. Laboratory sessions are tailored to acquisition of specific skills fundamental to the practice of theriogenology of production animals. Emphasis is on dairy cows.

**VTMED 656 Special Problems in Equine Medicine**

Spring (Feb.-Mar.—4 weeks). 1.5 credits.

Third- and fourth-year veterinary students. Enrollment: minimum, 10; maximum, 30. S-U grades. T. Divers and others.

This course is intended for students who plan to or may enter equine practice. In-depth study of important diseases, review of recent literature, health management, and hands-on procedures or demonstrations will be the core of this course.

**VTMED 657 Disorders of Large Animal Neonates**

Spring. 1 credit. Enrollment: minimum, 10; maximum, 100. All years. D. Ainsworth.

The common medical problems of foals and calves, with emphasis placed on the neonatal period, are discussed. Specific topics examined in detail include disorders affecting the respiratory, gastrointestinal, and musculoskeletal systems. Students will also spend several hours in the neonatal intensive care unit providing medical care of hospitalized patients under staff supervision.

**[VTMED 658 Small Animal Orthopedic Surgery**

Spring (Feb.-Apr.—4 hours). 0.5 credit.

Enrollment: no minimum; 80 maximum. Prerequisite: Block V. Third- and fourth-year veterinary students. Not offered 1998-99. E. Trotter.

This course is essentially a laboratory course utilizing inanimate models (Sawbones) and appropriate orthopedic equipment. Working in pairs, students perform a variety of surgical techniques for both the external and internal fixation of fractures under the direct supervision of board certified orthopedic surgeons. No live animals are used. Canine bone models provide an appropriate and inexpensive alternative to live animals. Utilizing these

models and various surgical implants and power equipment, students should further develop their orthopedic surgical skills outside the operating room setting as a supplement to didactic instruction in the reduction and fixation of fractures in small animals.]

#### **VTMED 659 Equine Soft Tissue Surgery**

Spring (Jan.-Feb.—4 weeks). 1 credit.

Enrollment: minimum, 6; maximum 21.

Third- and fourth-year veterinary students.

Letter grades. R. Hackett and others.

This course, intended for students anticipating equine practice after graduation, will build upon material presented in the foundation courses to provide supplemental instruction in surgical disorders of the horse. Lectures will be case based and emphasize those disorders likely to be encountered in equine practice (colic, traumatic injuries, dentistry, upper respiratory tract disorders, prepurchase examination). Laboratories will emphasize those 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.

For second-, third-, and fourth-year veterinary students. Letter grades.

B. A. Valentine.

This two-week course (approximately eight hours per day for 2 credits) will provide hands-on experience in the Surgical Pathology Service of the Department of Pathology. Students will assist in tissue selection and sample submission and in trimming and preparing specimens. Working with residents and the attending pathologist, they will examine tissue specimens histologically, propose diagnoses, and discuss their interpretations.

#### **VTMED 662 The Bottom Line**

Fall and spring. 1 credit. S-U grades only.

R. Lewis.

This course provides case analysis of material submitted to the necropsy service. Gross and microscopic lesions for each disease/condition are emphasized and correlated with relevant antemortem findings. When appropriate, pathogenetic mechanisms, epidemiology, etiology, prevention, and treatment are included in the discussion.

#### **VTMED 663 Wildlife Pathology**

Spring. 1 credit. Enrollment limited to

veterinary students. Letter grades. J. King.

This course introduces students to common and important lesions of wild species of animals. The etiology and pathogenesis of diseases of importance to wildlife are discussed. Slide presentations of lesions are made, and they are discussed by an experienced pathologist.

The nature and causes of diseases of wild rabbits, opossums, squirrels, deer, certain waterfowl, and some other species are presented. Emphasis is on epizootiology, etiology, pathogenesis, diagnostic lesions, and effects on populations. Laboratory experience is provided in specimen collection and necropsy techniques. Guest lectures are provided on ecology and population dynamics by members of the Department of Natural Resources.

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

Spring (Apr.-May—4 wks). 1.5 credits.

Enrollment minimum 6; maximum 28.

Third- and fourth-year veterinary students.

Letter grades. S. Fubini and others.

This course will provide students with a special interest in dairy practice the opportunity for in-depth discussions of special problems in bovine medicine and surgery. Emphasis will be on case discussions, physical examination techniques, and ethical and practical matters. The course will emphasize individual cow treatment.

#### **VTMED 666 Small Animal Clinical Oncology**

Spring (Feb.-Mar.—4 wks). 1 credit.

Enrollment: no minimum/maximum.

Third- and fourth-year veterinary students.

Letter grades. H. J. Harvey.

This course will present common tumor syndromes in small animals. Emphasis will be placed on biological behavior, patient management, and client relations. Format will include lectures, journal club discussions, demonstrations, and seminars.

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

Spring. 2 credits. Enrollment minimum

10; maximum 40. Third- and fourth-year

veterinary students. K. Simpson and

others.

During the 4-week course, students will work through cases in small animal medicine. The course consists of a 50-minute weekly discussion period. The focus will be 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. Limited to third- and

fourth-year veterinary students. The

number of sections will be determined by the enrollment. Letter grades. J. E. Saidla.

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. The managers of three area veterinary practices will speak to the group about their very different successful practices, concentrating on management and organizational skills.

#### **VTMED 669 Sheep and Goat Medicine**

Spring, 8 weeks. 1 or 1.5 credits.

(Lectures only: 1 credit; lectures plus

laboratory: 1.5 credits). S-U grading.

Third- and fourth-year veterinary students; others by permission of instructor.

M. Smith.

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

#### **VTMED 670 Drug Handling in the Body**

Spring. 0.5 credit. Maximum enrollment:

60. For second-, third-, and fourth-year

veterinary students. Letter grade.

R. A. Cerione and G. A. Weiland.

This course will provide an in-depth consideration of the pharmacological principles of administration, adsorption, distribution, metabolism, and elimination of drugs. Emphasis will be on the conceptual basis of the pharmacokinetic considerations in the therapeutic use of drugs. The course will build on the pharmacological and physiological principles learned in Foundation Course III.

#### **VTMED 671 Autonomic Pharmacology**

Spring. 0.5 credit. Maximum enrollment:

80. For second-, third-, and fourth-year

veterinary students. Letter grade.

G. A. Weiland.

This course will provide an in-depth consideration of the pharmacological and physiological principles of autonomic pharmacology. Molecular, cellular, and organ system mechanisms will be emphasized. The course will explore in more detail the fundamental pharmacological and physiological principles of the effects of drugs on autonomic organs covered in Foundation Course III.

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

Spring. 1 credit. For second-, third-, and

fourth-year DVM students. Letter grade.

W. S. Schwark.

The objective of this course is to familiarize students with antimicrobial drugs used in veterinary practice. The course will build on fundamental pharmacological and microbiological principles covered in Foundation Courses III and IV and will consider 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 673 Growth Factor-Coupled Signal Transduction**

Spring, even-numbered years. 0.5 credit.

Letter grade. R. A. Cerione.

This course will present basic information regarding the regulation of cell growth and differentiation. The emphasis will be on the



signal transduction pathways that are responsible for translating growth factor binding at the cell surface into nuclear responses and mitogenesis. The course should complement cases covered in Foundation Course II and tie together the biochemical pathways underlying cell growth with biological processes such as wound healing and disease states such as cancer.

**[VTMED 674 Physiology and Pharmacology in the Understanding and Treatment of Diabetes]**

Spring, even-numbered years. 1 credit. Maximum enrollment: 24. Letter grade. Not offered 1998-99. G. Sharp.

This course will cover the basic causes of the manifestations of diabetes, signal transduction mechanisms controlling insulin secretion and insulin action, and the principles underlying current and potential future treatment for this group of diseases. The course will stress the value of basic research into cellular and molecular mechanisms for the treatment and cure of disease.]

**[VTMED 675 Fundamental Principles of Vertebrate Central Nervous System Pharmacology]**

Spring, even-numbered years. 0.5 credit. Enrollment: 6 minimum; maximum open. Second-, third-, and fourth-year veterinary students. Letter grade. L. M. Nowak.

This course will include up-to-date knowledge of physiological and pharmacological aspects of the main central nervous system neurotransmitter receptors and provide a basis for rational understanding of the drugs used during surgery and in treatment of neurological diseases.]

**[VTMED 676 Clinical Ophthalmology]**

Spring (Feb.-Mar.—4 wks). 0.5 credit. Enrollment: no minimum/maximum. Third- and fourth-year veterinary students. R. Riis, W. Rebhun and T. Kern.

**[VTMED 677 Dairy Production Medicine]**

Fall. 2 credits. Enrollment: 6 minimum; maximum 14. Third-, and fourth-year veterinary students. Letter grade. 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 will be introduced to the dominant software currently used in dairy management. Local dairy herds will serve as additional laboratories for class projects.

**[VTMED 678 Small Animal Theriogenology]**

Spring (Feb.-Mar.—4 wks). 0.5 credit. Third- and fourth-year veterinary students. R. Gilbert.

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 non-infectious causes of infertility and pathology of the male and female reproductive tracts, their diagnosis and management. The

emphasis of the course will be on conditions affecting dogs and cats, but some conditions of other common pet species will be discussed.

**[VTMED 679 Clinical Pharmacology]**

Spring. 0.5 credit. Enrollment: no minimum/maximum. Third- and fourth-year veterinary students. Letter grade. W. Schwark.

This course is offered after Blocks I-V and formal exposure to pharmacology coursework is completed. The course is designed to familiarize students with drug use in the clinical setting and utilizes ongoing cases in the teaching hospital 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, utilizing basic concepts obtained during formal coursework. The onus will be 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. S-U option. 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 will be presented.

**[VTMED 681 Behavior Problems of Small Animals]**

Spring. 1 credit. Prerequisite: one semester of veterinary curriculum. S-U exclusive. 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 will be presented. Each student will have the opportunity to participate in three cases. Behavioral and pharmacological treatments for behavior problems will be presented.

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

Spring. 1 credit. Open to 3rd and 4th year veterinary students, all others need instructor approval. P. Moon.

This course will provide an introduction to emergency and critical care medicine. It is designed to have 1-2 topics per week. An introductory seminar will present basic information on the topic(s) at the beginning of the week, students will receive 1-2 case scenarios with homework questions and a two hour group discussion will occur later in the week. Although most of the cases will be based on small animal cases, the same principles will apply to both large animal and small animal cases, the same principles will apply to both large animal and small animal situations. Topics which might be covered include: trauma stabilization, emergency fluid therapy, cardiac and pulmonary emergencies, nutritional support, common toxicology problems, emergency surgical procedures

(chest tubes, tracheotomies), and basic and advanced cardiopulmonary resuscitation. When two courses (i.e. section "A" and "B") are offered in the same year, different topics will be covered in the two courses.

**[VTMED 684 Thermal Regulation and Exercise (also BloS 713)]**

Fall. 1 credit. Offered alternate years. Next offered fall 1999. Letter grade. D. Robertshaw.

An examination of the competing demands on the body of exercise and heat exposure with particular emphasis on the cardiopulmonary system and integration of thermoregulatory reflexes.

**[VTMED 685 Physiology of Pregnancy]**

Spring. 2 credits. Maximum enrollment: 20. For second-, third-, and fourth-year veterinary students. Letter grade. P. W. Nathanielsz.

This course is presented in lecture fashion, with weekly assignments consisting of one major reference per lecture related to that week's work to review. Subjects covered are placental function, fetal growth, central nervous system development, fetal breathing, biorhythms in maternal and fetal physiology, parturition, and adaptations to newborn life.

**[VTMED 689 Fundamentals of Ruminant Digestion]**

Spring, weeks 1-7. 0.5 credit. All years. Minimum enrollment: 6. Letter grade. T. R. Houpt.

This course is designed for the student with little or no previous course work in ruminant digestive physiology. It will consist primarily of lectures surveying the functional aspects of: control of feed intake; salivation; reticulorumen motility, including rumination and eructation; microbial flora and fauna; fermentation in reticulorumen (digestion of carbohydrates, proteins and fats); ruminal gas formation; absorption of short-chained fatty acids; special features of ruminal nitrogen metabolism; passage of nutrients to lower tract; and a brief consideration of the functions of omasum, abomasum, small and large intestines. Emphasis will be on the differences of the ruminant digestive processes from those of the simple-stomached animals.

**[VTMED 690 Molecular and Genetic Basis of Inherited Disorders in Animals and Application to Clinical Medicine]**

Spring, every other year. 2 credits. All years. Enrollment: 5 minimum; 15 maximum. Letter grade. Not offered spring 1999. J. Ray.

This course introduces the molecular basis of inherited diseases in domestic animals. Topics include several inherited metabolic defects causing systematic malfunctions; muscle, bone abnormalities; retinal degeneration; failure of the immune systems. Techniques to characterize genes and mutations. Use of molecular techniques for diagnosis and prevention. Use of molecular tools for the treatment of inherited disorders.]

**[VTMED 691 Bovine Reproductive Management]**

Fall. 3 credits. Limited to 8 students. S-U only. P. Daels, C. Guard.

This course will be available to junior students during the fall semester. Students must be enrolled in Dr. Guard's dairy herd management course. The objectives are to give training in modern herd-level reproductive

management and develop technical skills involved in fertility evaluation of dairy cows. Each student will be responsible for a subset of the dairy herd and take charge of all aspects of the reproductive management of these animals. Students will be expected to follow progress of the reproductive management on a daily basis and will meet three times per week with the instructor to evaluate progress and discuss clinical findings. There will be required reading material and formal meetings (1 per month) to discuss progress and specific topics.

#### **[VTMED 692 Current Concepts in Reproductive Biology]**

Fall. 3 credits. First-, second-, and third-year veterinary students or appropriate undergraduate/graduate training. S-U grades optional. Lec, 2 hours each week; disc, 2 hours each week; T R 10:10-12:05. Not offered 1998-99. J. Fortune, R. Butler, and staff.

This is a team-taught survey course in reproductive physiology/endocrinology. Lectures 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); pregnancy; parturition; puberty; and reproductive technology. Student participation in the form of discussions and/or presentations.]

#### **[VTMED 695 Genetic Basis of Eye Diseases]**

Spring (Jan.-Feb.—4 wks). 1 credit. All years. Enrollment: 6 minimum; maximum 14. Letter grade. G. Aguirre.

This course covers the topic of 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 will be 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 the class discussions and for the paper.

#### **[VTMED 696 Fundamental Principles and Anesthetic Techniques for Small Animal Practice]**

Spring, 4 weeks. Next offered spring 1999. 1 credit. Enrollment: 15 minimum; maximum open. Third-, and fourth-year veterinary students. C. Short.

This course is designed for the veterinary student with interest in small animal practice. It will consist of lectures, case discussions, and anesthetic protocol development for routine and complicated cases. Subjects covered in the course will include: management of anesthesia for elective surgery, management of the high-risk patient, fluid therapy, drug interactions, pain management, treatment of respiratory complications, treatment of cardiovascular complications, cardiopulmonary resuscitation, and post-anesthetic management.

While fundamental concepts and advancements in anesthesia will be utilized in this course, a practical application for use in private practice will be a major objective.

#### **[VTMED 697 Fundamental Principles in Anesthetic Techniques for Equine or Mixed Animal Practice]**

Spring. 1 credit. Enrollment: 15 minimum; maximum open. Third-, and fourth-year veterinary students. C. Short.

This course is designed for the veterinary student with interest in equine or mixed animal practice. It will consist of lectures, case discussions, and anesthetic protocol development for routine and complicated cases. Subjects covered in the course will include: management of anesthesia for elective surgery, management of the high-risk patient, fluid therapy, drug interactions, pain management, treatment of respiratory complications, treatment of cardiovascular complications, cardiopulmonary resuscitation, and post-anesthetic management.

While fundamental concepts and advancements in anesthesia will be utilized in this course, a practical application of these principles for use in private practice will be a major objective.

#### **[VTMED 698 Special Projects in Veterinary Medicine]**

Fall, winter, spring, summer. Variable credit. Letter grade. Tenure track faculty, College of Veterinary Medicine.

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 credit. Letter grade. Tenure track faculty, College of Veterinary Medicine.

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.

#### **[VTMED 700 Theriogenology Service]**

Spring. 2 or 4 credits. Enrollment min/max. Third- and fourth-year veterinary students. R. O. Gilbert and others.

This clinical service rotation is offered to provide additional hands-on experience in all phases of theriogenology. Equine reproductive experience is gained in teasing, rectal palpations, ultrasound scanning, semen collection and evaluation, natural breeding, and artificial insemination. Additional techniques emphasized include taking and evaluating endometrial biopsies, endometrial culturing, and collecting and evaluating endometrial cytology smears. Bovine experience includes weekly trips to the slaughterhouse, where rectal-palpation findings can be compared to actual structures present in recovered tracts. Additional experience in rectal palpation is gained by following cyclic changes in assigned cows in the college dairy herd as well as by participating in herd-health palpations. Trips to the Department of Animal Science sheep and swine barns allow observation of breeding programs and provide experience in castration, docking, clipping milk teeth, and notching ears. Weekly seminars are presented on current topics in theriogenology.

#### **[VTMED 701 Cardiology Service]**

Fall and spring. 2 credits. Enrollment min/max. Third-, and fourth-year veterinary students. Letter grades. Not offered 1998-99. S. Moise.

The purpose of the cardiology rotation is to provide the student with the opportunity to put into practice what they have learned in the foundation years. The management of the most common cardiac diseases will be emphasized including congestive heart failure, arrhythmias, and secondary cardiac diseases. All species will be examined, large and small, although the majority will be small animals. Diagnostics including cardiovascular physical examination, electrocardiography, radiography, and echocardiography will be taught. The rotation includes clinical work, didactic teaching, and self-initiated digging for information. A written report concerning a clinical case study will be required for completion of this rotation.]

#### **[VTMED 702 Laboratory Animal Medicine]**

Fall and spring. 2 credits. Enrollment min/max. Third- and fourth-year veterinary students. Letter grades. F. Quimby and others.

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 a field trip to the research animal facilities of Rockefeller University, the Cornell University Medical College, Marshall Farms, and the Laboratory of Experimental Medicine and Surgery in Primates.

#### **[VTMED 703 Clinical Wildlife, Exotic, and Zoo Animal Medicine]**

Fall, winter, spring, and summer. 2 credits. Enrollment min 2 per rotation/max 2 per rotation. Third- and fourth-year veterinary students. Letter grades. G. V. Kollias and others.

This course introduces students to primary medical care of non-traditional pet species zoo animals and native wildlife. Students are responsible for the assessment, physical examination, and medical management of exotic animal species presented to the veterinary teaching hospital. 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 Burnett Park Zoo. Successful completion of the course requires satisfactory participation during this 14-day clinical rotation.

#### **[VTMED 704 Quality Milk]**

Fall or spring. 2 credits. Enrollment min/max. Third- and fourth-year veterinary students. Letter grades. R. Gonzalez, D. Wilson and others.

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 Promotion Services—New York State Mastitis Control Program.

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

Fall, spring, and summer. Variable credits. Enrollment min/max. Third- and fourth-year veterinary students. S-U grades only. This course provides opportunities for students after the end of 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 associate dean for academic programs 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 732 Veterinary Clinical Toxicology**

Spring. 1.5 credits. Prerequisites: 2nd, 3rd or 4th year standing. S-U optional grading, grades will be based on weekly quizzes, a final exam, a short paper and oral presentation. L. Thompson and K. Earnest-Koons.

This course will provide the veterinary student with a solid introduction to concepts and principles of toxicology and how they are applied in the clinical setting. Students will learn about specific common toxicants, clinical signs in affected animals and treatment protocols for the toxicants in question. Students will 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 will be conducted with two one-hour lectures per week and one hour-long large group discussion per week. The class will meet two days per week, the first day for one hour and the second day for two hours. Grades will be based on weekly quizzes, a final exam, a short paper and oral participation.

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

Spring. 1 credit. 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 drives changes in management. Dairy cattle are handled in groups, although individual cow health and productivity fundamentally underpin the financial success of the dairy enterprise. 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 modern veterinarians to recognize and solve complex and interdependent milk production, reproduction, and health issues. Until the advent of the new veterinary curriculum, biological systems were often taught in isolation. Yet there are research models that integrate the dynamic nature of dairy production, health, management, and economics through epidemiological and economic modeling. Despite the existence of such advanced research models, they have not been integrated fully into the curriculum. The goal of this course is to teach

students the dynamic relationships of herd performance parameters with dairy herd health and management. This will be done with a combination of lectures and exercises using two computer simulation models. The following topics will be 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 simulation models on the other day.

## **ANATOMY**

#### **VETA 600 Special Projects in Anatomy**

Fall and spring. 1 credit per 2.5-hour period. By permission of the instructor. S-U grades only.

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

Spring. 1 credit. By permission of the instructor. S-U optional grading. J. W. Hermanson.

Form and function are often discussed as a correlated entity in biology. This seminar group will start with the question, "Does form really predict function?" This will be addressed initially with respect to the analysis of paleobiology, but will then encompass 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 will be selected by participants in this course. Participation will be open to interested graduate students, advanced undergraduate students, and veterinary students.

## **CLINICAL SCIENCES**

#### **VETCS 664 Introduction to Epidemiology (Graduate)**

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

Lectures and discussion deal with the fundamentals of epidemiology. Current topics in epidemiology from the fields of nutrition, infectious and chronic diseases, occupational medicine, and veterinary medicine will be reviewed to illustrate the principles and practice of epidemiology, especially of clinical trial design and infectious-disease epidemiology.

#### **VETCS 665 Study Designs (Graduate)**

Spring. 2 credits. Prerequisites: 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 will include sample size, bias, and relative advantages and disadvantages.

The course objectives are: 1) know the difference between different types of 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 will consist 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).

#### **VETCS 666 Advanced Methods in Epidemiology (Graduate)**

Fall. 3 credits. Prerequisites: VETCS 665 and Statistics and Biometry 602 (College of Agriculture and Life Sciences). S-U grades optional. M W F 8:45-9:35. Y. T. Grohn.

Concepts introduced in VETCS 664 and VETCS 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.

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

Fall, every third year. 1.5 credits. Next offered fall 1998. S-U grades only. N. G. Ducharme.

Normal anatomy and physiology of the gastrointestinal system in carnivores, herbivores and ruminants will be presented initially. This will be followed by in-depth discussion of the pathophysiological mechanisms and sequelae of gastrointestinal obstructions including reperfusion injury, peritonitis, adhesions and short bowel syndrome.

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

Spring, every third year. 1.5 credits. Next offered spring 1999. S-U grades only.

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

Fall, every third year. Offered fall 1999. 1.5 credits. Prerequisite: DVM degree or equivalent. S-U grades only. R. P. Hackett, S. L. Fubini, N. G. Ducharme, H. J. Harvey.

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 thoracic disease (various forms of upper airway resistance). The emphasis is placed on understanding these mechanisms and outlining the surgeon's response to these.]

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

Spring, every third year. Offered spring 1999. 1.5 credits. S-U grades only.

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, every third year. 1.5 credits. S-U grades only. Not offered 1998-99.]

**VETCS 705 Animal Pain and Its Control (Graduate)**

Spring 1999. 2 credits. By permission of the instructor. Letter or S-U option. C. E. Short.

This course is open to interns, residents, graduate students, and postdoctoral associates to provide instruction in fundamental and applied concepts of animal pain. The emphasis will be on neurologic, cardiopulmonary, and endocrine responses to either noxious stimulation or pain due to injury and disease processes and the medications used for its control. The subject material will be covered by lectures, group discussions, and group evaluation of protocols to treat or prevent animal pain.

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

Spring, every third year. 1.5 credits. S-U grades only. Next offered spring 2001.]

**VETCS 707 Clinical Biostatistics (Graduate)**

Spring, alternate years. 2 credits. Letter grade only. H. N. Erb, Y. T. Grohn, H. O. Mohammed, J. M. Scarlett (coordinator).

The theory behind and interpretation of parametric and nonparametric statistical techniques commonly employed in clinical medicine will be explained. Students will analyze small data sets using a commercial statistical software package.

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

Fall and spring. 1 credit. S-U grades only. Epidemiology faculty.

Advanced theoretical and analytical epidemiologic concepts and techniques will be discussed.

**VETCS 710 Advanced Veterinary Anesthesiology I**

Fall and winter. Third- and fourth-year veterinary students, graduate students, interns, and residents. Prerequisites: VTMED 568 Veterinary Anesthesiology or permission from instructor. S-U grading. P. F. Moon (coordinator) and others.

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

**VETCS 711 Advanced Veterinary Anesthesiology II**

Fall and winter. 1 credit. Third- and fourth-year veterinary students, graduate students, interns, and residents. Prerequisites: VTMED 568, Veterinary Anesthesiology I or permission from instructor. S-U grading. P. F. Moon (coordinator) and others.

For course description, see VETCS 710.

**VETCS 766 Graduate Research (Graduate)**

Fall, spring, and summer. Credit and hours to be arranged. By 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.

**VETCS 768 Master's-Level Thesis Research (Graduate)**

Fall or spring. 1-6 credits. S-U grading. Epidemiology faculty.

This course enables graduate students in the Section of Epidemiology to receive graduate research credits for master's-level thesis research.

**VETCS 769 Doctoral-Level Thesis Research (Graduate)**

Fall or spring. 1-6 credits. S-U grading. Epidemiology faculty.

This course enables students in the Section of Epidemiology to receive graduate research credits for doctoral-level thesis research.

**VETCS 799 Independent Studies in Epidemiology**

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

## DIAGNOSTIC LABORATORY

**VETDL 700 Special Projects in Diagnostic Endocrinology**

Fall and spring. 1-3 credits. By permission of the instructor. Letter grades only. T. J. Reimers.

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

**VETDL 701 Special Projects in Infectious Diseases**

Fall and spring. 1-3 credits. By permission of the instructor. S-U grades optional. Diagnostic laboratory faculty.

This course provides laboratory experience with attention to specific aspects of infectious disease problems.

**VETDL 702 Special Topics in Infectious Diseases**

Fall and spring. 1-3 credits. By permission of the instructor. S-U grades optional. Diagnostic laboratory faculty.

The objective of this course is to offer a broad exposure to various aspects of infectious diseases.

**VETDL 703 Doctoral-Level Thesis Research (Graduate)**

Fall and spring. 6-9 credits. By permission of the instructor. S-U grades only. Diagnostic Laboratory faculty.

Research leading to a Ph.D. degree.

**VETDL 704 Master's-Level Thesis Research (Graduate)**

Fall and spring. 1-3 credits. By permission of the instructor. S-U grades only. Diagnostic Laboratory faculty.

Research leading to an M.S. degree.

## MICROBIOLOGY AND IMMUNOLOGY

**VETMI 315 Basic Immunology (Undergraduate) (also Biological Sciences 305)**

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

A survey of immunology, with emphasis on the biological functions of the immune response.

**VETMI 320 Principles of Toxicology (Undergraduate) (also Biological Sciences 320 and Toxicology 320)**

Spring. 3 credits. Prerequisites: one year each of introductory biology and chemistry, with lab; one semester of organic chemistry lecture or waiver by instructor. S-U optional grading. T R 1:25-2:40. S. Penningroth, R. Dietert, and S. Bloom.

An introduction to the interdisciplinary science of toxicology, drawing on material from biology, chemistry, ecology and pharmacology. Principles are illustrated by case examples, such as pesticide toxicity to wildlife reproduction and human health risk assessment at a Superfund hazardous chemical waste site. Chemical risk management is presented as a sociopolitical process involving the integration of scientific, economic and cultural factors.

Independent student projects include a toxicological profile and a team analysis of hypothetical "environmental risk scenarios." Periodic talks by toxicology faculty acquaint students with basic research in this interdisciplinary branch of Biological Science. This is an introductory level course in toxicology. Format: lecture supplemented by case examples. One field trip to a hazardous chemical waste site. Appropriate for non-majors seeking basic literacy in environmental and human toxicology. "Gateway course" for students interested in 400 and 600 level toxicology courses.

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

Spring, odd-numbered years. 2 or 3 credits (3 credits with lecture and seminar). Prerequisites: BIOMI 290 and 291. Strongly recommended: VETMI 315. Seminar is required of graduate students and open to undergraduates with permission of instructor. Seminar limited to 15 students. E. Tullson.

This is a course in medical microbiology, presenting the major groups of bacterial and mycotic pathogens important to human and veterinary medicine. The emphasis of this course is 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 level.

**VETMI 408 Viruses and Diseases I (also Biological Sciences 408)**

Spring, alternate years. 3 credits. Intended primarily for graduate and undergraduate microbiology majors. Prerequisites: Microbiology 290 and 291 (College of Agriculture and Life Sciences). Recommended: VETMI 315, GENetics 281. Letter grades only. J. W. Casey.



The course will cover basic concepts in virology with emphasis on virus-host interactions, strategies for gene regulation, and mechanisms of pathogenicity. Selected viral infections that result in immune dysfunction and neoplasia will be highlighted in the context of approaches to prevent or reduce the severity of diseases.

**VETMI 431 Medical Parasitology (Undergraduate)**

Fall, alternate years. Offered fall 1998. 2 credits. Prerequisites: zoology or biology. Letter grades only. D. D. Bowman.

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 and spring. Credit to be arranged. By permission of the 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 700 The Biology of Animal Viruses (Graduate and Upper-level Undergraduate)]**

Fall, odd-numbered years. 2 credits. Next offered fall 1999. Letter grade only. C. R. Parrish.

This course is a general introduction to the biology of animal viruses. A brief history of the concept and study of viruses, along with an overview and classification of the major viral groups, will be given. Topics include the structures of viruses and their components, viral nucleic acids and genome replication strategies, selected examples of gene regulation mechanisms, structural and nonstructural viral proteins, and the interactions between viruses and cells. Traditional and recent examples of methods for the genetic analysis of viruses will be given. Further topics include evolution, variation, and selection of virus strains over time and during infections of host animals; traditional and novel approaches to vaccine development; and antiviral chemotherapy.]

**VETMI 701 Pathogenesis of Viral Diseases**

Spring alternative years. 2 credits. Letter grades. Given during 8-week spring distribution period, January-March. Open to graduate students and advanced undergraduates with permission of instructor. Strongly recommended prerequisite: Immunology. Microbiology faculty.

Course content and objectives: the course will focus on the balance between host defense against viral infections and the mechanisms by which viruses perpetuate themselves in human and animal populations. In the process, the mechanisms of cell and animal infection, spread between cells, disease mechanisms, and the roles of the immune response in enhancing and suppressing disease will be explored. This will include a systems-based approach exploring the pathogenesis of disease in the CNS, gas-

trointestinal, hepatic, tegumentary, respiratory and urogenital systems. The basic principles of virus taxonomy, structure and replication will be included to introduce various viral groups and their special properties. Methods of intervention (vaccination, antiviral drugs) will also be covered. Lectures are derived from relevant current literature, the text, Nathanson's *Viral Pathogenesis*, 1997, and Field's *Virology*, third edition, 1996. Relevant materials will be placed on reserve in the veterinary library.

**[VETMI 702 Molecular Biology and Immunology of Host-Parasite Interactions (Graduate) (also VTMED 620)]**

Spring, even-numbered years. 2 credits. Letter grade or S-U option. E. J. Pearce. See description for VTMED 620.]

**VETMI 705 Advanced Immunology (Graduate) (also Biological Sciences 705)**

Spring, even-numbered years. 3 credits. Prerequisite: VETMI 315 Basic Immunology or permission of instructor. Letter grades only. R. G. Bell (coordinator) and staff.

Coverage at an advanced level of molecular and cellular immunology.

**VETMI 706 Immunology Seminar Series (Graduate)**

Fall and spring. No credit. Required of all graduate students in the Field of Immunology. S-U grades only. Fall, E. Pearce; spring, R. Dietert.

Presentations of research investigations by Cornell faculty members, postdoctoral fellows, and graduate students in the Field of Immunology and by invited speakers from other institutions.

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

Fall and spring. Credit to be arranged. By permission of the instructor. Letter grade or S-U option. 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 709 Laboratory Methods of Diagnosis (Graduate)**

Fall and spring. 1-3 credits by arrangement. By permission of instructor. Letter grade or S-U option. Microbiology staff.

Instructions and practice in the application of microbiological and serological methods for the diagnosis of disease.

**VETMI 710 Microbiology Seminar (Graduate)**

Fall and spring. 1 credit. Required of all graduate students in the Department of Microbiology and Immunology. S-U grades only. E. J. Pearce, C. R. Parrish.

**[VETMI 719 Immunology of Infectious Diseases and Tumors (also Biological Sciences 706) (Graduate)]**

Spring, alternate years. Next offered spring 1999. 2 credits. Prerequisite: VETMI 315 Basic Immunology or permission of instructor. S-U optional. R. G. Bell (coordinator) and staff.

Coverage at an advanced level of the immunology of diseases caused by selected bacterial, viral, protozoan, and helminthic parasites, and tumor immunology.]

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

Fall and spring. 1-3 credits by arrangement. For advanced undergraduate and graduate students. Letter grades only. D. D. Bowman and other faculty.

This course is intended for graduate students minoring in parasitology and for highly motivated veterinary students with interests in parasitology research.

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

Fall and spring. Credit to be arranged. By special arrangement with the instructor. Letter grades only. S. A. Naqi.

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

Fall and spring. Credit to be arranged. By special arrangement with the instructor. S-U grades only. P. R. Bowser.

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

Fall and spring. 1 credit. Open to veterinary students, graduate students minoring in the field of parasitology; others by permission of the 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, immunoparasitology, and parasitic diseases of plants and animals, including humans.

## PATHOLOGY

**[VETPA 636 Wildlife Pathology]**

Fall and spring. 2 credits. Open enrollment. Letter grade or S-U option. Not offered 1998-99. J. King.

This course introduces students to common and important lesions of wild species of animals. The etiology and pathogenesis of diseases of importance to wildlife are discussed. Slide presentations of lesions are made, and they are discussed by an experienced pathologist.

The nature and causes of diseases of wild animals, birds, and some other species are presented. Emphasis is on epizootiology, etiology, pathogenesis and diagnostic lesions. Experience is provided in specimen collection and necropsy techniques. Attendance at Show and Tell at 4-5:00 P.M. Fridays during the course is mandatory in the necropsy room for the presentation of fresh, wet tissue specimens and discussion by clinicians and pathologists as well as actual handling of the tissues (gloves provided) after the class.]

**[VETPA 637 Postmortem Pathology]**

Fall and spring. 2 credits. Intended for veterinary students but open to others. Letter grade or S-U option. Not offered 1998-99. J. M. King.

A presentation of gross and microscopic lesions of diagnostic significance, employing color projection slides as illustrations. Emphasis on pathological and differential diagnosis of a wide spectrum of viral, metabolic, bacterial, parasitic, and other diseases.]

**VETPA 639 Autotutorial in Laboratory Animal Medicine and Science**

Spring. 1-3 credits. Letter grade.

F. W. Quimby.

This course is offered to individuals interested in pursuing various aspects of laboratory animal medicine and science in depth. A variety of resources are available to assist students in their research on a particular topic: the library of the Division of Laboratory Animal Medicine, including the autotutorial library; the university libraries; and special information collected from other institutions. Grades are determined on the basis of a paper, an oral presentation, or the creation of an audiovisual teaching aid, any of which may be selected by the student.

**VETPA 641 Veterinary Clinical Immunology**

Spring. 1 credit. Limited to veterinary students; others by permission of the instructor. Letter grades. R. M. Lewis.

This course emphasizes the clinical aspects of fifteen specific diseases that are mediated by immunologic processes. Case material from the Teaching Hospital is used to illustrate presenting clinical signs, laboratory diagnostic methods, clinical course, therapeutic approaches, and eventual outcome of each disease under discussion. Student participation in the informal case discussions is encouraged as a means of introducing students to the practice of veterinary medicine through case discussion and analysis. Training is also provided in the use of the college's computerized biomedical information system and the hospital records system to develop a critical written case analysis, which serves as the basis for grading.

**VETPA 750 Cancer Cell Biology (also Biological Sciences 750) (Graduate)**

Spring, alternate years. 3 credits.

Prerequisite: Biological Sciences 330 or 331 or equivalent. Recommended: graduate courses in biological sciences. Letter grade. J. L. Guan (coordinator), R. A. Levine, B. U. Pauli, A. Yen.

This advanced graduate course will cover molecular, cellular, and genetic aspects of cancer. The course is divided into three sections. The first section will address tumor etiology, progression, and metastasis. Topics in this section will include causes of cancer, morphologic and genetic models of cancer progression, tumor angiogenesis, tumor invasion, and metastasis. The second section will discuss cell-matrix and cell-cell interactions in cancer. Topics will include the structure and function of the major matrix receptor integrin family of cell adhesion molecules, integrin interactions with the cytoskeleton, intracellular signaling pathways in cell-ECM interactions, integrin-mediated signaling in cellular growth regulation, changes of integrins in human tumors and metastasis, structure and function of cadherin family of cell-cell adhesion molecules, signaling mechanisms in cell-cell interactions in normal development and cancer. The third section will be on cell cycle. It will develop properties of the cell cycle and how its phases are measured, changes associated with cell transformation, and how oncogenes and tumor suppressor genes regulate cell proliferation, differentiation, and apoptosis.

**VETPA 788 Seminar in Surgical Pathology**

Fall and spring. 1 credit. Intended for residents. Third- and fourth-year veterinary students may attend. Letter grades only. B. A. Summers (coordinator) and others.

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.

**[VETPA 796 Medical Primatology**

Fall, alternate years. 1 credit. Not offered fall 1998. For residents and graduate students by permission of instructor. F. W. Quimby.

A survey of major diseases, medical care, and management techniques for all life stages of primates. Topics include physical examination, restraint anesthesia, housing, and management of various nonhuman primate species; bacterial, viral, and parasitic diseases; noninfectious diseases; infant and nursery care reproduction and behavioral considerations; and therapeutics.]

**PHARMACOLOGY****Lecture Courses****VETPR 470 Biophysical Methods (also A&EP 470)**

Spring. 3 credits. Prerequisites: by permission of the instructor only. Letter grading only. M. Lindau.

An overview of the diversity of modern biophysical experimental techniques used in the study of biophysical systems at the cellular and molecular level. Topics covered will include methods that examine both structure and function of biological systems, with emphasis on the applications of these methods to biological membranes. The course format will include assigned literature reviews by the students on specific biophysics topics and individual student presentations on these topics. The course is intended for students of the engineering, physics, chemistry, and biological disciplines who seek an introduction to modern biophysical experimental methods. A solid knowledge of basic physics, and of mathematics through the sophomore level is expected. Some knowledge of cellular biology is helpful but not required.

**VETPR 610 Cellular and Molecular Pharmacology**

Fall, odd-numbered years. 2 credits. By permission of the instructors. Letter grades or S-U option. G. A. Weiland and pharmacology faculty.

A graduate-level course surveying the molecular and cellular aspects of receptor mechanisms, signaling pathways, and effector systems. Topics covered 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.

**VETPR 611 Systems Pharmacology**

Spring, even-numbered years. 2 credits.

By permission of the instructors. Letter grades or S-U option. G. A. Weiland and pharmacology faculty.

A graduate-level course surveying system- and organ-related aspects of pharmacology. Topics covered 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.

**VETPR 615 Molecular Biophysics of Cell Dynamics (also A&EP 615)**

To be arranged. 3 credits. Prerequisite: graduate or senior level in science or engineering. Letter grade. W. W. Webb.

Physical mechanisms in cellular function: statistical thermodynamics of ion channel molecules, single channel recording, receptor signaling, molecular motility and mobility. Intermolecular forces, spontaneous self-assembly of mesoscopic structures, molecular mechanisms of secretion, supramolecular mechanisms in memory and development.

**VETPR 672 Protein Kinetics (also CHEM 672)**

Fall. 4 credits. Prerequisite: CHEM 288 or 390, BIOBM 331 (or equivalents) or permission of the instructor. Letter grade or S-U option. B. A. Baird.

Focus is on protein interactions with ligands and consequent changes in structure and activity. Topics include: protein structure and dynamics; thermodynamics and kinetics of ligand binding; steady state and transient enzyme kinetics; enzyme catalysis and regulation; role of cell membrane receptors in regulating cellular activities.

**[VETPR 700 Calcium as a Second Messenger in Cell Activation**

Spring, even-numbered years. 2 credits.

By permission of the instructor. Lecture-discussion. S-U grading. C. M. S. Fewtrell.

Regulation of intracellular calcium and techniques for studying calcium movements and distribution in cells. 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 will be introduced with a lecture followed by discussion of recent papers from the literature.]

**VETPR 701 Organ System Toxicology (also TOX 611)**

Fall, even-numbered years. 1 credit. S-U grading. W. S. Schwark.

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 will be considered.

**VETPR 703 Receptor-Ligand Interactions (also BIONB 790-02)**

Fall, even-numbered years. 2 credits. By permission of the instructors. Letter grade or S-U option. R. E. Oswald, G. A. Weiland (coordinator).

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.

**VETPR 704 CNS Neuropharmacology: Mechanisms of Synaptic Transmission**

Spring, odd-numbered years. 2 credits. Maximum enrollment: 20 graduate students and undergraduate seniors by permission of the instructor. Letter grade or S-U option. L. M. Nowak.

This is a survey course in vertebrate central nervous system physiology and pharmacology, and focuses on mechanisms of neurotransmitter action at the membrane and cellular levels. Roles of selected neurotransmitters in normal and dysfunctional brains are covered. Topics are introduced in lectures and followed up in discussions of recent journal articles.

**VETPR 705 Molecular Mechanisms of Receptor-G Protein Coupled Signaling**

Spring, odd-numbered years. 2 credits. By permission of the instructor. Letter grade or S-U option. R. A. Cerione.

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

**VETPR 706 Growth Factor-Coupled Signaling (also BIOBM 734)**

Spring, odd-numbered years. 0.5 credits. By permission of the instructor. Letter grade or S-U option. R. A. Cerione.

General theme will be mitogenic signaling pathways. Receptor tyrosine kinases, src, ras, and ras-regulatory proteins will be covered.

**VETPR 707 Protein NMR Spectroscopy (also BIOBM 730)**

Spring, odd-numbered years. 2 credits. By permission of the instructors. Letter grade or S-U option. R. E. Oswald and L. K. Nicholson.

The fundamentals of NMR will be presented and the student will acquire the tools necessary to establish an in-depth understanding of multidimensional, multinuclear NMR experiments. Application of the technique to proteins for assignment of resonances, determination of structure, and characterization of dynamics will be presented. Special approaches for applying solution NMR techniques to large proteins will be discussed.

**VETPR 708 Lipid Second Messengers**

Fall, even-numbered years. 1 credit. Prerequisite: general biochemistry or permission of instructor. Lecture-discussion. Letter or S-U grading option. H. Alex Brown.

This course covers the biochemical pathways involved in the production of lipid second messengers. These pathways function as essential elements of cellular signal transduction cascades. Topics include pathways of phospholipid synthesis, regulation of major mammalian phospholipases by receptors linked through G-proteins and tyrosine kinase receptors to intracellular cascades, and subsequent metabolism of lipid products. The roles of lipids in regulating cell processes, such as membrane structure, exocytosis, cell cycle, and apoptosis, are topics for discussion following reviews of recent publications.

**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. Pharmacology faculty. Independent study or research.

These courses cover a variety of topics related to the research interests of the faculty.

**VETPR 711 The Role of Calcium in Stimulus-Secretion Coupling**

C. M. S. Fewtrell.

**VETPR 713 Mechanisms of Growth-Factor Action**

R. A. Cerione.

**VETPR 714 Central Nervous System Neurotransmitters**

L. M. Nowak.

**VETPR 718 Structure-Function of the Nicotinic Acetylcholine Receptor**

R. E. Oswald.

**VETPR 724 The Control of Hormone Secretion**

G. W. G. Sharp.

**VETPR 730 Graduate Research in Pharmacology**

1-10 credits. This course is offered by individual faculty members in the Department of Pharmacology for graduate students undertaking research toward M.S. or Ph.D. degrees.

**Directed Readings in Pharmacology**

Fall, spring, and summer. 1-3 credits each topic. By arrangement with the instructor. Letter grade or S-U option. Pharmacology faculty. Reading and discussions.

These courses are offered to small groups or to individual students.

**VETPR 742 Receptor Mechanisms**

G. A. Weiland.

**VETPR 745 Biochemical Neuropharmacology**

G. A. Weiland.

**VETPR 747 Amino Acid Neurotransmitters**

L. M. Nowak.

**VETPR 748 Stimulus-Secretion Coupling**

C. M. S. Fewtrell.

**VETPR 750 Cell Calcium**

C. M. S. Fewtrell.

**VETPR 755 Calcium in the Control of Hormone Secretion**

G. W. G. Sharp.

**VETPR 760 Advanced Topics in Pharmacology**

Pharmacology faculty.

**PHYSIOLOGY****VETPH 346 Introductory Animal Physiology (also BIOAP 311) (Undergraduate)**

Fall. 3 credits. Prerequisites: one year of college-level biology, chemistry, and mathematics. S-U by permission. E. R. Loew. M W F 11:15.

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.

**VETPH 628 Graduate Research in Animal Physiology (Graduate) (also BIO S 719)**

Fall and spring. Variable credit. Prerequisite: written permission of section chairperson and staff member who will supervise the work and assign the grade. S-U grades optional.

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

**VETPH 720 Special Problems in Physiology (Graduate)**

Fall and spring. By permission. Laboratory work, conferences, collateral readings, and reports. Adapted to the needs of students.

**VETPH 811 and 812 Advanced Physiology Methods I & II (also BIO S 811 and 812 (Graduate))**

Fall and spring. 2 credits each. Enrollment limited. Prerequisites: graduate student status or permission of course coordinator. S-U grades only. P. Nathanielsz.

This is a course primarily for graduate students in physiology and related disciplines. Experiments are carried out in the laboratories of physiology faculty members to acquaint students with the latest techniques and methods in physiological research. Three modules are offered each semester by arrangement with the course coordinator.

**FACULTY ROSTER**

Aquirre, Gustavo D., Ph.D., U. of Pennsylvania.  
Alfred H. Caspary Professor, Clinical Sciences  
Ainsworth, Dorothy M., Ph.D., U. of Wisconsin-Madison. Assoc. Prof., Clinical Sciences  
Antczak, Douglas F., Ph.D., U. of Cambridge (England). Dorothy Havemeyer McConville Professor of Microbiology and Immunology  
Appel, Max J., Ph.D., Cornell U. Prof. Emeritus, Microbiology and Immunology  
Appleton, Judith A., Ph.D., U. of Georgia. Assoc. Prof., Microbiology and Immunology  
Avery, Roger J., Ph.D., U. of Newcastle-upon-Tyne (England). Prof., Microbiology and Immunology  
Baines, Joel, Ph.D., Cornell U. Asst. Prof., Microbiology and Immunology  
Barr, Stephen C., Ph.D., Louisiana State U. Assoc. Prof., Clinical Sciences

- Battison, Andrea L., D.V.M., U. of Saskatchewan. Instructor, Clinical Pathology
- Bell, Robin G., Ph.D., John Curtin School (Australia). Prof., Microbiology and Immunology
- Bertram, John E., Ph.D., U. of Chicago. Asst. Prof., Anatomy
- Bloom, Stephen E., Ph.D., Penn State U. Prof., Microbiology and Immunology
- Blue, Julia T., D.V.M., OK State. Ph.D., U. of Pennsylvania. Assoc. Prof., Clinical Pathology/Dept. of Pathology
- Bowman, Dwight D., Ph.D., Tulane U. Assoc. Prof., Microbiology and Immunology
- Bowser, Paul R., Ph.D., Auburn U. Prof., Microbiology and Immunology
- Brown, H. Alex, Ph.D., U. of North Carolina at Chapel Hill. Asst. Prof., Pharmacology
- Casey, James W., Ph.D., U. of Chicago. Assoc. Prof., Microbiology and Immunology
- Center, Sharon A., D.V.M., U. of California at Davis. Prof., Clinical Sciences
- Cerione, Richard A., Ph.D., Rutgers U. Prof., Pharmacology
- Chang, Yung Fu, Ph.D., Texas A&M. Assoc. Prof., Diagnostic Laboratory
- Clark, Theodore G., Ph.D., State U. of NY Stony Brook. Asst. Prof., Microbiology and Immunology
- Cooley, Anjilla J., D.V.M., U. of Tennessee. Lecturer, Clinical Sciences
- Cooper, Barry J., Ph.D., U. of Sydney (Australia). Prof., Pathology
- Dael, Peter F., Ph.D., U. of California at Davis. Assoc. Prof., Clinical Sciences
- Davies, Christopher, Ph.D., D.V.M., Cornell U. Asst. Prof., Microbiology and Immunology
- Denkers, Eric Y., Ph.D., U. of Wisconsin, Madison. Asst. Prof., Microbiology and Immunology
- deLahunta, Alexander, Ph.D., Cornell U. James Law Professor of Veterinary Anatomy
- Dietert, Rodney R., Ph.D., U. of Texas at Austin. Prof., Microbiology and Immunology
- Divers, Thomas J., D.V.M., U. of Georgia. Prof., Clinical Sciences
- Dubovi, Edward J., Ph.D., U. of Pittsburgh. Assoc. Prof., Diagnostic Laboratory
- Ducharme, Normand G., D.V.M., U. of Montreal (Canada). Prof., Clinical Sciences
- Dykes, Nathan L., D.V.M., Cornell U. Lecturer, Clinical Sciences
- Erb, Hollis N., Ph.D., U. of Guelph (Canada). Prof., Clinical Sciences
- Evans, Howard E., Ph.D., Cornell U. Prof. Emeritus, Veterinary and Comparative Anatomy
- Farnum, Cornelia, Ph.D., U. of Wisconsin-Madison. Prof., Anatomy
- Fewtrell, Clare, D.Phil., U. of Oxford (England). Assoc. Prof., Pharmacology
- Flanders, James A., D.V.M., U. of California at Davis. Assoc. Prof., Clinical Sciences
- Fortune, Joanne E., Ph.D., Cornell U. Prof., Physiology
- Fox, Francis H., D.V.M., Cornell U. Prof. Emeritus, Clinical Sciences
- French, Tracy W., D.V.M., Purdue U. Assoc. Prof., Clinical Pathology/Dept. of Pathology
- Fubini, Susan L., D.V.M., U. of Georgia. Prof., Clinical Sciences
- Gilbert, Robert O., B.V.Sc., U. of Pretoria (South Africa). Assoc. Prof., Clinical Sciences
- Gilmour, Robert F., Jr., Ph.D., SUNY—Upstate Medical Center. Assoc. Prof., Physiology
- Gleed, Robin D., B.V.Sc., U. of Liverpool (England). Assoc. Prof., Clinical Sciences
- Grohn, Yrjo T., Ph.D., College of Veterinary Medicine, Helsinki (Finland). Prof., Clinical Sciences
- Guan, Jun-Lin, Ph.D., U. of California at San Diego. Assoc. Prof., Pathology
- Guard, Charles L. III, Ph.D., Case Western Reserve U. Assoc. Prof., Clinical Sciences
- Habel, Robert E., D.V.M., M.Sc., M.V.D., Cornell U. Prof. Emeritus, Anatomy
- Hackett, Mary S., D.V.M., Michigan State U. Lecturer, Anatomy
- Hackett, Richard P., Jr., D.V.M., Ohio State U. Prof., Clinical Sciences
- Harvey, H. Jay, D.V.M., Kansas State U. Assoc. Prof., Clinical Sciences
- Henion, John D., Ph.D., SUNY at Albany. Prof., Analytical Toxicology, Diagnostic Laboratory
- Hermanson, John W., Ph.D., U. of Florida. Assoc. Prof., Anatomy
- Hornbuckle, William E., D.V.M., Oklahoma State U. Prof., Clinical Sciences
- Haupt, Katherine A., Ph.D., U. of Pennsylvania. Prof., Physiology/(Section of Physiology)
- Haupt, T. Richard, Ph.D., U. of Pennsylvania. Prof., Physiology/(Section of Physiology)
- Irby, Nita L., D.V.M., U. of Georgia. Lecturer, Clinical Sciences
- Jacobson, Richard H., Ph.D., Montana State U. Assoc. Prof., Diagnostic Laboratory
- 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., Pathology
- Kollas, George V., Ph.D., U. of California at Davis. Jay D. Hyman Prof., Wildlife Medicine
- Krook, Lennart P., Ph.D., Royal Veterinary College at Stockholm (Sweden). Emeritus Prof., Pathology
- Lein, Donald H., Ph.D., U. of Connecticut. Assoc. Prof., Diagnostic Laboratory
- Levine, Roy A., Ph.D., Indiana U. Asst. Prof., Pathology
- Lewis, Robert M., D.V.M., Washington State U. Prof., Pathology
- Ludders, John W., D.V.M., Washington State U. Assoc. Prof., Clinical Sciences
- Lust, George, Ph.D., Cornell U. Prof., Microbiology and Immunology
- Macleod, James N., V.M.D., Ph.D., U. of Pennsylvania. Asst. Prof., Physiology
- Marsh, James A., Ph.D., Northwestern U. Prof., Microbiology and Immunology
- Maylin, George A., Ph.D., Cornell U. Assoc. Prof., Diagnostic Laboratory
- McDonough, Patrick, Ph.D., Cornell U. Asst. Prof., Diagnostic Laboratory
- McDonough, Sean P., Ph.D., U. of California. Asst. Prof., Pathology
- McGregor, Douglas D., D.Phil., U. of Oxford (England). Prof., Microbiology and Immunology
- Meyers-Wallen, Vicki N., Ph.D., U. of Pennsylvania. Assoc. Prof., Anatomy
- Miller, William H., Jr., V.M.D., U. of Pennsylvania. Prof., Clinical Sciences
- Minor, Ronald R., Ph.D., U. of Pennsylvania. Prof., Pathology
- Mizer, Linda, Ph.D., Ohio State U. Senior Lecturer, Anatomy
- Mohammed, Hussni, O., Ph.D., U. of California at Davis. Assoc. Prof., Clinical Sciences
- Moise, N. Sydney, D.V.M., Texas A & M. Prof., Clinical Sciences
- Moon, Paula, D.V.M., Ohio State U. Asst. Prof., Clinical Sciences
- Naqi, Syed A., Ph.D., Texas A & M U. Prof., Microbiology and Immunology
- Nathanielsz, Peter W., M.D., U. of Cambridge (England). James Law Prof. of Physiology
- Nixon, Alan J., B.V.Sc., U. of Sydney (Australia). Assoc. Prof., Clinical Sciences
- Noden, Drew M., Ph.D., Washington U. Prof., Anatomy
- Noronha, Fernando M., D.V.M., U. of Lisbon (Portugal). Emeritus Prof., Microbiology and Immunology
- Nowak, Linda M., Ph.D., U. of Michigan. Assoc. Prof., Pharmacology
- Oswald, Robert E., Ph.D., Vanderbilt U. Prof., Pharmacology
- Parrish, Colin R., Ph.D., Cornell U. Assoc. Prof., Microbiology and Immunology
- Pauli, Bendicht U., Ph.D., U. of Bern (Switzerland). Prof., Pathology
- Pearce, Edward, J., Ph.D., National Institute for Medical Research (England). Assoc. Prof., Microbiology and Immunology
- Phemister, Robert D., Ph.D., Colorado State U. Prof., Pathology
- Quimby, Fred W., Ph.D., U. of Pennsylvania. Prof., Pathology
- Randolph, John F., D.V.M., Cornell U. Assoc. Prof., Clinical Sciences
- Rawson, Richard, Ph.D., Kansas State U. Lecturer, Physiology
- Ray, Jharna, Ph.D., U. of Calcutta (India). Asst. Prof.
- Rebhun, William C., D.V.M., Cornell U. Prof., Clinical Sciences
- Reimers, Thomas J., Ph.D., U. of Illinois. Prof., Diagnostic Laboratory
- Reynolds, Arleigh J., Ph.D., Cornell U. Asst. Prof., Clinical Sciences
- Riis, Ronald C., D.V.M., U. of Minnesota. Assoc. Prof., Clinical Sciences
- Roberson, Mark S., Ph.D., U. of Nebraska at Lincoln. Asst. Prof., Physiology
- Robertshaw, David, Ph.D., Glasgow U. (Britain). Prof., Physiology
- Sack, Wolfgang O., D.V.M., Ph.D., U. of Edinburgh. Prof. Emeritus, Anatomy
- Scarlett, Janet M., Ph.D., U. of Minnesota. Assoc. Prof., Clinical Sciences
- Schat, Karel A., Ph.D., Cornell U. Prof., Microbiology and Immunology
- Schlafer, Donald H., Ph.D., U. of Georgia. Prof., Pathology
- Schwark, Wayne S., Ph.D., U. of Ottawa (Canada). Prof., Pharmacology
- Schweizer, Christine, D.V.M., Cornell U. Lecturer, Clinical Sciences
- 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
- Sharp, Geoffrey W. G., D.Sc., U. of London (England). Prof., Pharmacology
- Shin, Sang J., D.V.M., Seoul National U. (Korea). Assoc. Prof., Diagnostic Laboratory
- Short, Charles E., Ph.D., U. of Turku (Finland). Prof., Clinical Sciences
- Simpson, Kenneth W., Ph.D., U. of Leicester (England). Asst. Prof., Clinical Sciences
- Smith, Donald F., D.V.M., U. of Guelph (Canada). Prof., Clinical Sciences
- Smith, Mary C., D.V.M., Cornell U. Assoc. Prof., Clinical Sciences
- Stokol, Tracy, Ph.D., U. of Melbourne (Australia). Asst. Prof., Clinical Pathology
- Suarez, Susan S., Ph.D., U. of Virginia. Assoc. Prof., Pathology
- Summers, Brian A., Ph.D., Cornell U. Prof., Pathology
- Tapper, Daniel N., Ph.D., Cornell U. Emeritus Prof., Physiology/(Section of Physiology)
- Tennant, Bud C., D.V.M., U. of California at Davis. James Law Professor of Comparative Medicine, Clinical Sciences
- Todhunter, Rory J., Ph.D., Cornell U. Asst. Prof., Clinical Sciences
- Trotter, Eric J., D.V.M., U. of Illinois. Assoc. Prof., Clinical Sciences
- Tullson, Elaine D., D.V.M., Ph.D., U. of California-Davis. Asst. Prof., Microbiology and Immunology
- Valentine, Beth A., Ph.D., Cornell U. Asst. Prof., Pathology
- Warnick, Lorin D., Ph.D., Cornell U. Asst. Prof., Clinical Sciences
- Wasserman, Robert H., Ph.D., Cornell U. James Law Professor of Physiology, Emeritus Physiology/(Section of Physiology)
- Weiland, Gregory A., Ph.D., U. of California at San Diego. Assoc. Prof., Pharmacology
- Whittaker, Gary R., Ph.D., U. of Leeds (England). Asst. Prof., Microbiology and Immunology
- White, Maurice E., D.V.M., Cornell U. Prof., Clinical Sciences
- Winand, Nena J., Ph.D., Cornell U. Asst. Prof., Pathology
- Winter, Lola, M.S., U. of Wisconsin. Lecturer, Microbiology and Immunology
- Wootton, John F., Ph.D., Cornell U. Prof., Physiology
- Yen, Andrew, Ph.D., Cornell U. Prof., Pathology
- Joint Appointees
- Beyenbach, Klaus W., Ph.D., Washington State U. Prof., Section of Physiology (CALS)/Physiology
- Corradino, Robert A., Ph.D., Cornell U. Assoc. Prof., Section of Physiology (CALS)/Physiology
- Loew, Ellis R., Ph.D., U. of California at Los Angeles. Assoc. Prof., Section of Physiology (CALS)/Physiology
- Quaroni, Andrea, Ph.D., U. of Pavia (Italy). Prof., Section of Physiology (CALS)/Physiology



