

Veterinary Diagnostic and Production Animal Medicine

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum (<https://nextcatalog.registrar.iastate.edu/collegeofveterinarymedicine/#curriculuminveterinarymedicine>).

Courses in veterinary diagnostic and production animal medicine provide students with basic and advanced skills in diagnostics, reproduction, medicine, surgery, production, welfare, and health management of the major livestock species. Students in the fourth year of the curriculum in veterinary medicine may elect to take advanced courses in beef, dairy, swine, poultry or small ruminant production medicine. Elective courses may include preceptorships in private practices, at other veterinary schools, in research and disease control laboratories, or in related agribusinesses.

Production animal medicine emphasizes the integration of veterinary medicine with nutrition, genetics, economics, food safety, and other disciplines, enabling graduates to acquire and use a broad knowledge base to support the health and improve the production and efficiency of the food supply chain.

Graduate Study in Veterinary Preventive Medicine

Veterinary Preventive Medicine is a multidisciplinary program focused on the study of health and disease in populations. The various disciplines represented in the program are unified by a common approach based on the application of epidemiological methods to problem solving in populations. Through their research and course work, students will learn to understand and apply a variety of disciplines, principles, and techniques to population health issues involving environmental, ecological, nutritional, genetic, infectious, or non-infectious diseases.

Graduate study in Veterinary Preventive Medicine will provide valuable skills and experience to persons interested in public health, food safety, emerging infectious diseases, zoo or wildlife health, and livestock health. A degree in Veterinary Preventive Medicine may be valuable for individuals considering a future in the biological or pharmaceutical industries, government regulatory agencies, public veterinary practice, international service agencies responsible for population health or progressive private practice.

Veterinary Preventive Medicine is an interdepartmental major administered by the Department of Veterinary Diagnostic and Production Animal Medicine (VDPAM) with participating faculty from colleges and departments across the University and collaborators from the National Animal Disease Center (USDA:ARS) and the National Veterinary Services Laboratories (USDA:APHIS) located in Ames, Iowa.

Both thesis and non-thesis options are available and require the completion of a minimum of 30 graduate credits for thesis and 36 graduate credits for non-thesis and a final examination.

Program of Study: Master of Science in Veterinary Preventive Medicine (Thesis Option) 30 credits

VDPAM 522	Principles of Epidemiology and Population Health	3
STAT 401	Statistical Methods for Research Workers	4
VDPAM 527	Applied Statistical Methods in Population Studies	3
VDPAM 529	Epidemiological Methods in Population Research	3
VDPAM 699	Research	arr †

Research or Electives to total at least 17 additional credits

† Arranged with instructor.

Program of Study: Master of Science in Veterinary Preventive Medicine (Non-Thesis Option) 36 Credits

VDPAM 522	Principles of Epidemiology and Population Health	3
STAT 401	Statistical Methods for Research Workers	4
VDPAM 527	Applied Statistical Methods in Population Studies	3
VDPAM 529	Epidemiological Methods in Population Research	3
VDPAM 590	Special Topics	3
One Additional STAT course from the following		3
STAT 402	Statistical Design and the Analysis of Experiments	
STAT 407	Methods of Multivariate Analysis	
STAT 415	Advanced Statistical Methods for Research Workers	
STAT 421	Survey Sampling Techniques	
VDPAM 599	Creative Component	arr †

Creative Component and Electives to total 18 additional credits

† Arranged with instructor.

Graduate Certificate in Veterinary Preventive Medicine

Veterinary Diagnostic and Production Animal Medicine offers a graduate certificate for DVMs, concurrent DVM students and non-DVMs in allied animal industries in Veterinary Preventive Medicine.

Students in this program are able to select courses that focus in areas of animal welfare, diagnostics, food safety, evidence-based medicine, surgery, pathology, microbiology, epidemiology, public health, statistics and production medicine.

The purpose of the graduate certificate in Veterinary Preventive Medicine for industry professionals is to address the continued and advanced needs of animal health professionals. The certificate enables professionals to gain recognition for a skill set that includes epidemiology, risk assessment, production medicine and animal welfare. A graduate certificate may be used to increase knowledge in a new or emerging area of interest to the candidate. As such, it may be used to formally gain recognition for retraining to meet the needs of today's food production systems.

The graduate certificate for concurrent DVM students is designed to give additional skills to students planning on working with populations of animals. Using a combination of on-line and dual listed graduate level courses, the program is designed to enable DVM students to complete the certificate while studying for their DVM degree. Students enrolled in any US-based DVM program are able to complete a graduate certificate at ISU using a combination of on-line and transfer graduate level courses.

The graduate certificate is an additional qualification awarded by Iowa State University after successful completion of 15 graduate level credits. A graduate certificate is different from continuing education as the certificate includes an academic transcript from Iowa State University. Students complete the same courses graduate students do with the the same expectations for all assignments and exams.

The program is available as a strictly on-line (off campus) delivery method or as a combination of classroom-based and on-line course offerings providing maximum flexibility in scheduling.

Program of Study: Graduate Certificate in Veterinary Preventive Medicine (15 credits)

First Year	Credits
VDPAM 522 (Offered in Spring only)	3
Required	
STAT 401	4
Required	
	7
Second Year	Credits
VDPAM 570 (Offered Fall odd numbered years)	3

AND/OR

VDPAM 527 (Offered Fall odd
numbered years)

AND/OR

VDPAM 529 (Offered Fall even
numbered years)Need 3 Credits from additional VDPAM
graduate courses. (The above are
available on line)Other classroom-based options are
available**Third Year**5 credits from any approved ISU
graduate course or transfer credit from
another university

3

3

9

Credits

0

Total Credits: 16

Courses primarily for professional curriculum students:**VDPAM 308. Spanish for Veterinarians.**(2-0) Cr. 2. S. *Prereq: Basic knowledge of Spanish*

This course is designed to meet the needs of veterinary students who will practice in an environment in which the use of Spanish for accurate client communication is essential which includes much of our food animal industry in the state of Iowa. This is not a traditional Spanish language course. To be successful, students taking the course should have a basic knowledge of Spanish pronunciation, grammar and syntax.

VDPAM 309. Introduction to Production Animal Informatics.

(1-0) Cr. 1. S.

The fundamentals of how clinical, diagnostic, production and financial information is obtained and used by production animal operations will be presented. Students will acquire skills to create and use spreadsheets for manipulating and summarizing data. They will also acquire knowledge of where to find inexpensive and readily available resources with information on how to use spreadsheets and other software. Students will also have the opportunity to work with different record keeping programs used by swine, beef and dairy operations.

VDPAM 310. Introduction to Production Medicine.Cr. 2. S. *Prereq: Classification as second or third year veterinary student or permission of instructor*

The role of the veterinarian in the management of animal health and production in dairy and beef cattle herds, beef feedlots and swine herds will be described. Provides veterinary students with a starting point to understand the principles and techniques that are the basis of food-animal health management programs.

VDPAM 312. Introduction to Animal Welfare.(1-0) Cr. 1. S. *Prereq: Classification as a first year veterinary student*

A continuation of the Veterinarian in Society series. An introduction to the topics of animal behavior, animal welfare, and the human animal bond.

VDPAM 340. Clinical Foundations.(0-30) Cr. 1. F.S. *Prereq: Classification in veterinary medicine*

One week course at Iowa State University. An introduction to Food Supply Veterinary Medicine covering overviews of major animal agriculture species (beef, dairy, pork, sheep and camelid), production systems, behavior, welfare, handling and restraint, examination techniques, biosecurity, epidemiology and food safety. Visits to production units are utilized to introduce the application of clinical skills. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 351. Bovine Embryo Transfer and Related Technology.(2-0) Cr. 2. S. *Prereq: Classification as a second or third year veterinary student*

This course will meet for two hours once each week of the Spring Semester. The first hour will be traditional lecture and the second hour will be a combination of student projects, labs and demonstrations of applied clinical procedures. Bovine embryo transfer and closely related topics such as: female reproductive physiology, estrus synchronization, semen sexing and reproductive disease will be emphasized. In addition, several class periods will be devoted to the use of ultrasound for diagnosis of reproductive and non-reproductive conditions.

VDPAM 365. Animal Welfare Judging and Assessment.

Cr. 2. Repeatable. F.S.S.

Preparation for competition in the Intercollegiate Animal Welfare Judging Contest. Development of critical appraisal and oral communication skills in regard to animal welfare. Animal behavior, physiology, health and performance parameters, basic husbandry, housing and preventive care will be explored for select farmed, companion and exotic species. Optional field trips.

VDPAM 402. Advanced Dairy Production Informatics.(1-1) Cr. 2. Repeatable. F.S. *Prereq: VDPAM 309 or permission of instructor*

Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart as well as other dairy management and information software. Nonmajor graduate credit.

VDPAM 407. Evidence Based Clinical Decision Making.(Dual-listed with VDPAM 507). (1-0) Cr. 1. S. *Prereq: Permission of instructor*

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 408. Poultry Diseases.(Dual-listed with VDPAM 508). Cr. 2. Alt. S., offered 2014. *Prereq: Enrollment in College of Veterinary Medicine or permission of instructor*

Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 409. Veterinary Practice Management and Organization.

(2-0) Cr. 2. F.S.

An A to Z introduction to proven veterinary practice management methods and strategies. The student will follow a detailed hands-on workbook describing most of the processes and procedures of day to day veterinary practice. The class content will be composed of class room discussions, didactic presentations, a practical workbook, ancillary handouts, and both in and out of class assignments.

VDPAM 414. Veterinary Practice Entrepreneurship.

(Dual-listed with VDPAM 514). Cr. 2. S.

Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity.

VDPAM 416. Bovine Reproduction Evaluation Laboratory.(0-4) Cr. 1. F.S. *Prereq: Classification as a third year student in veterinary medicine. 10 students per section.*

Bovine rectal palpation techniques will be repetitively taught in 7 four-hour sessions. Students will also learn techniques of epidural anesthesia, artificial insemination, and ultrasonic imaging. University-owned cattle will be used. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.,No Wednesday section in Spring semester.

VDPAM 419. Advanced Swine Production Informatics.(1-0) Cr. 1. F. *Prereq: VDPAM 309 or permission of instructor*

Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by swine production companies. Production, financial, diagnostic and clinical data will be covered in the course. Hands-on experience with computer software and information systems used in swine production will be provided. Students will learn to objectively evaluate the validity of information that is presented to them and also be able to make practical and useful recommendations regarding the types of information tools that can/should be used. The students will learn what software and information systems are available and be able to critically evaluate them. Nonmajor graduate credit.

VDPAM 420. Applied Production Animal Medicine Preceptorship.(0-30) Cr. 1-6. Repeatable. F.S.S.S. *Prereq: Classification as a fourth year student in veterinary medicine.*

Advanced course in production animal medicine with emphasis on government, industry or veterinary practice settings. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 421. Great Plains Veterinary Educational Center.Cr. 1. F.S.S.S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required.

VDPAM 421A. Calving at Great Plains Veterinary Educational Center.

Cr. 1. F.S.SS. *Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Calving Elective provides an opportunity to expand knowledge and experience in all phases of calving management. The program is structured around normal calving operations at U.S. MARC. The GPVEC and U.S. MARC veterinary staff will make an effort to include students in veterinary activities that take place during the Calving Elective. The opportunity exists for assistance in diagnosis, treatment, and management of many commonly encountered situations in the dam and calf. Students are encouraged to make every effort to become involved in U.S. MARC calving activities. Direct involvement includes routine husbandry activities beyond those involving traditional veterinary roles which are expected of the student.

VDPAM 421B. Bull Breeding Soundness at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

The Bull Breeding Soundness Examination Elective involves training in all phases of the examination, collection, and semen evaluation for up to 200 herd bulls and/or sale bulls as recommended by the Society for Theriogenology. Culture for trichomoniasis and discussion of bull management and breeding season considerations.

VDPAM 421C. Clinical Calving at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. This clinical rotation involves participation in veterinary field services at the U.S. MARC during calving season. Activities include examination, diagnosis, treatment, and intensive care of individual animals as well as occasional herd problems. Additional activities include clinical and/or microbiological diagnostic techniques, clinical pharmacology, record keeping, and health surveillance. Students will accompany the "on duty" veterinarian on all cases, including emergency, after-hours calls. The majority of clinical activities during calving season are related to peri-parturient, perinatal and neonatal problems. Students will assist in handling difficult calf deliveries and cesarean sections and will be involved with the necropsy examination of all animals lost during the previous 24 hours.

VDPAM 421D. Feedlot Management at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. F.S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. Evaluation of production techniques and production efficiency including ration and feeding management, health management program development and evaluation, environmental management, quality assurance, feedlot necropsy and microbiology techniques, and break even analysis. Approaches to solve seasonal health problems within the management objectives for different feed yards are the strong emphasis of this elective. Students may have the opportunity to follow cattle to a packing plant to learn the methods for tracking animals into the food chain, identifying production problems that are not diagnosable at the feedlot level, and monitoring beef quality assurance. Biosecurity activities will be emphasized and practiced.

VDPAM 421E. Weaning Management at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. F. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. This is a hands-on elective in which students participate in the weaning management at the U.S. Meat Animal Research Center. Students will be involved with processing, feeding, finding, and treating sick calves. Additionally, students will be introduced to developing weaning rations and managing feed delivery. Students will also learn how to develop vaccination and treatment protocols and each student will have as an objective the development of their own vaccination and treatment protocol template. As time allows, students will visit commercial feed yards and cover production management topics.

VDPAM 421F. Pregnancy Examination at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. F. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Pregnancy Examination Elective involves students, the GPVEC faculty, and U.S.MARC personnel during pregnancy examination. Activities involve rectal examinations for pregnancy, collecting data and entry into the CowHerd/CowCalf computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some palpation experience and are interested in honing their skills. Some ultrasound technology will be utilized. Pregnancy Examination occurs during yearly fall herd work at the U.S. MARC, therefore, speed and accuracy will be stressed, rather than basic technique. Introduction into rectal examination for reproductive use is stressed during the Bovine Reproduction Elective.

VDPAM 421G. Bovine Reproduction at Great Plains Veterinary Educational Center.

Cr. 1. F. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. This elective involves some of the clinical techniques utilized in beef cattle reproductive management. The majority of time will be spent in the examination of cows for pregnancy and the collection of ovarian data from non-pregnant cows. Additional opportunities will involve hands on activities such as data collection and analysis, breeding herd nutrition, artificial insemination, and the use of ultrasound technology.

VDPAM 421J. Lambing at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Lambing Elective involves students with the U.S. MARC lambing crew and GPVEC faculty in observations, assistance with delivery when necessary, and routine lambing duties. Students will work with veterinary personnel in sheep necropsy and health surveillance. Activities and objectives closely parallel to those listed in the Calving Elective. Self study material will be provided covering topics such as pre-breeding and breeding, pregnancy diagnosis, pregnant ewe management, pre-lambing ewe/lambing management, feeder lamb health and nutrition management, and replacement ewe and ram management.

VDPAM 421K. Equine Dentistry at Great Plains Veterinary Educational Center.

(20-20) Cr. 1. S. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Equine Dentistry Elective provides the opportunity for students to expand their knowledge and experience related to equine dentistry. The rotation consists of lectures on topics relevant to equine dental care and hands-on laboratories during which students practice routine dental care procedures on U.S.MARC horses. Equine Dentistry will involve both lecture and lab time at about equal shares.

VDPAM 421M. Preconditioning at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. F.SS. *Prereq: Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.*

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Preconditioning Elective provides the opportunity for students to expand their knowledge and experience in the development and implementation of calf preweaning programs. Students will assist GPVEC and U.S.MARC personnel during routine processing of U.S.MARC spring-born calves prior to weaning. GPVEC faculty will also lead discussions related to vaccine and dewormer protocols, preweaning nutrition, and other topics related to preparing beef calves for weaning.

VDPAM 421P. Gomer Bull Surgery at Great Plains Veterinary Educational Center.

(0-40) Cr. 1. F. *Prereq:* Classification as a fourth year student in veterinary medicine; ability to provide own transportation to each site.

GPVEC, located in Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required. The Gomer Bull Surgery Elective is designed to give students interested in food animal surgery an opportunity to practice their surgical skills by performing penile translocations and epididymectomies on USMARC teaser bull candidates. Lectures specific to gomer bull surgery as well as other topics related to food animal surgery will be presented during this elective.

VDPAM 422. Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F.S.SS. *Prereq:* VDPAM 310; ability to provide own transportation to each site

Hands-on working experience at beef cattle feedlots, cow/calf operations and/or beef cattle focused veterinary consulting practice in Oklahoma and Missouri.

VDPAM 422B. Cattle Processing-Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F.S.SS. *Prereq:* VDPAM 310; ability to provide own transportation to each site

This elective is for students interested in getting "hands on" cattle working experience. The elective is based out of Oklahoma, but students will be working cattle at multiple locations in Oklahoma, Texas, Kansas, and Missouri (season/time of year dependent). Every attempt will be made to schedule calf/stocker/feedyard cattle processing as well as heifer/cow pregnancy examinations with and without ultrasound where season/weather and client compliance allow. The fundamentals of cattle working – BQA, proper product administration, chute operation, and cattle handling techniques will be reviewed, however, the majority of the elective will be conducted at client operations with work to get completed. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 422C. Beef Feedlot-Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F.S.SS. *Prereq:* VDPAM 310, ability to provide own transportation to each site

This elective is for students interested in getting "hands on", working experience at a commercial feedyard in Oklahoma. This experience will consist of working with and assisting the feedyard crew in their daily activities including: detecting and treating sick cattle, processing newly arrived cattle, hospital pen management, performing necropsies, and overall cattle care in general. Other learning opportunities such as feeding (bunk management), feed mill operations, feedyard maintenance, pasture management, and feedyard management may be available if interested and timing of elective coincides with activities. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 422D. Cattle Client Consulting-Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F.S.SS. *Prereq:* VDPAM 310; ability to provide own transportation to each site

This elective is for students interested in beef production medicine consulting. It will be conducted in a veterinary practice in Oklahoma and will consist of "shadowing" the practice owner on consulting visits to feedyard and stocker clients and other practice activities such as cattle buying, cattle working, attending producer and/or veterinary meetings, and conducting research (depending on the time of year). Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 422E. Beef Cattle Calving-Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F.S. *Prereq:* VDPAM 310; ability to provide own transportation to each site

This elective provides students an opportunity to assist a cow-calf operation in northwest Missouri with calving. This operation typically calves between 400 and 600 head each spring. Calving experience is not required, but a good understanding of working around cattle is necessary. Students will be actively participating in the day to day, normal calving operation routine – including detecting and sorting off "springers", calf "watch", detecting when intervention is needed and assisting delivery, caring for and monitoring newborns and dams for good health and early disease detection, tagging/processing new calves, treating calves needing intervention and performing other routine calving event chores. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 422F. Stocker Experience-Southern Plains States Beef Cattle Production Medicine.

Cr. 2. F. *Prereq:* VDPAM 310; ability to provide own transportation to each site

This elective is for students interested in getting "hands on", working experience at a stocker operation in Oklahoma. This experience will consist of working with and assisting the stocker client in their daily activities including: detecting and treating sick cattle, processing newly arrived cattle, performing necropsies, and overall cattle care in general. Other learning opportunities such as feeding (bunk management), and pasture and grazing management may be available if interested and timing of elective coincides with activities. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 426. Veterinary Toxicology.

(Dual-listed with VDPAM 526). (3-0) Cr. 3. S. *Prereq:* Classification as a third year student in veterinary medicine

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 436. Beef Records Analysis.

(0-30) Cr. 1-2. Repeatable. F.S. *Prereq:* Classification in Veterinary Medicine, VM1-VM3 or special permission of instructor

The class will have both a lecture and lab component and students can enroll in one or both. Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. Each semester's content builds on the material from the previous semester. Enrolling in the class for multiple semesters will be encouraged.

VDPAM 437. Basic Clinical Skills for Production Medicine (MS 623-701): Dairy Herd Problem Identification.

(7-33) Cr. 2. F.S.SS. *Prereq:* Fourth-year classification in veterinary medicine

Seven hours recitation/discussion and 33 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison, on a space-available basis. Learn to interpret DHI records and use them to identify and monitor herd problems of production, mastitis, reproduction, and replacement heifer management. Evaluate rates and treatment protocols of common dairy herd diseases. Assess dairy housing including ventilation and freestalls. Estimate costs of herd problems and develop partial-budgets.

VDPAM 438. Mastitis Problem Investigations (MS 623-703): Mastitis/Milk Quality.

(9-31) Cr. 2. F.S.SS. *Prereq:* Fourth-year classification in veterinary medicine

Nine hours recitation/discussion and 31 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison, on a space-available basis. Learn to evaluate rates of clinical mastitis using manual and computerized (DC305) record systems. Interpret somatic cell count records to target mastitis problems. Collect samples and interpret milk microbiology reports. Evaluate mastitis risks in housing systems (stalls, bedded packs, etc). Analyze milking systems and milker practices. Develop mastitis treatment protocols.

VDPAM 439. Clinical Investigations of Fresh Cow and Calf Problems (MS 623-705): Applied Dairy Nutrition.

(3-37) Cr. 2. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine*
 Three hours lecture, 37 hours clinical experience per week. Course taken for two weeks at University of Wisconsin, Madison, on a space-available basis. Learn to evaluate calf and peri-parturient cow management practices. Develop an investigation strategy for ambiguous herd problems. Collect samples and interpret herd-based diagnostic tests for infectious and metabolic diseases. Assess environmental risk factors for metabolic and infectious disease including hygiene and housing. Assess nutritional status of herds via nutritional management, actual feed intake, particle length determination, etc.

VDPAM 445. Production Animal Clinical Medicine.

(3-0) Cr. 3. S. *Prereq: Third year classification in veterinary medicine*
 Clinical diagnosis and treatment of non-infectious diseases of swine, beef and dairy cattle, and small ruminants.

VDPAM 450. Disturbances of Reproduction.

(4-0) Cr. 4. F. *Prereq: Third-year classification in veterinary medicine*
 General principles of normal reproductive functions in addition to environment, management and diseases causing disturbances in reproduction.

VDPAM 451. Clinical Embryo Transfer.

(0-40) Cr. 2. F.S.SS. *Prereq: Fourth year classification in veterinary medicine*
 Elective clinical assignment in techniques of embryo transfer. Primary species studied will be bovine but equine and small ruminant embryo transfer will be covered during appropriate seasons. Enrollment is limited to four students per two week session. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 455. Diagnostic Laboratory Practicum.

Cr. 1. Repeatable. F.S. *Prereq: Fourth-year classification in veterinary medicine*
 Practical experience in necropsy and test selection for the diagnosis of infectious and toxic diseases of livestock through exposure to cases in the ISU Veterinary Diagnostic Laboratory.

VDPAM 456. Veterinary Diagnostic Lab Methods & Applications.

(16-0) Cr. 1. F. *Prereq: Classification as a second, third or fourth year student in veterinary medicine*
 Case materials are used to develop diagnostic questions and to better understand the value of diagnostic tests. Testing methods and interpretation of diagnostic tests are coupled with sampling strategy and objective assessment of available evidence to provide accurate diagnosis.

VDPAM 464. Advanced Stocker/Feedlot Medicine.

(2-0) Cr. 2. F.S. *Prereq: VDPAM 310*
 Two week advanced clinical rotation in stocker/feedlot beef production medicine held in Oklahoma. The instructor will lead field trips as well as problem solving exercises where the student will apply concepts of stocker/feedlot health management, production and economic analysis, and disease control/prevention. Travel and overnight stays will be required. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 476. Food Animal and Camelid Field Service.

(0-40) Cr. 2. Repeatable. F.S.SS. *Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine*
 Elective course in food animal and camelid field services. Students will assist university veterinarians in delivering health care and production management services to the ISU livestock farms and other livestock farms in the local area. Focus will be on delivery of individual animal care and establishment of best practices for herd management of production systems at the university and in the region. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 477. Food Animal and Camelid Medicine and Surgery.

Cr. 1-2. Repeatable. F.S.SS. *Prereq: Fourth-year classification in veterinary medicine*
 Clinical assignment focused on the management of food animal and camelid medicine and surgery cases. Specific instruction in clinical evaluation of cases coupled with appropriate diagnostic testing and therapeutic intervention will be emphasized. Additional instruction will be provided in disease prevention, intensive care and management of food animal and camelid species. Particular emphasis will be placed on appropriate on-label and extra-label drug usage in food animal species. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 479. Applied Swine Production Medicine Preceptorship.

(0-40) Cr. 1-6. Repeatable. F.S.SS. *Prereq: VDPAM 310*
 Advanced course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian and/or a production unit. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 480. Swine Production Medicine.

(15-25) Cr. 2. Repeatable. F.S.SS. *Prereq: VDPAM 310 or permission of instructor*
 Two week clinical rotation in swine production medicine. Students will be assigned to take the lead in investigating field based client cases with supervision of the instructors. Development of critical thinking skills that will allow students to apply concepts of herd management, production analysis, economic analysis, and disease prevention in addressing client cases. Variable amounts of travel to farm sites will be required with the potential for rare overnight stays. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 481. Advanced Cow/Calf Production Medicine.

(Dual-listed with VDPAM 581). (20-20) Cr. 2. S. *Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (V MED 596 Cattle Production), fourth year classification in veterinary medicine*
 Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 482. Applied Beef Production Medicine Preceptorship.

(0-40) Cr. 1-6. Repeatable. F.S.SS. *Prereq: VDPAM 310 and permission of instructor; ability to provide transportation to each site*
 Advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 483. Beef Production Medicine.

(15-20) Cr. 2. F.S.SS. *Prereq: VDPAM 310*
 Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. This course is designed to expose students to cow-calf and feedlot production concepts. The activities scheduled for the rotation depend greatly on the time of year. Whenever possible, the class incorporates field trips. Students should anticipate that travel, including overnight stays, may be required. These field trips can vary in length from several hours to several days and may include weekends. Typically, 3-4 days of the rotation are spent at the Great Plains Veterinary Education Center, Clay Center, NE. Students should, therefore, plan accordingly and contact the instructor, immediately, if they anticipate a conflict. Students should not schedule Grand Rounds during this rotation. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 484. Dairy Production Medicine.

(15-20) Cr. 2. F.SS. *Prereq: VDPAM 310; Fourth-year classification in veterinary medicine*
 Two week course in dairy production medicine combining class time with multiple on-farm visits to learn various management aspects (DHIA, DC305 & PC Dart record analysis, calf rearing through lactating cows, reproduction programs, udder health and milk quality, biosecurity, welfare, nutrition and cow comfort) for a wide variety of dairy operations. Students will learn the latest in dairy management by reviewing current topic articles and gain experience in farm evaluation through a group project. Fifteen hours recitation/discussion and 20 hours clinical experience per week. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 485. Applied Dairy Production Medicine Preceptorship.

(0-30) Cr. 1-6. Repeatable. F.S.SS. *Prereq:* VDPAM 310
Advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 486. Introduction to Small Ruminant Production Medicine.

(13-6) Cr. 1. S. *Prereq:* Classification as a third year veterinary student or permission of instructor.
Survey of small ruminant production systems, common management practices, and disease processes of small ruminants. This course is intended to give the student a background in small ruminant medicine. Herd health, disease monitoring and prevention, and typical management systems will be emphasized in lecture.

VDPAM 487. Livestock Disease Prevention.

(3-0) Cr. 3. F.
The course is designed for both the pre-veterinary and animal science majors who have an interest in production animal health, disease prevention methods, epidemiology of economically important agents, and the ecology of currently important pathogens found in North American livestock industries. It will focus on disease prevention principles for individuals and large production population systems.

VDPAM 488. Laboratory in Clinical Microbiology.

Cr. 1. Repeatable. F.S. *Prereq:* Fourth-year classification in veterinary medicine
Application of microbiological procedures to the diagnosis of infectious diseases.

VDPAM 489. Issues in Food Safety.

(Cross-listed with AN S, HRI, FS HN). (1-0) Cr. 1. S. *Prereq:* Credit or enrollment in FS HN 101 or FS HN 272 or HRI 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

VDPAM 490. Independent Study.

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

VDPAM 491. Advanced Ruminant Nutrition.

(30-10) Cr. 3. F.
Focus on dairy nutrition from the calf to the adult, lactating cow. Balancing rations for dairy operations. Introduction to different feedstuffs and forage varieties to determine those that are best suited to bovine diets. This course is held the week immediately prior to the start of the spring semester. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred. Nonmajor graduate credit.

VDPAM 492. Orientation for International Experience.

(2-0) Cr. 1. S. *Prereq:* Classification in veterinary medicine
Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned. Offered on a satisfactory-fail basis only.

VDPAM 494. Advanced Dairy Production Medicine.

(20-20) Cr. 2. S. *Prereq:* VDPAM 484 or permission of instructor
Advanced course in investigating dairy herd problems relating to milk quality or nutrition. Milk quality and nutrition troubleshooting will be taught through the combination of lecture and on-farm investigations. Students will combine lecture knowledge, data acquired from on-farm investigations and record analysis to generate management plans. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred. Nonmajor graduate credit.

VDPAM 495. Advanced Small Ruminant Production Medicine.

(15-20) Cr. 2. F.S. *Prereq:* VDPAM 486, fourth year classification in veterinary medicine, or permission of instructor
Two week clinical rotation in small ruminant production medicine. Field trips (including overnight stays) will be incorporated when possible. Topics to be covered include small ruminant industries (milk, meat, and fiber), milk quality, nutrition, reproduction, and disease management of small ruminants. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 496. International Preceptorship.

(Dual-listed with VDPAM 596). (0-40) Cr. 1-12. Repeatable. F.S.SS. *Prereq:* Second-year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:**VDPAM 507. Evidence Based Clinical Decision Making.**

(Dual-listed with VDPAM 407). (1-0) Cr. 1. S. *Prereq:* Permission of instructor
Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 508. Poultry Diseases.

(Dual-listed with VDPAM 408). Cr. 2. Alt. S., offered 2014. *Prereq:* Permission of instructor
Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 514. Veterinary Practice Entrepreneurship.

(Dual-listed with VDPAM 414). Cr. 2. S. *Prereq:* Graduate Veterinarian or DVM-dual graduate degree candidate
Provide a formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary business.

VDPAM 522. Principles of Epidemiology and Population Health.

(Cross-listed with V MPM). (3-0) Cr. 3. S.
Epidemiology and ecology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

VDPAM 526. Veterinary Toxicology.

(Dual-listed with VDPAM 426). (3-0) Cr. 3. S. *Prereq:* Permission of instructor
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 527. Applied Statistical Methods in Population Studies.

(3-0) Cr. 3. Alt. F., offered 2013. *Prereq:* STAT 401
ANOVA, Linear Regression, Model Selection, Mixed Models, ANCOVA, Repeated Measurement Analysis, MANOVA, Nonparametric Methods, Diagnostic Test Evaluation, ROC Curve Analysis, Generalized Linear Models, Logistic Regression, Survival Analysis, Cox Proportional Hazards Regression. This course is available on campus and by distance.

VDPAM 529. Epidemiological Methods in Population Research.

(3-0) Cr. 3. Alt. F., offered 2014.
Designing, conducting, and analyzing outcomes from field-based studies, including cross-sectional, case-control, cohort, and clinical trials with categorical outcomes. This course is available on campus and by distance.

VDPAM 542. Introduction to Molecular Biology Techniques.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, GDCB). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542A. Introduction to Molecular Biology Techniques: DNA.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, GDCB). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

VDPAM 542B. Protein Techniques. Includes fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, immunophenotyping, and monoclonal antibody production. (S.SS.).

(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.SS. *Prereq:* Graduate classification
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542C. Introduction to Molecular Biology Techniques: Cell.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, GDCB). Cr. 1. Repeatable. F.S. *Prereq: Graduate classification*
Includes immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

VDPAM 542D. Introduction to Molecular Biology Techniques: Plant Transformation.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, GDCB). Cr. 1. Repeatable. S. *Prereq: Graduate classification*
Includes Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only.

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

(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.SS. *Prereq: Graduate classification*
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

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

(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.SS. *Prereq: Graduate classification*
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542G. Introduction to Molecular Biology Techniques: Genomic.

(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, GDCB). Cr. 1. Repeatable. S. *Prereq: Graduate classification*
Offered on a satisfactory-fail basis only.

VDPAM 546. Clinical and Diagnostic Toxicology.

(Cross-listed with TOX). (0-3) Cr. 1-3. Repeatable. F.S.SS. *Prereq: D.V.M. degree or VDPAM 526*

Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

VDPAM 551. Advanced Veterinary Diagnostic Medicine.

(0-3) Cr. 1-3. Repeatable. F.S.SS. *Prereq: VDPAM 455*
Necropsy techniques of animals with emphasis on gross and microscopic lesion description and microbiological diagnosis of disease in food animals.

VDPAM 570. Risk Assessment for Food, Agriculture and Veterinary Medicine.

(Cross-listed with AGRON, TOX). (3-0) Cr. 3. F. *Prereq: STAT 104 or consent of instructor*

Wolt, Hurd. Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available on campus and by distance.

VDPAM 581. Advanced Cow/Calf Production Medicine.

(Dual-listed with VDPAM 481). (20-20) Cr. 2. S. *Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (VMED 596 Cattle Production), 4th year classification in veterinary medicine, graduate classification or permission of instructor*

Two-week elective that will focus on the economics of animal disease in cow/calf operations. Evidence-based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting will be used and field trips are expected. In order to obtain graduate credit, students will be required to produce a paper in a published manuscript format on a beef cattle disease topic of their choice. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 590. Special Topics.

Cr. 1-3. Repeatable. F.S.SS. *Prereq: Permission of instructor*
Topics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine.

VDPAM 596. International Preceptorship.

(Dual-listed with VDPAM 496). (0-40) Cr. 1-12. Repeatable. F.S.SS. *Prereq: Admission to graduate college*
International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

VDPAM 599. Creative Component.

Cr. arr. Repeatable. F.S.SS. *Prereq: Enrollment in nonthesis master's degree program*

Courses for graduate students:**VDPAM 650. Swine Diagnostic Medicine.**

Cr. 1-4. F. *Prereq: Permission of instructor*
A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases.

VDPAM 654. Comparative Antimicrobial Clinical Pharmacology.

Cr. 2. S. *Prereq: Graduate student, resident, or intern in College of Veterinary Medicine*
Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy.

VDPAM 655. Advanced Swine Production Medicine.

Cr. 1-4. S. *Prereq: Permission of instructor*
Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, production economics and financial analysis, therapeutic and vaccination strategies, quality control procedures and food safety.

VDPAM 699. Research.

Cr. arr. Repeatable.