



College of VETERINARY MEDICINE

Christopher M. Brown,
DEAN

In 1907, recognizing that animal agriculture was a significant part of a healthy state economy, the Michigan legislature authorized a course of study leading to the Doctor of Veterinary Medicine degree. This program, inaugurated in 1910, was the beginning of the College of Veterinary Medicine. Since that time, society has come to value animals in additional roles beyond their role in agriculture. Pets are a source of companionship and comfort for people of all ages. And the pleasure that the general public enjoys from zoos and from nature depends in large part on the well being of the animals that are found there.

The present-day College of Veterinary Medicine is the only veterinary college in the state of Michigan and one of 28 nationally. It is organized in six departments — Large Animal Clinical Sciences, Microbiology and Molecular Genetics, Pathobiology and Diagnostic Investigation, Pharmacology and Toxicology, Physiology, and Small Animal Clinical Sciences — and includes the Veterinary Teaching Hospital and the Diagnostic Center for Population and Animal Health.

The College offers the programs that are listed below:

- a preveterinary program
- a professional program leading to the Doctor of Veterinary Medicine degree
- a certificate program in veterinary technology
- a Bachelor of Science degree program in veterinary technology
- graduate programs leading to the Master of Science and Doctor of Philosophy degrees
- a graduate specialization in food safety
- intern and residency training programs in various clinical specialties

VETERINARY TECHNOLOGY

Helene E. Pazak, Director

Veterinary technicians and technologists are compassionate, highly motivated paraprofessionals dedicated to animal health care. As integral members of the veterinary health care team, they are entrusted with diverse medical responsibilities that include animal nursing care, laboratory specimen analysis, surgical assistance, anesthesia, radiographic imaging (x-ray), nutritional management, dental prophylaxis, physical therapy, and client education. These varied duties afford the veterinary paraprofessional a profound impact on every aspect of animal care. Their involvement enables veterinary hospitals and animal care and research facilities to offer expanded services efficiently and effectively.

The American Veterinary Medical Association (AVMA) recognizes two levels of training for the veterinary paraprofessional: veterinary technician and veterinary technologists. The Certificate of Completion at Michigan State University prepares veterinary technicians and the Bachelor of Science degree prepares veterinary technologists. The Certificate of Completion is two-year training program. After completion of the pre-clinical courses, students complete clinical clerkship training at the MSU Veterinary Teaching Hospital. Through the clinical clerkships, the students develop and apply their knowledge and problem-solving skills in a functional hospital setting. The level of training of the veterinary technician is most appropriate for individuals who seek employment in privately owned veterinary clinical practices.

VETERINARY MEDICINE
Veterinary Technology

Veterinary technologists require four years of academic training. In addition to the core curriculum of the Certificate of Completion, the students complete the general education requirements of Michigan State University and elective courses. The elective courses allow the students to focus on potential career paths within the veterinary profession such as production animal medicine, equine and companion animal medicine, pathology, biomedical research, and practice management. Their training offers exposure to clinical specialty areas such as emergency medicine, cardiology, ophthalmology, equine anesthesia, and necropsy. The level of training of the veterinary technologist is linked with employment in research facilities, vivaria, industry, educational institutions, pharmaceutical companies, and large-group or specialty practices.

The state of Michigan requires that any person practicing as a veterinary technician/technologist must be licensed and registered with the state. Regulation of veterinary technicians/technologists is the responsibility of the Veterinary Board of Examiners in the Michigan Department of Licensing and Regulation. The credentialing examination is *only* available to qualified graduates of accredited training programs. The Veterinary Technology Program is accredited by the American Veterinary Medical Association (AVMA) and graduates of the Certificate of Completion or Bachelor of Science in Veterinary Technology are eligible to take the National and State Board Examinations for licensure.

Enrollment in the Veterinary Technology Program's academic certificate and degree options is limited. Students are admitted for Fall Semester only. Applications for admission are accepted through January 15th of the year that admission is sought. For additional information, contact the Veterinary Technology Program, F-101 Veterinary Medical Center, Michigan State University, East Lansing, MI 48824-1316 or visit <http://cvm.msu.edu>.

The Certificate of Completion articulates with an Associate in Applied Sciences degree from Lansing Community College. For specific degree requirements for the Associate in Applied Science, contact Lansing Community College at <http://www.lcc.edu>.

Bachelor of Science

Admission

The number of students who can be admitted to the Bachelor of Science degree program in veterinary technology is limited. All persons who are interested in applying for admission to the bachelor's degree program in veterinary technology must request a special application form and detailed information regarding admission requirements and procedures from the Veterinary Technology Program, F-101 Veterinary Medical Center, Michigan State University, East Lansing, MI 48824-1316.

Applications for admission to the bachelor's degree program in veterinary technology are accepted through January 15th of the year that admission is sought.

Students who are enrolled in colleges and universities other than Michigan State University should contact MSU's Office of Admissions and the College of Veterinary Medicine regarding admission to the bachelor's degree program in veterinary technology as transfer students.

Minimal criteria for admission to the Bachelor of Science degree program in Veterinary Technology are:

1. Completion of at least 28 credits of the University graduation requirements or transfer equivalents with a cumulative grade-point average of 2.50 or higher including:
 - a. Mathematics 106 or 110 or 116 or 124 or 132 or 152H.
 - b. Biological Science 111 and 111L.
 - c. Tier I writing course.
 - d. Additional credits selected from an Integrative Studies in the Arts and Humanities course numbered below 211,

an Integrative Studies in the Arts and Humanities course numbered 211 or higher, an Integrative Studies in the Social, Behavioral, and Economic Sciences 200-level course, and an Integrative Studies in the Social, Behavioral, and Economic Sciences 300-level course.

The final selection of students to be admitted to the baccalaureate degree program in veterinary technology is based on the cumulative grade-point average of all courses taken, the grade-point average calculated on all courses in mathematics and the physical and biological sciences, and the grade-point average of the last 12 credits. The selection process also includes submission of a personal statement, letters of recommendation and documentation of 80 hours of veterinary related experience.

Students who complete the requirements for the Bachelor of Science degree in Veterinary Technology will be qualified to take the National and State Board Examinations for licensure as veterinary-technicians.

Requirements for the Bachelor of Science Degree in Veterinary Technology

1. The requirements for a bachelor's degree as specified in the *Undergraduate Education* section of the University catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Veterinary Technology.

The completion of Mathematics 110 or 116 that is referenced in item 2. b. below may also be used to satisfy the University mathematics requirement.

The University's Tier II writing requirement for the Veterinary Technology major is met by completing the following courses: Veterinary Medicine 410, 411, 412, 413, and 415. Those courses are referenced in item 2. a. below.

Students who are enrolled in the Bachelor of Science degree in Veterinary Technology may complete the alternative track to Integrative Studies in Biological and Physical Sciences that consists of the following courses: Biological Sciences 110, 111, and 111L; and Chemistry 141. The completion of Biological Science 111L satisfies the laboratory requirement. Biological Science 110 and Chemistry 141 may be counted toward both the alternative track and the requirements for the major referenced in item 2. below.

	CREDITS
2. The following requirements for the major:	101
a. All of the following courses (73 credits):	
BS 110 Organisms and Populations	4
BS 111 Cells and Molecules	3
BS 111L Cells and Molecular Biology Laboratory	2
CEM 141 General Chemistry	4
VM 110 Veterinary Medical Terminology	1
VM 120 Applied Biochemistry and Nutrients for Veterinary Technicians	2
VM 130 Comparative Anatomy for Veterinary Technicians	2
VM 140 Pharmacology for Veterinary Technicians	2
VM 150 Hospital Procedures and Communication	2
VM 155 Veterinary Technology Careers and Professional Development	1
VM 160 Small Animal Nursing Skills	2
VM 165 Large Animal and Laboratory Animal Nursing Care Techniques	2
VM 170 Hematology and Immunology for Veterinary Technicians	2
VM 175 Clinical Pathology Laboratory for Veterinary Technicians	1
VM 176 Clinical Pathology Laboratory for Veterinary Technicians	1
VM 210 Surgical Nursing for Veterinary Technicians	2
VM 215 Surgical Nursing and Anesthetic Management Laboratory	1
VM 245 Parasitology for Veterinary Technicians	2
VM 250 Veterinary Comparative Clinical Physiology	5
VM 255 Small Animal Diseases and Management	3
VM 265 Dentistry Techniques for Veterinary Technicians	1
VM 270 Veterinary Technician Health Care Development	1
VM 275 Large Animal Diseases and Management	3
VM 285 Clinical Nutrition for Veterinary Technologists	1
VM 295 Biomedical Research and Regulatory Issues for Veterinary Technicians	1
VM 303 Anesthesiology for Veterinary Technicians	2
VM 304 Radiology for Veterinary Technicians	2
VM 305 Hospital Practice Management for Veterinary Technicians	2
VM 310 Advanced Clinical Pathology Techniques	1
VM 410 Veterinary Technology Clerkship in Anesthesiology	3
VM 411 Veterinary Technology Clerkship in Radiology	3
VM 412 Veterinary Technology Clerkship in Companion Animal Medicine	3
VM 413 Veterinary Technology Clerkship in Companion Animal Surgery	3

VM	415	Veterinary Technician Clerkship in Food Animal and Equine Medicine and Surgery	3
b.	One of the following courses (5 credits):		
MTH	110	Finite Mathematics and Elements of College Algebra	5
MTH	116	College Algebra and Trigonometry	5
c.	At least 8 credits from the following courses approved by the student's academic adviser:		
ABM	100	Decision-making in the Agri-Food System	3
ABM	225	Commodity Marketing I	3
ACC	230	Survey of Accounting Concepts	3
ANS	305	Applied Animal Behavior	3
ANS	313	Principles of Animal Feeding and Nutrition	4
ANS	314	Genetic Improvement of Domestic Animals	4
ANS	404	Advanced Genetics of Farm Animals	2
ANS	407	Food and Animal Toxicology	3
ANS	407L	Toxicology Methods Laboratory	2
ANS	413	Non-Ruminant Nutrition	4
ANS	417	Topics in Toxicology	1
ANS	445	Equine Exercise Physiology	4
EPI	390	Disease in Society: An Introduction to Epidemiology and Public Health	3
FW	205	Principles of Fisheries and Wildlife Management	3
FW	324	Wildlife Biometry	3
LCS	412	Hazard Analysis and Critical Control Points in Production Medicine	2
MT	212	Fundamentals of Laboratory Analysis	3
PHM	350	Introductory Human Pharmacology	3
ZOL	313	Animal Behavior	3
ZOL	341	Fundamentals of Genetics	4
ZOL	369	Introduction to Zoo and Aquarium Science	3
ZOL	402	Neurobiology	3
ZOL	408	Histology	4
ZOL	413	Laboratory in Behavioral Neuroscience (W)	4
ZOL	415	Ecological Aspects of Animal Behavior	3
ZOL	430	Neuroendocrine Aspects of Behavior	3
d.	At least 15 credits from the following courses or from the courses listed in item 2. c. All course selections must be approved by the student's academic adviser:		
VM	414	Veterinary Technology Clerkship in Equine Medicine and Surgery	3
VM	450	Veterinary Technology Clerkship in Emergency Medicine	3
VM	451	Veterinary Technology Clerkship in Cardiology	3
VM	452	Veterinary Technology Clerkship in Neurology	3
VM	453	Veterinary Technology Clerkship in Ophthalmology	3
VM	454	Veterinary Technology Clerkship in Critical Care	3
VM	466	Veterinary Technology Clerkship in Large Animal Anesthesia	3
VM	470	Veterinary Technology Clerkship in Food Animal Medicine	3
VM	480	Veterinary Technology Clerkship in Clinical Pathology	3
VM	482	Veterinary Technology Clerkship in Necropsy	3
VM	483	Veterinary Technology Clerkship in Biomedical Research	3 to 12
VM	484	Veterinary Technology Clerkship in Zoo and Wildlife	3 to 12
VM	486	Veterinary Technology Clerkship in Clinical Parasitology	3
VM	490	Veterinary Technology Clerkship in Special Problems	3 to 12

PREPROFESSIONAL PROGRAM for VETERINARY MEDICINE

Students who meet the requirements for admission to the University as freshmen and sophomores, as shown in the *Undergraduate Education* section of the catalog, may select the preveterinary program in the College of Veterinary Medicine as their major preference. A strong high school preparation in science, including chemistry, biology, and physics, is highly desirable. Students who are enrolled in the preveterinary program are enrolled in the Undergraduate University Division, but receive academic advising in the College of Veterinary Medicine Preveterinary Advising Center.

The courses in mathematics and natural science that are required for admission to the Professional Program in Veterinary Medicine are included in the requirements for the preveterinary program. Students who are enrolled in the preveterinary program should complete the University requirements for bachelor's degrees. Courses that are used to satisfy University requirements may also be used to satisfy certain requirements for admission to the Professional Program in Veterinary Medicine.

University regulations require that a student who has arrived at junior standing must select a major leading to a baccalaureate degree. The College of Veterinary Medicine does *not* offer a bachelor's degree program for preveterinary students. Therefore, upon reaching junior standing, students who have been enrolled in the preveterinary program and who have not been admitted to the Professional Program in Veterinary Medicine must be admitted to a major in another college in order to complete the requirements for a bachelor's degree.

Enrollments in the preveterinary program are not limited. However, because of the limitation on the number of students admitted each year to the Professional Program in Veterinary Medicine, completion of the preveterinary program does not assure admission to the professional program.

Because admission to the Professional Program in Veterinary Medicine is competitive and the majority of successful applicants have completed at least three years of a bachelor's degree program, students who are enrolled in the preveterinary program are encouraged to plan toward a baccalaureate degree in a major consistent with their interests and alternative educational and career goals. Students in any major may apply for admission to the Professional Program. For additional information, refer to the **Professional Program in Veterinary Medicine** statement.

Requirements for the Preveterinary Program

	CREDITS
1. All of the following courses:	50
ANS 313 Principles of Animal Feeding and Nutrition	4
BMB 401 Basic Biochemistry	4
BS 110 Organisms and Populations	4
BS 111 Cells and Molecules	3
BS 111L Cell and Molecular Biology Laboratory	2
CEM 141 General Chemistry	4
CEM 161 Chemistry Laboratory I	1
CEM 251 Organic Chemistry I	3
CEM 252 Organic Chemistry II	3
CEM 255 Organic Chemistry Laboratory	2
MMG 301 Introductory Microbiology	3
MMG 302 Introductory Microbiology Laboratory	1
MMG 409 Eukaryotic Cell Biology	3
MTH 116 College Algebra and Trigonometry	5
PHY 231 Introductory Physics I	3
PHY 232 Introductory Physics II	3
PHY 251 Introductory Physics Laboratory I	1
PHY 252 Introductory Physics Laboratory II	1
2. One of the following courses:	
ANS 314 Genetic Improvement of Domestic Animals	4
ZOL 341 Fundamental Genetics	4
3. Students who are enrolled in the preveterinary program should complete the University requirements for bachelor's degrees as described in the <i>Undergraduate Education</i> section of the catalog.	

The completion of Mathematics 116 referenced in item 1. above may also satisfy the University mathematics requirement.

Students who are enrolled in the Preveterinary Program in the College of Veterinary Medicine may complete an alternative track to Integrative Studies in Biological and Physical Sciences that consists of the following courses: Biological Science 110, 111, and 111L and Chemistry 141. The completion of Biological Science 110 and 111L satisfies the laboratory requirement. Biological Science 110, 111, and 111L and Chemistry 141 may be counted toward both the alternative track and the requirements for the preveterinary program referenced in item 1. above.

Students who are enrolled in the preveterinary program will be required to meet the Tier II writing requirement approved for the student's major leading to the bachelor's degree.

PROFESSIONAL PROGRAM in VETERINARY MEDICINE

The professional veterinary medicine program is designed to provide an excellent basic medical education as well as clinical training in the diagnosis, treatment, and prevention of animal diseases and injuries. Graduates may pursue a variety of careers in salaried positions or become licensed as private practitioners in any state.

About three-fourths of the veterinarians in the United States are engaged in private practice. These veterinarians may be in general practices that care for the needs of all of the species of domestic animals or in practices limited to companion animals, farm animals, horses, poultry, or some other specific aspect of veterinary medicine.

Many veterinarians are employed by the U.S. Department of Agriculture for important work in livestock disease control, meat and poultry inspection, development of biological products, and prevention of the entry of foreign animal diseases. Veterinarians also find rewarding positions in public health work for the U.S. Public Health Service, the U.S. Army and Air Force, and for state, county, and local health agencies.

Some of the most exciting opportunities for veterinarians are in biomedical research for the benefit of both animals and people. Excellent research opportunities are available with colleges and universities, government agencies, biological and pharmaceutical companies, and private medical research institutions.

The professional program leading to the Doctor of Veterinary Medicine degree has been accredited by the American Veterinary Medical Association.

Admission to the Professional Program in Veterinary Medicine

A new class of students begins the four-year professional program each fall semester. Applications for admission and related materials (e.g., scores on the Medical College Admission Test or Graduate Record Examination) must be received by October 1.

Factors considered by the Admissions Committee in determining an applicant's relative competitive position are: (1) cumulative grade-point average; (2) grade-point average for required preveterinary science courses in Biochemistry, General Biology, Chemistry, Mathematics, and Physics; (3) scores on the Medical College Admission Test (MCAT) or Graduate Record Examination (GRE); (4) average credit-load per semester; (5) total credits completed; (6) an interview; (7) veterinary exposure; (8) animal exposure; (9) activities and achievements; and (10) ability to communicate through a written essay. The admission process includes a procedure that attempts to reflect the diversity of society among candidates admitted to the professional program.

Applications, regular or transfer, are reviewed by the Admissions Committee. Applicants are considered for admission in the following order of priority:

1. Residents of the state of Michigan, as defined by Michigan State University. (Since MSU is a public, tax-assisted institution, admission priority is granted to residents of Michigan.)
2. Residents of states other than Michigan, including U.S. Territories and Trust Possessions.
3. All others.

Students should complete the following requirements prior to enrollment:

1. Chemistry — 3-5 semester or equivalent credits in general inorganic with laboratory; 6-8 semester or equivalent credits in or-

ganic with laboratories; 4 semester or equivalent credits in biochemistry.

2. General Physics — 8 semester or equivalent credits, including laboratory work.
3. General Biology — 6-9 semester or equivalent credits, to include principles of biological regulation, integration; genetics; development; selected physiological topics; taxonomy and systematics; comparative physiology; and ecology.
4. Microbiology with Laboratory — 3-4 semester or equivalent credits with the addition of 1 semester or equivalent credit of laboratory experience to include fundamentals of microbiology; including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.
5. Cell Biology — 3-4 semester or equivalent upper division credits including structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.
6. Genetics — 3-4 semester or equivalent credits to include principles of heredity in animals, plants and microorganisms. Classical and molecular methods in the study of gene structure, transmission, expression and evolution.
7. College Algebra and Trigonometry — 3 semester or equivalent credits; may substitute equivalent entry-level course, e.g., calculus.
8. Nutrition — 2-4 semester or equivalent credits including principles and practices of nutrition for cattle, horses, poultry, sheep and swine; metabolism of protein, minerals and vitamins; diet formulation; performance prediction; nutritional maladies.
9. Arts and Humanities — 8 semester or equivalent credits that may include two or more of the following subject areas: history, literature, music or art history or appreciation, philosophy, religion .
10. Social Science — 8 semester or equivalent credits that may include two or more of the following subject areas: cultural anthropology, economics, human geography, political science, psychology, sociology.
11. English — 4 semester or equivalent credits that may include composition, reading, speech, and other communication skills.

PRODUCTION MEDICINE SCHOLARS ADMISSION PATHWAY

This pathway has been established by the College of Veterinary Medicine in cooperation with the Department of Animal Science at Michigan State University in order to provide an admission pathway for MSU animal science students who wish to complete, in addition to the minimum preveterinary requirements, a Bachelor of Science degree in Animal Science with a concentration in Production Medicine. The concentration is designed to prepare students for a career in herd-based, agricultural veterinary practice. Completion of the production medicine concentration, combined with completion of the specific electives in the professional Doctor of Veterinary Medicine program, will lead to a certificate of emphasis in production medicine to accompany the DVM degree.

Up to ten MSU Bachelor of Science in Animal Science students may be chosen each year to be granted admission to the professional program in veterinary medicine contingent upon completion of a Bachelor of Science degree in Animal Science with a production medicine concentration.

The following components will be considered in selecting candidates for this admission pathway:

1. Enrollment in the Bachelor of Science degree in Animal Science with a concentration in production medicine.
2. Completion of at least 27 credits of the required preveterinary courses and 10 credits from the courses required for the production medicine concentration.
3. Minimum of 3.20 cumulative and preveterinary science grade-point averages.
4. Minimum 240 hours of veterinary exposure, at least two thirds of which must be associated with livestock enterprises.

The formal application to the professional program in veterinary medicine through this pathway will normally occur at the beginning of the junior year when the above eligibility requirements have been met. Criteria for admission to this pathway include:

1. Performance in the regular veterinary admission criteria including grade-point averages, GRE/MCAT scores, interview, veterinary experience, evaluations, extracurricular activities and achievements.
2. Evaluations of the animal science faculty mentor and other animal science faculty members having had direct instructional involvement with the candidate.
3. Commitment to livestock agriculture as demonstrated through youth activities, family experiences, employment, college extracurricular activities, or other participation in the livestock industry.

MSU animal science students who wish to enter the professional program in veterinary medicine without the production medicine concentration may apply through the regular veterinary admission process.

The College of Veterinary Medicine's Committee on Student Admissions selects the candidates for the production medicine scholars admission pathway and reserves the right to modify the criteria and process.

VETERINARY SCHOLARS ADMISSION PATHWAY

This pathway has been established by the College of Veterinary Medicine in cooperation with the Honors College at Michigan State University in order to provide an admission avenue for students who wish to complete a bachelor's degree consisting of advanced, scholarly studies in concert with their entry to the four-year professional veterinary medical degree program. All MSU preveterinary students who are members of the Honors College may choose to participate in this program. Up to ten MSU students may be chosen each year to be granted admission to the

veterinary medical program contingent upon completion of a bachelor's degree in a major of the student's choice.

The following components will be considered in selecting candidates for this admission pathway:

1. Completion of at least 75 percent of the required preveterinary science courses.
2. Minimum 3.20 cumulative and preveterinary science grade-point averages.
3. Bachelor's degree program proposal planned in consultation with the Honors College advising staff and a departmental honors adviser and demonstrating enriched, advanced, and scholarly work in a major of the student's choice.
4. Minimum 240 hours of veterinary exposure.
5. Completion of at least 10 credits in advanced or diverse course work beyond the minimum preveterinary requirements.
6. Performance in the regular veterinary admission criteria including grade-point averages, GRE/MCAT scores, interview, veterinary exposure, extracurricular activities and achievements.
7. Personal statement describing the scholarly content of the proposed bachelor's degree program and its relevance to the individual's career and personal goals.
8. Evaluations from the honors adviser in the student's degree program, a veterinarian, and an individual of the applicant's choice.

Students who wish to enter the professional veterinary medical program before earning a bachelor's degree may apply through the regular veterinary admission process.

The College of Veterinary Medicine's Committee on Student Admissions selects the candidates for this pathway and reserves the right to modify the criteria and process.

Additional Information

For additional information concerning admission to the professional program, contact the Admissions Office, College of Veterinary Medicine, F-104 Veterinary Medical Center, Michigan State University, East Lansing, Michigan 48824-1314. **Note:** Prospective applicants should maintain contact with the College's Admissions Office for current information.

Statement on Advanced Status

Rarely will students be considered for admission to the program with advanced standing.

Requirements for the Bachelor of Science Degree

1. The University requirements for the bachelor's degree as described in the *Undergraduate Education* section of this catalog.
2. Preveterinary program requirements.
3. At least 56 credits of the professional program in Veterinary Medicine.

Health Requirements for Students in the Professional Program in Veterinary Medicine

1. The student must be covered by a personal health insurance policy throughout enrollment in the program.
2. The student's tetanus vaccination must be current throughout enrollment in the program.
3. The student must have a rabies vaccination prior to participation in senior clerkships. Rabies vaccination is recommended for entering students.

VETERINARY MEDICINE
Professional Program in Veterinary Medicine

Curriculum

The curriculum leading to the D.V.M. degree is primarily the responsibility of the faculty of the College. Student input to curriculum matters is through student representation on the Curriculum Committee. Continuing development of new information in health-related fields and changes within the profession demand ongoing curricular evaluation and modification. Development of the knowledge, skills, and attitudes required of a veterinarian remains the major goal of this curriculum. Efficiency in obtaining this goal requires a dynamic program that can respond through instituting newly developed concepts and techniques. For these reasons, particulars of the curriculum described herein may change in subsequent years in accordance with established College and University policies and procedures.

Requirements for the Doctor of Veterinary Medicine Degree in Veterinary Medicine

Completion of the following 160-credit, four-year professional program with a grade-point average of at least 2.00.

CREDITS

SEMESTER 1 (Fall)

ANS	511	Animal Science for Veterinarians	2
MMG	559	Veterinary Microbiology and Immunology	4
PDI	514	Veterinary Neurosciences	2
PDI	518	Comparative Veterinary Gross Anatomy I	4
PDI	520	Veterinary Tissue Structure and Function	4
VM	511	Veterinary Clinical Examination and Techniques	2
VM	513	Ethical and Animal Welfare Issues in the Veterinary Profession	2
			20

SEMESTER 2 (Spring)

MMG	571	Veterinary Pathogenic Microbiology: Parasites	3
PDI	519	Comparative Veterinary Gross Anatomy II	4
PDI	521	Veterinary Organ Microanatomy	2
PHM	552	Veterinary Pharmacology I: Principles and Neuropharmacology	2
PSL	513	Animal Physiology for Veterinarians	4
VM	514	Comparative Life-stage Nutrition	1
VM	524	Basic Science in Clinical Medicine	1
VM	541	Veterinary Career Development and Practice Management	2
VM	548	Principals of Diagnostic Imaging	1
			20

SEMESTER 3 (Fall)

MMG	563	Veterinary Pathogenic Microbiology: Bacteria and Fungi	3
PDI	551	General Pathology	2
PHM	553	Veterinary Pharmacology II: Systems and Infectious Diseases	3
PHM	557	Veterinary Toxicology	2
VM	532	Veterinary Integrative Problem Solving	2
VM	533	Veterinary Epidemiology	3
VM	544	Veterinary Public Health	2
VM	547	Respiratory Diseases	2
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SEMESTER 4 (Spring)

MMG	565	Veterinary Pathogenic Microbiology: Viruses	2
PDI	553	Systemic Pathology	4
PDI	554	Veterinary Clinical Pathology	3
VM	543	Cardiovascular Diseases	2
VM	545	Principles of Anesthesia and Surgery	4
VM	546	Musculoskeletal Diseases	4
Selective – one credit selective course chosen from a list maintained in the College of Veterinary Medicine Academic Programs Office			1
			20

SEMESTER 5 (Fall)

SCS	561	Fundamental Clinical Skills For Small Animals	1
VM	549	Applied Diagnostic Imaging	1
VM	553	Therigenology and Urinary Diseases	5
VM	554	Hematological, Oncological and Dermatological Diseases	3
VM	555	Neurological and Ophthalmological Diseases	3

VM	557	Operative Surgery	2
VM	558	Digestive Diseases of Domestic Animals	3
VM	559	Metabolic and Endocrinological Diseases	2
Selective – one credit selective course chosen from a list maintained in the College of Veterinary Medicine Academic Programs Office			1

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SEMESTERS 6 (Spring), 7 (Summer), 8 (Fall), 9 (Spring)

Students will be required to complete 60 clerkship credits. Satisfactory completion of semesters one through five of the professional curriculum is required for enrollment in any of the listed clerkships.

REQUIRED CLERKSHIPS

LCS	620	Equine Clinical Clerkship (I)	3	
PDI	630	Diagnostic Pathology Clerkship	3	
SCS	611	Diagnostic Imaging Clerkship	3	
SCS	625	Small Animal General Medicine Clerkship	3	
SCS	626	Small Animal Soft Tissue Surgery Clerkship	3	
SCS	646	Small Animal Orthopedic Surgery Clerkship	3	
SCS	647	Small Animal Internal Medicine Clerkship	3	
SCS	648	Anesthesia Clerkship	3	
SCS	695	Emergency and Critical Care Medicine Clerkship	3	
Students must also select one experience from the following pairs of Clerkships:				
(1)	LCS	621	Equine Practice Clerkship	3
	LCS	631	Food Animal Practice Clerkship	3
(2)	LCS	630	Food Animal Medicine and Surgery Clerkship	3
	LCS	647	Concepts of Agricultural Practice Clerkship	3
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ELECTIVE CLERKSHIPS

LCS	610	Clinical Problems in Large Animal Clinical Sciences	3
LCS	611	Research Problems in Large Animal Clinical Sciences	3
LCS	613	Special Problems in Large Animal Clinical Sciences at Off-Campus Sites	3
LCS	614	Equine Clinical Proficiency Clerkship	3
LCS	615	Equine Emergency and Critical Care Clerkship	3
LCS	622	Equine Clinical Clerkship II	3
LCS	623	Equine Musculoskeletal Diseases Clerkship	3
LCS	624	Equine Theriogenology Clerkship	3
LCS	625	Equine Herd Health Clerkship	3
LCS	626	Advanced Equine Surgery Clerkship	3
LCS	627	Advanced Equine Medicine Clerkship	3
LCS	628	Techniques in Equine Anesthesia and Surgery	3
LCS	632	Advanced Food Animal Medicine and Surgery Clerkship	3
LCS	639	Small Ruminant Medicine and Management Clerkship	3
LCS	640	Large Animal Anesthesia Clerkship	3
LCS	641	Food Animal Theriogenology Clerkship	3
LCS	646	Equine Neonatal Medicine Clerkship	3
LCS	677	Veterinary Preceptorship	3
LCS	678	Government and Corporate Veterinary Practice	3
LCS	680	Food Animal Techniques	3
LCS	681	Food Animal Production Medicine I	3
LCS	682	Food Animal Production Medicine II	3
LCS	683	Food Animal Production Medicine III	3
LCS	690	Veterinary Public Health Field Experience Clerkship	3
LCS	691	Veterinary Public Health Research Clerkship	3
MMG	690	Veterinary Microbiology Clerkship	3
PDI	610	Veterinary Gross Anatomy Dissection	3
PDI	611	Research Problems in Veterinary Anatomy	3
PDI	631	Necropsy Clerkship	3
PDI	632	Problems in Veterinary Pathology	3
PDI	634	Endocrinology Clerkship	3
PDI	635	Special Problems in Histopathology and Cytology Clerkship	3
PDI	636	Aquatic Animal Medicine Clerkship	3
PHM	658	Research Problems in Pharmacology or Toxicology	3
SCS	613	Diagnostic Ultrasound Clerkship	3
SCS	630	Spay/Neuter Clerkship	3
SCS	637	Operative Surgery: Instruction and Review	3
SCS	640	Cardiology Clerkship	3
SCS	641	Comparative Ophthalmology Clerkship	3
SCS	642	Zoo and Wildlife Clerkship	3
SCS	644	Dermatology Clerkship	3
SCS	651	Advanced Comparative Ophthalmology Clerkship	3
SCS	654	Clinical Medical Oncology Clerkship	3
SCS	655	Clinical Surgical Oncology Clerkship	3
SCS	670	Clinical Nutrition for Small Animals	3
SCS	690	Veterinary Molecular Biology Clerkship	3
SCS	693	Problems in Small Animal Clinical Sciences Clerkship	3
SCS	694	Small Animal Specialty Practice Clerkship	3
VM	611	Veterinary Externship	3
VM	690	Special Problems in Veterinary Medicine	3
VM	692	Career Development and Business Skills	3

Student Performance

The Committee on Student Performance monitors student performance in accordance with established College standards and offers assistance to students experiencing difficulties in the professional curriculum. An important function of this committee is to determine the reasons for student difficulties and recommend study schedules, counseling, and other means of helping the student perform in a satisfactory manner. The Committee on Student Performance may take appropriate academic disciplinary action consistent with the academic standards of the College and the **Medical Student Rights and Responsibilities** document.

Student Rights and Responsibilities

Refer to the statement on *Student Rights and Responsibilities* in the *General Information, Policies, Procedures and Regulations* section of this catalog.

GRADUATE STUDY

The College of Veterinary Medicine offers graduate programs in each of six departments: Large Animal Clinical Sciences, Microbiology and Molecular Genetics, Pathobiology and Diagnostic Investigation, Pharmacology and Toxicology, Physiology, and Small Animal Clinical Sciences. All of these departments are authorized to offer master's degree programs. Doctor of Philosophy degree programs are offered in all departments except Small Animal Clinical Sciences. In addition, there are two college-based graduate programs: Comparative Medicine and Integrative Biology (Master of Science and Doctor of Philosophy) and Food Safety (Master of Science). These programs are designed primarily for those preparing themselves for positions in teaching or research. Other programs, including residencies for post-D.V.M. training in recognized clinical specialties, are available.

The Department of Microbiology and Molecular Genetics is affiliated with the Doctor of Philosophy degree program with a major in ecology, evolutionary biology and behavior. For more information refer to the statement on the doctoral program in ecology, evolutionary biology and behavior in the *College of Natural Science* section of this catalog.

Students who are enrolled in the Master of Science degree program in the Department of Microbiology and Molecular Genetics may elect a specialization in ecology, evolutionary biology and behavior. For additional information, refer to the statement on the specialization in the *College of Natural Science* section of this catalog.

The College of Agriculture and Natural Resources, the College of Communication Arts and Sciences, the College of Engineering, the College of Human Ecology, the College of Human Medicine, the College of Natural Science, the College of Social Science, and the College of Veterinary Medicine participate in the graduate specialization in food safety. The College of Veterinary Medicine is the primary administrative unit. For more information, refer to the *Graduate Specialization in Food Safety* statement.

The College of Veterinary Medicine, the College of Agriculture and Natural Resources, the College of Engineering, and the College of Natural Science administer the graduate specialization in environmental toxicology. The College of Agriculture and Natural Resources is the primary administrative unit. For additional information, refer to the *Graduate Specialization in Environmental Toxicology* statement in the *College of Agriculture and Natural Resources* section of this catalog.

Students who are enrolled in master's degree programs in the College of Veterinary Medicine may elect the master's specialization in agribusiness. For additional information, refer to the *Mas-*

ter's Specialization in Agribusiness Management statement in the *Department of Agricultural Economics* statement in the *College of Agriculture and Natural Resources* section of this catalog.

Several colleges and departments within Michigan State University cooperate in offering the interdepartmental Doctor of Philosophy degree program with a major in neuroscience, which is administered by the College of Natural Science. For additional information, refer to the statement on the doctoral program in neuroscience in the *College of Natural Science* section of this catalog.

Students who are enrolled in master's and doctoral degree programs in the College of Agriculture and Natural Resources, the College of Natural Science, and the College of Veterinary Medicine may elect the Graduate Specialization in Fish and Wildlife Disease Ecology and Conservation Medicine. For additional information, refer to the statement on *Graduate Specialization in Fish and Wildlife Disease Ecology and Conservation Medicine* in the *College of Agriculture and Natural Resources* section of this catalog.

GRADUATE SPECIALIZATION IN FOOD SAFETY

The College of Agriculture and Natural Resources, the College of Communication Arts and Sciences, the College of Engineering, the College of Human Ecology, the College of Human Medicine, the College of Natural Science, the College of Social Science, and the College of Veterinary Medicine participate in the graduate specialization in food safety. The College of Veterinary Medicine is the primary administrative unit.

The specialization is available as an elective to students who are enrolled in a master's degree program in the departments of Agricultural Economics, Agricultural Engineering, Animal Science, Communication, Entomology, Epidemiology, Food Science and Human Nutrition, Horticulture, Large Animal Clinical Sciences, Microbiology and Molecular Genetics, Packaging, Pathobiology and Diagnostic Investigation, Pharmacology and Toxicology, Plant Pathology, and Sociology.

The specialization is designed for students who are interested in enhancing the focus of their study on food safety so they can apply their knowledge from basic disciplines to solve problems in the area of food safety.

A faculty member who is in the department that administers the student's degree program will serve as the student's academic adviser for the specialization. The academic adviser will assist the student in planning a program of study that is related to the student's interests, capabilities, and professional goals. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the master's degree.

Requirements for the Graduate Specialization in Food Safety

The student's program of study must be approved by the student's academic adviser for the specialization. To qualify for this graduate specialization, the student must meet the requirements specified below:

	CREDITS
1. Maintain a grade-point average of at least 3.0 in the courses that are used to satisfy the requirements for the specialization.	
2. Complete both of the following seminar courses (2 credits):	
VM 828 Food Safety Seminar Series	1
VM 829 Problems in Food Safety	1
3. Complete one course from each of the following topic areas in food safety (9 credits):	
Risk/Public Health	
EPI 813 Investigation of Disease Outbreaks	3
LCS 830 Epidemiology, Risk Assessment and Public Health Impact of Food-borne Diseases	3
VM 831 Foodborne Disease Epidemiology for the Professional	3
VM 832 Food Safety Disease Control	3
Human Dimensions	

VETERINARY MEDICINE
Graduate Study

FSC 421	Food Laws and Regulations	3
PKG 480	Packaging Laws and Regulations	3
SOC 950	Topics in Rural and Environmental Studies	3
Food		
FSC 440	Food Microbiology	3
FSC 840	Advanced Food Microbiology	3
FSC 842	Foodborne Disease	3

A list of supporting electives for the graduate specialization in food safety, depending on the student's individual focus of study in food safety is available from the student's academic adviser.

Upon completion of the requirements for the master's degree and the requirements for the specialization in food safety, the student should contact the chairperson of the department that administers the student's degree program and request certification for the completion of the specialization. After the certification is approved by the chairperson of the department, the Director of the National Food Safety and Toxicology Center, and the Dean of the College of Veterinary Medicine, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

Master of Science

For the master's degree, departments of the College of Veterinary Medicine recommend Plan A with thesis unless otherwise specified.

In addition to meeting the requirements of the University as described in the *Graduate Education* section of this catalog, students must meet the requirements specified below.

Admission

A bachelor's degree is required of all applicants for graduate study. Admission must be approved by the department in which the applicant proposes to do the major work. Scholastic record, experience, personal qualifications, and area of subject-matter interest are considered by the department in determining the applicant's acceptability.

Upon admission, the master's student is classified in one of two categories:

1. **Regular status:** for those who have an undergraduate grade-point average of 3.00 or above and are otherwise qualified to undertake a master's program.
2. **Provisional status:** for those who have some remediable inadequacy of qualifications or subject-matter preparation.

Requirements for the Master of Science Degree

Up to 10 credits may be allowed for thesis research (course number 899). The distribution of credits among major and minor areas is determined by the student's major department.

Residence

A minimum of 9 credits must be earned in residence on campus unless a department specifies more than 9 credits.

Time Limit

For the master's degree, the student must complete all requirements within six calendar years from the beginning of the first semester in which credit was earned toward the degree.

Doctor of Philosophy

Doctor of Philosophy degree programs are offered in anatomy, large animal clinical sciences, microbiology, pathology, pharmacology, and physiology.

In addition to meeting the requirements of the University as described in the *Graduate Education* section of this catalog, students must meet the requirements specified below.

Admission

Admission to a doctoral program requires the approval of the department in which the applicant's major work is to be done.

The doctoral student is classified in one of two categories:

1. **Regular status:** for those who have a grade-point average in prior graduate work of 3.00 or above and who are otherwise qualified to undertake a doctoral program.
2. **Provisional status:** for those who have some remediable inadequacy of qualifications.

Dual Degree Programs in the College of Veterinary Medicine

Students who are enrolled in the Doctor of Veterinary Medicine degree program may be granted approval to pursue simultaneously either a research-focused Master of Science degree or a Doctor of Philosophy degree. For additional information, interested students should refer to the *Requirements for a Joint Master's Degree and Medical Degree* or *Special Programs* statements in the *Graduate Education* section of this catalog. They should also contact the Associate Dean for Academic Programs and the Associate Dean for Research and Graduate Studies in the College.

Dual Degree Medical Scientist Training Program

The Dual Degree Medical Scientist Training Program is a special program for students who want to earn both a professional veterinary doctoral degree (Doctor of Veterinary Medicine) and a graduate research doctoral degree (Doctor of Philosophy). The program seeks to meet a national need for veterinarians who are proficient in research as well as in veterinary medicine, and who will pursue careers as faculty members in veterinary medical school and research institutions.

The program is designed to select, educate, and train highly motivated students having outstanding research and academic qualifications. Trainees pursue veterinary medical and graduate studies in parallel, meet regularly with peers in seminars, and engage in veterinary medical-level and graduate-level courses and clerkships, as well as in research with highly qualified mentors.

A student who is interested in this program should contact the Office of the Associate Dean for Research and Graduate Studies in the College of Veterinary Medicine.

For additional information, refer to the statement on *Special Programs* in the *Graduate Education* section of this catalog.

Post-D.V.M. Clinical Education Programs

Internships. The Department of Small Animal Clinical Sciences offers 13-month rotating internships designed to provide general clinical training for the post-D.V.M. student and a basis for further education in a specialty area.

Residencies. Residencies designed to meet the training requirement for board certification are offered in a variety of clinical specialties by the departments of Small Animal Clinical Sciences, Large Animal Clinical Sciences, and Pathology. Concurrent work toward an advanced degree is possible.

COMPARATIVE MEDICINE AND INTEGRATIVE BIOLOGY

Nationwide, there is a need for scientists who understand modern molecular biology in the context of integrated systems and can apply this understanding to human and animal health. Addressing this national need with an interdepartmental graduate program in Comparative Medicine and Integrative Biology will offer graduates the understanding of how molecular and cellular events integrate into whole-animal systems, knowledge of how appropriate animal models can be used to study human and animal disease, and understanding of how species differences and similarities can be used to investigate basic biology and disease.

Graduates of the master's and/or the doctoral program in comparative medicine and integrative biology will find employment in academia, governmental research and regulatory agencies, and in pharmaceutical industry research. They will become leaders in discovery and problem-solving research in medical science and will play an instrumental role in the translation of new knowledge to address current issues in human and animal health and well-being. The overall program is designed to develop an integrative approach to research in clinical, cellular, and molecular problems in comparative medicine and integrative biology. It emphasizes development of a firm scientific background in clinical and basic biomedical sciences and the conduct of original research.

Admission

To be considered for admission, applicants must hold a bachelor's or higher degree in life sciences or related fields and have achieved a grade-point average of at least 3.0. As biological sciences interface more and more with disciplines such as bioinformatics, mathematics, and engineering, it is possible that students holding degrees in fields other than life sciences may contribute to and benefit from training in comparative medicine and integrative biology. The admissions committee may recommend that degree holders in other fields be admitted if their background is deemed appropriate to a particular research area in the college. The committee is chaired by the associate dean for research and graduate studies of the College of Veterinary Medicine and has representatives from each department, as appointed by the chair of each department. An applicant's acceptance will be based on the academic record including grade-point average, quality of previous training, performance on standard tests such as the GRE, and proficiency in English as demonstrated by standard tests such as the TOEFL or equivalents; statement of professional goals, three letters of reference, and availability of appropriate mentors.

Upon admission to the program, the admissions committee will appoint a temporary adviser. Within six months after entrance into the program, a major adviser will be selected by mutual agreement between the student and the proposed major adviser, after consultation with the associate dean for research and graduate studies and the department chair from the home department of the proposed major adviser.

The major adviser will be required to submit a student's progress report to the admissions committee by December 30 of each year. The committee will conduct an individual interview with each graduate student annually to assess progress in the program. Assessment of the student's progress will be reported to the major adviser, chairperson of the adviser's department, and the Associate Dean of Research and Graduate Studies.

Master of Science

The College of Veterinary Medicine offers a master of science program in comparative medicine and integrative biology to develop an understanding of major concepts in comparative medicine and integrative biology as well as to acquire comprehensive knowledge of a major field and related subjects. **Plan A** consists of prescribed course work, original research of an important problem in human and animal health or biology, a thesis, and a final oral examination. **Plan B** consists of prescribed course work and a final research paper.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine, students must meet the requirements specified below.

Requirements for the Master of Science Degree in Comparative Medicine and Integrative Biology

The student must complete a total of 30 credits for the degree under Plan A (with thesis) or Plan B (without thesis), with at least 12 of those non-research credits in courses at the 800-900 level. Student's who lack sufficient background in certain areas may be asked to take collateral courses at the 400-500 level. These collateral courses are not counted toward degree requirements. The student's program of study must be approved by the student's major adviser and must meet the requirements specified below:

CREDITS
30

Requirements for Both Plan A and Plan B:

- Both of the following courses:

EPI	827	The Nature and Practice of Scientific Integrity	3
VM	820	Current Topics in Comparative Medicine and Integrative Biology	2
- One of the following courses:

STT	421	Statistics I	3
STT	422	Statistics II	3
PHM	980	Problems	3

Additional Requirements for Plan A:

- One course from *two* of the following three major areas: Molecular Life Sciences, Integrative Biology, and Pathology. A list of approved courses is available from your academic adviser.
- Complete 10 credits of 899 Master's Thesis Research from one of the following departments: Large Animal Clinical Sciences, Microbiology and Molecular Genetics, Pathology, Pharmacology and Toxicology, Physiology and Small Animal Clinical Sciences.
- Elective credits including non-research and seminar courses as determined by the academic adviser.
- Pass an oral examination in defense of the thesis.

Additional Requirements for Plan B:

- One course from *each* of the following three major areas: Molecular Life Sciences, Integrative Biology, and Pathology. A list of approved courses is available from your academic adviser.
- Elective credits including non-research and seminar courses as determined by the academic adviser.
- Submit a satisfactory research paper.

Doctor of Philosophy

The College also offers the Doctor of Philosophy degree focused on depth of understanding across disciplines, acquisition of research skills and the conducting of original research.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine, students must meet the requirements specified below.

VETERINARY MEDICINE
Graduate Study

Requirements for the Doctor of Philosophy Degree in Comparative Medicine and Integrative Biology

The student must complete a minimum of 18 credits of non-research courses, with at least 12 credits in courses at the 800 level and above. All students are required to take the following courses, with at least two enrollments in Veterinary Medicine 820:

			CREDITS
EPI	827	The Nature and Practice of Scientific Integrity	3
VM	820	Current Topics in Comparative Medicine and Integrative Biology	2

All students are required to take at least one course from each of four major areas: molecular life sciences, integrative biology, pathology, and statistics and epidemiology. A list of approved courses is available from the major adviser. In rare cases, a student may lack sufficient background in certain areas and may be asked to complete collateral courses at the 400 or 500 level. Credits earned in such collateral courses are not counted towards the degree.

The doctor of philosophy degree program in comparative medicine and integrative biology is conducted in two phases:

Phase I consists of acquiring and/or documenting a high degree of competence in fundamental and basic biomedical sciences and developing research skills. Phase I culminates with a comprehensive examination, submission of a research proposal, and presentation of a research seminar outlining the research proposal including preliminary data. Students may elect to take their comprehensive exam after completion of at least 12 credit hours of course work.

Phase II consists of conducting research, continuing to expand knowledge by taking additional courses and seminars as necessary, and completing 24 credits in and successfully defending the Ph.D. Dissertation.

FOOD SAFETY

Master of Science

The Master of Science in Food Safety is primarily an online program designed for students who want to enhance their study of food safety.

The Master of Science is offered by the College of Veterinary Medicine, the lead college for the National Food Safety and Toxicology Center (NFSTC) at Michigan State University. This integrated multi-disciplinary program is designed for students with various disciplinary interests and experiences. It is particularly relevant for students whose professional careers are at the interface of research, regulatory affairs, production, marketing, finance, and management.

Admission

Applicants will be accepted after review by an admissions committee of faculty jointly appointed to the National Food Safety and Toxicology Center. A faculty member in the NFSTC will serve as the student's academic adviser and will assist the student in planning a program of study that is related to the student's interests and professional goals and that fulfills college and university requirements.

Applicants must have completed a bachelor's degree from an accredited and recognized college or university. The applicant must have completed at least 6 credits of college-level course work in biological sciences, including 3 credits in microbiology. The applicant must prove or demonstrate proficiency in written and spoken English and submit a professional letter of intent and two letters of recommendation. Experience in the workplace is weighed heavily in meeting requirements for admission.

Applicants who do not meet all of the requirements listed above may be admitted provisionally and permitted to enroll for collateral course work, not to count toward the degree. This course work must be approved beforehand by the program director.

Requirements for the Master of Science Degree in Food Safety

The student must complete 30 credits under Plan B (without thesis). The specific program of study must be approved by the student's academic adviser.

			CREDITS
1.	One of the following courses (3 credits):		
	ANR	810 International Food Laws and Regulations	3
	ANR	811 U.S. Food Laws and Regulations	3
2.	All of the following courses (17 or 18 credits):		
	LCS	830 Epidemiology of Foodborne Diseases and Food Safety: An Overview	3
	VM	810 Food Safety Introduction and Professional Management	3
	VM	811 Evolution and Ecology of Foodborne Pathogens	3
	VM	812 Food Safety Toxicology	3
	VM	815 Applied Project in Food Safety	6
3.	Nine additional credits in electives approved by the student's academic adviser.		
4.	Pass a final oral examination.		

**DOCTORAL PROGRAM
 IN ENVIRONMENTAL
 AND INTEGRATIVE
 TOXICOLOGICAL SCIENCES**

The College of Veterinary Medicine offers Doctor of Philosophy degree programs with majors in Microbiology—Environmental Toxicology, Pathology—Environmental Toxicology, Pharmacology and Toxicology—Environmental Toxicology, and Physiology— Environmental Toxicology. For additional information about these programs, refer to the statement on *Doctoral Program in Environmental and Integrative Toxicological Sciences* in the *Graduate Education* section of this catalog.

**DEPARTMENT of
 LARGE ANIMAL
 CLINICAL SCIENCES**

Thomas H. Herdt, Chairperson

The Department of Large Animal Clinical Sciences offers courses for students in the professional program in Veterinary Medicine. Post-D.V.M. programs are offered which lead to the Master of Science degree in large animal clinical sciences and provide training in American Veterinary Medical Association (AVMA) recognized specialty areas. The department also offers a Doctor of Philosophy degree program with a major in large animal clinical sciences.

Students who are enrolled in Master of Science degree programs in the Department of Large Animal Clinical Sciences may elect a specialization in food safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

GRADUATE STUDY

Master of Science

The principal objectives of the Master of Science program are to introduce candidates to research and to prepare them for positions requiring advanced education. Opportunities are available in veterinary and medical colleges, animal and veterinary science departments, industrial research and development, U. S. Public Health Service, U. S. Food and Drug Administration, U. S. Department of Agriculture, and private business organizations or practices.

The master's degree student is usually required to develop a course of study which requires writing a thesis based upon original research (Plan A). In rare instances, a student may be permitted to elect a non-thesis (Plan B) course of study upon recommendation of the guidance committee and the approval of the department's faculty.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine, students must meet the requirements specified below.

Admission

The candidate must possess a Doctor of Veterinary Medicine degree or an equivalent degree and be accepted by the graduate faculty of the department.

Requirements for the Master of Science Degree in Large Animal Clinical Sciences

The student must complete 30 credits under either Plan A (with thesis) or Plan B (without thesis).

Students majoring in large animal clinical sciences may elect to support the major field with courses in two or three additional areas. Supporting and minor courses may be in anatomy, pathology, physiology, pharmacology, bacteriology, virology, immunology, mycology, parasitology, nutrition, animal science, statistics, chemistry, genetics, or education.

Academic Standards

A second semester of grades averaging below 3.00 constitutes cause for withdrawal from the program.

Doctor of Philosophy

The Doctor of Philosophy degree program is designed to provide veterinary medical graduates the experience and training necessary to develop an integrative approach to animal disease research. The program emphasizes the development of a firm scientific background in fundamental and basic biomedical sciences, in-depth knowledge in an area of veterinary science, and the conduct of in-depth original research.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine, students must meet the requirements specified below.

Admission

Applicants for admission must hold a Doctor of Veterinary Medicine degree or another medical degree and have a grade-point average of at least 3.00 in two previous years of graduate or professional study. At least one year of clinical experience is recommended. A Master of Science degree is not required.

Applicants must submit an autobiographical sketch, a statement of interest and objectives, and three letters of recommenda-

tion from individuals capable of judging their academic capabilities and accomplishments. The department's Graduate Postgraduate Training Committee reviews applications for admission and recommends persons for admission to the department chairperson. The admissions decision is based upon the applicant's academic record and professional goals, the letters of recommendation, and space and faculty availability.

Requirements for the Doctor of Philosophy Degree in Large Animal Clinical Sciences

The doctoral program is divided into three phases: Phase I culminating with a qualifying examination, Phase II culminating with a comprehensive examination, and Phase III culminating with the completion and defense of the dissertation. There is no foreign language requirement.

Phase I consists of fundamental and basic biomedical sciences courses in which the student must demonstrate a high degree of competence. The student must complete 15 credits of inorganic chemistry, organic chemistry, biochemistry, and physiologic chemistry. No fewer than 3 credits must be in biochemistry. The student must also complete no fewer than 3 credits of statistics and no fewer than 6 credits in courses emphasizing mechanisms of animal disease. In order to continue in the doctoral program, the student must pass a qualifying examination formulated and conducted by the qualifying examination committee.

Phase II consists of at least 13 credits in an area of veterinary science chosen by the student. The 13 credits must be in courses at the 400 level or above. At least 8 of the 13 credits must be in courses at the 800 level or above, and it is recommended that these credits be from one of the following departments: anatomy, physiology, pharmacology and toxicology, microbiology, pathology, statistics and probability, or community health science. With the agreement of the department that administers the courses, the 8 credits may contribute to a minor from that department, but a minor is not required for the program.

The comprehensive examination is given by the student's guidance committee toward the end of Phase II when the student has completed most of the required courses. The examination consists of two parts: an oral examination and the presentation of a dissertation proposal. The oral examination is designed to evaluate the student's depth of knowledge in his or her chosen area of veterinary science and includes, but is not limited to, material from the required courses. The student must pass the oral examination before he or she may present the dissertation proposal. The proposal must be presented no earlier than 15 days, and no later than 45 days, after the student has passed the oral examination.

Phase III consists of conducting animal disease research, completing the dissertation, and defending the dissertation.

Academic Standards

A candidate may not receive more than three grades below 3.0 in courses required for the degree.

DEPARTMENT of MICROBIOLOGY and MOLECULAR GENETICS

Walter Esselman, Chairperson

GRADUATE STUDY

The Department of Microbiology and Molecular Genetics is administered jointly by the colleges of Veterinary Medicine, Human Medicine, Natural Science, and Osteopathic Medicine. All four of these colleges offer a Master of Science degree in microbiology and molecular genetics and a Doctor of Philosophy degree in microbiology and molecular genetics. In addition, the College of Veterinary Medicine offers a Doctor of Philosophy degree program with a major in microbiology—environmental toxicology. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Microbiology and Molecular Genetics* in the *College of Natural Science* section of this catalog.

Students who are enrolled in Master of Science degree programs in the Department of Microbiology and Molecular Genetics may elect a specialization in food safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

DEPARTMENT of PATHOBIOLOGY and DIAGNOSTIC INVESTIGATION

Jennifer S. Thomas, Acting Chairperson

The Department of Pathobiology and Diagnostic Investigation offers courses for students in the professional program in Veterinary Medicine. The department offers Master of Science and Doctor of Philosophy degree programs. Residency training in diagnostic veterinary anatomic or clinical pathology is also available.

GRADUATE STUDY

Students who are enrolled in Master of Science degree programs in the Department of Pathobiology and Diagnostic Investigation may elect a specialization in food safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

Residency Training in Veterinary Pathology

The veterinary residency program is designed to provide post-D.V.M. advanced training for proficiency in the practice of pathology. Scheduled rotational assignments are available in the areas of necropsy, clinical pathology, and surgical pathology. Residents also receive experience in teaching and are exposed to the research activities of the department. Residents must identify their area of interest in either clinical pathology or anatomic pa-

thology. Appointments are for a 2 to 4 year period depending on the background and career objectives of the individual resident. Annual evaluations are conducted, and reappointments are contingent on the student's performance.

Pathology for Graduate Students in Related Fields

Students majoring in related fields may elect to take supportive courses in pathology. Such students are expected to have an adequate background in biochemistry, microbiology, physiology, gross anatomy, and histology. Also, due to limited facilities, permission must be obtained from the department chairperson prior to enrollment.

PATHOLOGY

Graduate education and research may be directed to either human or animal pathology. Major areas of research in pathology provide the basis for advanced degree programs. These areas include toxicologic pathology, oncology, neuropathology, hematology in a broad sense, immunopathology, pathology of infectious diseases, reproductive and cardiovascular pathology, and pathology of animal models for human disease. Comparative aspects of disease processes may encompass a variety of species, including humans and domestic or wild mammals and birds, and may emphasize anthroponoses dealing with diseases transmissible across species lines. An interdisciplinary approach to problem solving will be applied in all instances where indicated.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine students must meet the requirements specified below.

Admission

With few exceptions, the graduate student majoring in pathology will have a professional degree in some branch of medicine. Students holding a bachelor's degree and seeking graduate training in pathology are advised to inquire about possible openings before going through the process of formal application. The doctoral candidate will usually have, in addition, a master's degree in a medical or paramedical science; however, possession of a master's degree does not guarantee admission to a doctoral program.

Academic Standards

In all graduate study programs in pathology, the student is expected to assume much responsibility. In research, particularly, the qualified student must demonstrate ability to independently plan, initiate, and carry to completion the project which the student undertakes.

Master of Science

Requirements for the Master of Science Degree in Pathology

The student must complete 30 credits under Plan A (with thesis). The student is required to prepare a manuscript judged by the academic adviser and the director of thesis research as suitable to submit for publication in an appropriate scientific journal.

Residence

A minimum of 10 semester credits must be acquired in residence.

Doctor of Philosophy

Requirements for the Doctor of Philosophy Degree in Pathology

The student is required to prepare a manuscript judged by the academic adviser and director of dissertation research as suitable to submit for publication in an appropriate scientific journal.

The minimum number of credits required for the degree depends principally upon the student's educational background and level of scholarly attainment. Those students who are well advanced in training or who have had considerable professional experience in pathology and can submit bona fide evidence of scholarship and attainment may not be required to take as many as the usual 40 credits of course work beyond the master's degree.

PATHOLOGY—ENVIRONMENTAL TOXICOLOGY

Doctor of Philosophy

For information about the Doctor of Philosophy degree program in pathology—environmental toxicology, refer to the statement on *Doctoral Program in Environmental and Integrative Toxicological Sciences* in the *Graduate Education* section of this catalog.

DEPARTMENT of PHARMACOLOGY and TOXICOLOGY

Joseph R. Haywood II, Chairperson

The Department of Pharmacology and Toxicology is administered jointly by the colleges of Veterinary Medicine, Human Medicine, and Osteopathic Medicine. The College of Veterinary Medicine is the primary administrative unit. All three of these colleges offer Master of Science and Doctor of Philosophy degree programs with majors in Pharmacology and Toxicology. A Master of Science degree with a major in Integrative Pharmacology is also available. In addition, the College of Veterinary Medicine offers a Doctor of Philosophy degree program with a major in pharmacology and toxicology—environmental toxicology. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Pharmacology and Toxicology* in the *College of Osteopathic Medicine* section of this catalog.

Students who are enrolled in Master of Science degree programs in the Department of Pharmacology and Toxicology may elect a specialization in food safety. For additional information, refer to the statement on the specialization.

DEPARTMENT of PHYSIOLOGY

William S. Spielman, Chairperson

The Department of Physiology is administered jointly by the colleges of Veterinary Medicine, Human Medicine, Natural Science, and Osteopathic Medicine. All four of these colleges offer Master

of Science and Doctor of Philosophy degree programs with majors in physiology. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Physiology* in the *College of Natural Science* section of this catalog.

DEPARTMENT of SMALL ANIMAL CLINICAL SCIENCES

Charles DeCamp, Chairperson

The Department of Small Animal Clinical Sciences offers courses designed to meet the needs of the professional program in veterinary medicine, the post-D.V.M. clinical training programs that provide the basis for specialty board certification, and the graduate program leading to the Master of Science degree.

GRADUATE STUDY

Master of Science

The department offers advanced studies leading to the Master of Science degree. The program is designed primarily for graduate veterinarians in the residency training program in the department.

Emphasis in the program is placed on clinically oriented research which is well supported by the facilities available and the clinical case volume. Graduates of this program will find opportunities in all areas of practice, teaching, and research.

In addition to meeting the requirements of the University and of the College of Veterinary Medicine, students must meet the requirements specified below.

Admission

The candidate must possess a Doctor of Veterinary Medicine degree or its equivalent and have the potential qualifications for graduate study. Licensure to practice veterinary medicine in the State of Michigan is usually required.

Requirements for the Master of Science Degree in Small Animal Clinical Sciences

The student must complete 30 credits under Plan A (with thesis).

Supporting courses may be taken in such areas as anatomy, pathology, physiology, pharmacology, microbiology, immunology, nutrition, parasitology, statistics, virology, chemistry, and animal genetics.

Academic Standards

Three grades below a 3.0 in graduate courses will remove a student from degree candidacy.

Transfer Credits

As many as 9 semester credits of graduate work (excluding research and thesis credits) may be transferred from other institutions, upon approval of the department chairperson, the Associate Dean for Research and Graduate Studies, and the student's guidance committee.

Post-D.V.M. Clinical Training Programs

These programs are supported by the clinical service activities of a highly specialized faculty utilizing the facilities and support staff of The Veterinary Teaching Hospital.

Internships

The department offers thirteen-month rotating internships designed to provide general clinical training for the post-D.V.M. student as well as to provide a basis for further specialty training. Selection of trainees is normally made through the National Internship-Residency Matching Program.

Residencies

Residencies designed to meet the training requirements for specialty board certification are currently offered in dermatology, internal medicine, and surgery. The dermatology residency is two years in length and the others are three years in length with yearly evaluation of progress and continuance based on trainee performance. Concurrent work toward the Master of Science degree is encouraged. Selection of trainees is normally accomplished through the National Internship Residency Matching Program.

CENTER FOR INTEGRATIVE TOXICOLOGY

Norbert E. Kaminski, Director

The Center for Integrative Toxicology was established to facilitate and coordinate the varied programs in departments and colleges across the MSU campus related to toxic substances which include multidisciplinary research, education, and training in toxicology. These programs address almost all aspects of environmental toxicology with particular focus on adverse effects of chemical contaminants on living organisms. Research spans a broad range from studies of biochemical and molecular mechanisms of toxicity to studies on the distribution and fate of chemicals in various environmental media.

The Center for Integrative Toxicology administers the doctoral Program in Environmental and Integrative Toxicological Sciences providing students with excellent training in a basic science discipline and training and credentials in environmental and integrative toxicology sciences. Students who complete this multidisciplinary course of study earn the Ph.D. degree in a basic science discipline with a dual major in environmental toxicology. In this way and through its colleges, MSU makes study in the area of environmental toxicology available to graduate students.

DIAGNOSTIC CENTER FOR POPULATION and ANIMAL HEALTH

Thomas Mullaney, Acting Director

The Diagnostic Center for Population and Animal Health was established to provide a complete animal disease diagnostic service for Michigan veterinarians and animal owners. The primary objective of the service is efficient food production and a safer food supply and environment.

Expertise is provided in the areas of endocrinology, bacteriology, mycology, nutrition, pathology, toxicology, and virology.

Faculty are jointly appointed with academic departments and participate in teaching and research programs.

The laboratory is accredited by the American Association of Veterinary Laboratory Diagnosticians.

NATIONAL FOOD SAFETY and TOXICOLOGY CENTER

Scott R. Winterstein, Acting Director

The National Food Safety and Toxicology Center (NFSTC) is a nondegree-granting center with staff, faculty and students from sixteen departments and seven colleges and from the Michigan Agricultural Experiment Station (MAES) and Michigan State University Extension (MSUE). The center is administered from the Food Safety and Toxicology Building that has laboratory and other experimental facilities for researchers with expertise in toxicology, carcinogenesis, pathology, biochemistry, microbiology, epidemiology and the social sciences. The center also supports food safety targeted outreach and education programs, seminars and workshops.

At the heart of the center lies its mission: to conduct research that will increase understanding of chemical and microbial hazards in foods and to use this knowledge to develop a safer food supply, well-founded public policy, and a greater public understanding of food safety issues.

The center provides a focal point for experts throughout the University to use a multi-college, multidisciplinary approach to investigate food safety issues and generate new knowledge. It has established national and international links to address the global reduction of foodborne disease.

VETERINARY TEACHING HOSPITAL

Patrick LeBlanc, Director

The Veterinary Teaching Hospital provides the environment for the clinical instruction of veterinary technology and veterinary medicine students, as well as interns and residents. The hospital provides facilities for the research activities of graduate students,

postdoctoral students, residents, and faculty. It offers primary and specialty services in nineteen areas: anesthesiology, cardiology, dentistry, diagnostic imaging, emergency and critical care, general medicine, internal medicine, general surgery, nutrition, oncology, ophthalmology, orthopedic surgery, pharmacy service, theriogenology, zoo and wildlife medicine, equine surgery, equine medicine, food animal medicine/ surgery and production animal medicine. The Veterinary Teaching Hospital delivers care to over 27,000 patients annually and is accredited by the American Animal Hospital Association.