Animal Sciences

Division of Animal Sciences
College of Agriculture, Food and Natural Resources
S102 Animal Sciences Center
(573) 882-7446
Fax: (573) 882-6827
http://animalsciences.missouri.edu

Interim Division Director: Dr. William Lamberson

Animal sciences is a broad field centered on the study of agriculturally important animals and their products. Graduates in animal sciences have employment opportunities in many areas including agribusiness (feed, pharmaceutical and meat industries; dairy and poultry products; public relations and research), production and management (farming/ranching; managers of livestock and poultry operations; zookeepers; consultants and technical service representatives), governmental agencies (USDA) and educational institutions (extension, teaching and research).

Students seeking admission into graduate and professional schools usually take more courses in the sciences than students in production and management, who select more business-related courses. Students and their faculty advisors select courses that fit the students’ needs, interests and objectives. The most specialization occurs at the graduate level.

The department offers BS, MS and PhD degrees with majors in Animal Sciences. A minor is also available.

Faculty

Associate Professor , C. Elsik**, J. A. Green**, R. Rivera**, R. Schnabel*, K. Wells**
Assistant Professor J. Decker**, A. Meyer**
Assistant Teaching Professor T. Strauch*
Associate Research Professor T. Ezashi*
Assistant Research Professor A. Alexenko, D. Hagen*, J. Kim, E. Walters**
Adjunct Professor D. Lubahn*
Instructor M. Crosby, S. Hamilton

* Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.
** Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

- BS in Animal Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/animalsciences/bs-animal-sciences)
- Minor in Animal Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/animalsciences/minor-animal-sciences)

Divisional Honors Program

In addition to the guidelines for the honors program in the College of Agriculture, Food and Natural Resources, students must meet the following requirements for the honors program in animal sciences. A student must be a junior or senior to participate in the honors program.

- Successful completion of either an internship or undergraduate research or a combination of both for 6 credits in animal sciences honors
- Program approval by a three-member departmental honors committee
- Submission of a written report plus an oral or poster presentation

Ag Scholars Program

This program provides early assurance of admission to the MU College of Veterinary Medicine for selected animal science majors on the University of Missouri campus.

High School seniors and MU freshman with an ACT composite score of 27 or more or an equivalent SAT score are eligible to apply for the Ag Scholars Program.

Students must have demonstrated experience or interest in livestock production and health. Examples of appropriate experience may include participation in a livestock enterprise as either a family member or an employee; enrollment in at least two years of high school agricultural coursework; and participation in FFA, 4H or equivalent organizations with projects directly related to livestock production or health; or completion of an internship of at least 250 supervised hours working in livestock production or a livestock health enterprise prior to applying for program admission.

For additional information, contact:
Preveterinary Medical Scholars and Ag Scholars Programs
W-203 Veterinary Medicine Bldg.
College of Veterinary Medicine
University of Missouri
Columbia, Missouri 65211
(573) 884-3341

Agreement with the College of Veterinary Medicine

The Division of Animal Sciences and the College of Veterinary Medicine have an articulation agreement which enables MU Animal Science majors who are admitted to the College of Veterinary Medicine before completing their B.S. degree to earn a B.S. degree in Animal Sciences during their days as a professional veterinary medicine student. In order to earn a B.S. degree in Animal Sciences the following requirements must be met:

- The student will successfully meet all General Education (http://catalog.missouri.edu/academicdegreerequirements/
general education requirements) requirements established by the University of Missouri campus.

- The student will meet any additional college or divisional requirements.
- The student will be required to complete all MU Animal Sciences requirements except for 9 hours of Animal Science Senior electives.
- The student will also be able to substitute up to 20 hours completed in the College of Veterinary Medicine in lieu of general electives in order to complete the total number of student credit hours necessary for a B.S. degree in Animal Sciences.
- The B.S. degree in Animal Science will be granted after successful completion of the first year of Veterinary Medicine.

Graduate

- MS in Animal Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/animalsciences/ms-animal-sciences)
- PhD in Animal Sciences (http://catalog.missouri.edu/undergraduategraduate/collegeofagriculturefoodandnaturalresources/animalsciences/phd-animal-sciences)

Division of Animal Sciences
920 E. Campus Drive, Columbia, MO 65211
(573) 882-8336
http://animalsciences.missouri.edu/academics/graduates.php

Director of Graduate Studies: William Lamberson

About Animal Sciences Graduate Programs

The Division of Animal Sciences has a broad-based teaching program, and our faculty members are noted for teaching and mentoring excellence. Our PhD program was recently ranked among the best in the country by the National Research Council and our research program among the best in the world by Reuters. Our graduate program has maintained or increased numbers, support, and placement rates over the past five years. The Division strives to maintain a diverse faculty qualified to teach relevant courses in five discipline areas (reproductive and environmental physiology, ruminant and monogastric nutrition, genetics/genomics, meat science and livestock production) and across six species (swine, dairy cattle, beef cattle, poultry, companion animals and horses) to serve the demand for graduates to be employed nationwide in research, teaching and industry.

AN_SCI 1001: Topics in Animal Science
Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged. There may be prerequisites enforced depending on the topic.

Credit Hour: 1-4

AN_SCI 1011: Animal Science
Principles of animal science including importance of animal agriculture, genetics, anatomy, physiology and nutrition.

Credit Hours: 3

AN_SCI 1011H: Animal Science - Honors
Principles of animal science including importance of animal agriculture, genetics, anatomy, physiology and nutrition.

Credit Hours: 3

Prerequisites: Honors eligibility required

AN_SCI 1012: Introduction to Captive Wild Animal Management
(same as F_W 1012), General introduction to housing, husbandry, behavior, genetics, nutrition, reproduction, animal health, and disease control of native and exotic species in zoological parks and other animal conservation facilities; emphasizes the role of captive animals in wildlife conservation. Graded on A-F basis only.

Credit Hours: 3

AN_SCI 1013: Biotechnology in Animal Agriculture
Concepts, discoveries, and applications of biotechnology ranging from the discovery of brewing and baking to animal cloning and genetic engineering are covered. Students will acquire a foundation to understand how biotechnology affects agriculture and our everyday lives. Graded on A-F basis only.

Credit Hours: 3

AN_SCI 1065: Animal Science Laboratory Practicum
An introductory course in skill, related to the care and management of livestock and poultry plus a section dealing with meats and a section dealing with research methods. Students will be expected to participate in hands-on learning development of fundamental skills and animal husbandry. This class will include one 3 hour lab and 1 hour DIS per week.

Credit Hours: 2

AN_SCI 2001: Topics in Animal Science
Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged. There may be prerequisites enforced depending on the topic.

Credit Hour: 1-4

AN_SCI 2045: Equine Practicum
Focus on learning hands-on equine skills through the care of horses at the university's equine facility. Experiential learning is emphasized. Skills include: how to identify the general health and well-being of horses, recognize early onset of illness or lameness, understand basic feeding, housing, and daily care, and demonstrate the ability to handle and feed horses in a safe manner. Monthly meetings, scheduled feed shifts, monthly journals, required skill assessments, and attendance at various educational activities are required. Feed shift scheduling is determined around individual availability and no equine or animal experience is required. To enroll, students should contact the instructor for an application. Graded on A-F basis only.

Credit Hour: 1-2

Prerequisites: Instructor consent required
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN_SCI 2085</td>
<td>Problems in Animal Science</td>
<td>Library and laboratory study of assigned problems in animal breeding, nutrition, physiology or production and management. Planning, conduction and reporting to be in consultation with instructor.</td>
<td>1-5</td>
<td>instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 2095</td>
<td>Equine Behavior and Training</td>
<td>Students learn the psychology and ethology of equine behavior and how it relates to training. The use and proper fitting of equipment is taught and students learn to teach horses to perform the basic movements needed prior to advancing to specialized training.</td>
<td>3</td>
<td>instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 2110</td>
<td>Global Animal Agriculture</td>
<td>Animal Agriculture as influenced globally by political, religious cultural, economic and climatic factors.</td>
<td>2</td>
<td>sophomore standing</td>
</tr>
<tr>
<td>AN_SCI 2111</td>
<td>Sophomore Seminar: Societal Issues Facing Animal Agriculture</td>
<td>Course designed to introduce students to key issues facing animal agriculture. Assignments focus on reading current publications associated with issues affecting the animal agriculture industry. Graded on A-F basis only.</td>
<td>3</td>
<td>ENGLISH 1000</td>
</tr>
<tr>
<td>AN_SCI 2111W</td>
<td>Sophomore Seminar: Societal Issues Facing Animal Agriculture - Writing Intensive</td>
<td>Course designed to introduce students to key issues facing animal agriculture. Assignments focus on reading current publications associated with issues affecting the animal agriculture industry. Graded on A-F basis only.</td>
<td>3</td>
<td>ENGLISH 1000</td>
</tr>
<tr>
<td>AN_SCI 2114</td>
<td>Live Animal and Meat Evaluation</td>
<td>(same as F_S 2114). The composition and quality meat produced from food animals is the driving component of livestock economic value. This course will teach the principles and procedures involved in evaluation, grading, selection, and economic value of meat animals and poultry and the carcasses they produce. This course is an excellent introduction and (or) prerequisite for all livestock production courses and will provide a baseline of information for students interested in livestock or meat judging.</td>
<td>3</td>
<td>Prerequisites: AN_SCI 1065</td>
</tr>
<tr>
<td>AN_SCI 2115</td>
<td>Livestock Judging</td>
<td>Comparative judging and evaluation; various classes of farm animals; particular reference to utility. Reference reading; illustrated lectures.</td>
<td>3</td>
<td>AN_SCI 1065</td>
</tr>
<tr>
<td>AN_SCI 2131</td>
<td>Dairy Products Evaluation</td>
<td>(same as F_S 2131) Sensory Evaluation and judging of dairy products.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 2135</td>
<td>Horse Selection and Evaluation</td>
<td>Techniques of selecting and evaluating horses based on conformation and performance characteristics. Effects of conformation on soundness. Includes learning to organize observations on the relative merits of a group of horses into an oral presentation.</td>
<td>2</td>
<td>AN_SCI 1065</td>
</tr>
<tr>
<td>AN_SCI 2140</td>
<td>Companion Animals</td>
<td>Focus on companion dog, cat, and horse owners concerns re: health zoonoses, legal responsibilities, inbreeding, choice of breeds, behavioral problems and loss of companion animals.</td>
<td>3</td>
<td>sophomore standing</td>
</tr>
<tr>
<td>AN_SCI 2165</td>
<td>Introduction to Ruminant Livestock Production</td>
<td>This is an introductory theory course which provides fundamental understanding of ruminant livestock - beef cattle and dairy cattle, production, management and associate industries. Graded on A-F basis only.</td>
<td>3</td>
<td>AN_SCI 1065</td>
</tr>
<tr>
<td>AN_SCI 2175</td>
<td>Introduction to Monogastric Production</td>
<td>Introductory course which provides fundamental understanding of hogs, horses and poultry. Graded on A-F basis only.</td>
<td>3</td>
<td>AN_SCI 1065</td>
</tr>
<tr>
<td>AN_SCI 2195</td>
<td>Equine Facility Management and Marketing</td>
<td>Focuses on learning equine facility management through student care and management of the University's equine facility and breeding herd. Students also learn handling techniques for a wide variety of horses and gain experience in general equine facility maintenance. Students will be responsible for marketing horses sold in the annual MU online horse auction. Graded on A-F basis only.</td>
<td>3</td>
<td>AN_SCI 2135 and instructor's consent. Cannot be taken at the same time as AN_SCI 2095</td>
</tr>
<tr>
<td>AN_SCI 3001</td>
<td>Topics in Animal Science</td>
<td>Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged. There may be prerequisites enforced depending on the topic.</td>
<td>1-4</td>
<td></td>
</tr>
</tbody>
</table>

**AN_SCI 2095: Equine Behavior and Training**

Students learn the psychology and ethology of equine behavior and how it relates to training. The use and proper fitting of equipment is taught and students learn to teach horses to perform the basic movements needed prior to advancing to specialized training.

**AN_SCI 2110: Global Animal Agriculture**

Animal Agriculture as influenced globally by political, religious cultural, economic and climatic factors.

**AN_SCI 2111: Sophomore Seminar: Societal Issues Facing Animal Agriculture**

Course designed to introduce students to key issues facing animal agriculture. Assignments focus on reading current publications associated with issues affecting the animal agriculture industry. Graded on A-F basis only.

**AN_SCI 2111W: Sophomore Seminar: Societal Issues Facing Animal Agriculture - Writing Intensive**

Course designed to introduce students to key issues facing animal agriculture. Assignments focus on reading current publications associated with issues affecting the animal agriculture industry. Graded on A-F basis only.

**AN_SCI 2114: Live Animal and Meat Evaluation**

(same as F_S 2114). The composition and quality meat produced from food animals is the driving component of livestock economic value. This course will teach the principles and procedures involved in evaluation, grading, selection, and economic value of meat animals and poultry and the carcasses they produce. This course is an excellent introduction and (or) prerequisite for all livestock production courses and will provide a baseline of information for students interested in livestock or meat judging.

**AN_SCI 2115: Livestock Judging**

Comparative judging and evaluation; various classes of farm animals; particular reference to utility. Reference reading; illustrated lectures.

**AN_SCI 2131: Dairy Products Evaluation**

(same as F_S 2131) Sensory Evaluation and judging of dairy products.

**AN_SCI 2135: Horse Selection and Evaluation**

Techniques of selecting and evaluating horses based on conformation and performance characteristics. Effects of conformation on soundness. Includes learning to organize observations on the relative merits of a group of horses into an oral presentation.

**AN_SCI 2140: Companion Animals**

Focus on companion dog, cat, and horse owners concerns re: health zoonoses, legal responsibilities, inbreeding, choice of breeds, behavioral problems and loss of companion animals.

**AN_SCI 2165: Introduction to Ruminant Livestock Production**

This is an introductory theory course which provides fundamental understanding of ruminant livestock - beef cattle and dairy cattle, production, management and associate industries. Graded on A-F basis only.

**AN_SCI 2175: Introduction to Monogastric Production**

Introductory course which provides fundamental understanding of hogs, horses and poultry. Graded on A-F basis only.

**AN_SCI 2195: Equine Facility Management and Marketing**

Focuses on learning equine facility management through student care and management of the University's equine facility and breeding herd. Students also learn handling techniques for a wide variety of horses and gain experience in general equine facility maintenance. Students will be responsible for marketing horses sold in the annual MU online horse auction. Graded on A-F basis only.

**AN_SCI 3001: Topics in Animal Science**

Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged. There may be prerequisites enforced depending on the topic.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN_SCI 3085: Problems in Animal Science</td>
<td>Current problems in animal breeding, nutrition, livestock production and management, meats. Assigned topics. In some cases student may undertake a project by outlining objectives, planning work, keeping records and summarizing results in written report. Some sections may be graded either on S/U or A-F basis only.</td>
<td>1-6</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3085W: Problems in Animal Science - Writing Intensive</td>
<td>Current problems in animal breeding, nutrition, livestock production and management, meats. Assigned topics. In some cases student may undertake a project by outlining objectives, planning work, keeping records and summarizing results in written report. Some sections may be graded either on S/U or A-F basis only.</td>
<td>1-6</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3190: Study Abroad: International Meat, Dairy and Enology (same as F_S 3190)</td>
<td>This study abroad course introduces students to the meat, dairy and wine industries in Germany or New Zealand (destinations are on a rotational basis). Students will visit small, medium and large-scale producers and learn about differences in comparisons to the US industries. May be repeated once for credit.</td>
<td>3</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3212: Principles of Animal Nutrition</td>
<td>The purpose of this course is to teach students the essential nutrients for animal life and to understand the basic principles of nutrition. Graded on A-F basis only. Recommend: 1 course in biochemistry or at least 4 hours of chemistry and MATH 1100 or equivalent.</td>
<td>3</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3213: Genetics of Agricultural Plants and Animals (same as PLNT_S 3213)</td>
<td>Concepts of molecular, transmission, and population and quantitative genetics. Special emphasis given to breeding and biotechnological applications in plant and animal agriculture. Prerequisites: MATH 1100 and one of the following: BIO_SC 1100 (or F_W 1100) or BIO_SC 1200 or BIO_SC 1500.</td>
<td>3</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3214: Principles of Meat Science (same as F_S 3214)</td>
<td>Study of the principles involved in the conversion of living animals to meat and by-products; efficient utilization of meat as a food.</td>
<td>3</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3215: Principles of Dairy Foods Science (same as F_S 3231)</td>
<td>Technology, chemistry and microbiology related to milk and its transformation into fluid milk products, fermented dairy foods and spreads. (2 hours of lecture and two hours of laboratory per week.)</td>
<td>3</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3224: Animal Feeds and Feeding</td>
<td>Description of feed ingredients, formulation of diets, and animal feeding management.</td>
<td>3</td>
<td>AN_SCI 3212 and MATH 1100 or equivalent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3242: Principles and Applications of Animal Nutrition</td>
<td>Fundamentals of animal nutrition, including digestion, absorption, metabolism, and function of nutrients; nutrient and energy requirements; feedstuffs used in livestock and companion animal nutrition; and integration of these principles with nutrition-based calculations to make nutritional management decisions. Graded on A-F basis only.</td>
<td>4</td>
<td>instructor's consent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3254: Physiology of Domestic Animals</td>
<td>A lecture and laboratory course that covers basic concepts of physiology and anatomy in vertebrate animals.</td>
<td>5</td>
<td>F_W 1100 or BIO_SC 1100 or BIO_SC 1500; CHEM 1320; MATH 1100</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3254H: Physiology of Domestic Animals - Honors</td>
<td>Basic concepts of physiology and anatomy as related to domestic animals.</td>
<td>3</td>
<td>BIO_SC 1010 and BIO_SC 1020 or BIO_SC 1500; CHEM 1310 and CHEM 1320; Honors eligibility required</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3255: Physiology of Domestic Animals Laboratory</td>
<td>This laboratory course covers the basic concepts of physiology as related to domestic animals.</td>
<td>2</td>
<td>BIO_SC 1010 and BIO_SC 1020 or BIO_SC 1500; CHEM 1310 and CHEM 1320; AN_SCI 3254 or equivalent</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 3275: Meat Animal Evaluation</td>
<td>Meat animal evaluation highlights the relationships and limitations that exist when evaluating market and breeding animals and develops an appreciation for carcass excellence as it relates to production, merchandising and consumption. Some travel time and commitments will be necessary.</td>
<td>2</td>
<td>AN_SCI 2114 and AN_SCI 2115</td>
<td></td>
</tr>
<tr>
<td>AN_SCI 4001: Topics in Animal Science</td>
<td>Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged.</td>
<td>1-4</td>
<td>instructor's consent</td>
<td></td>
</tr>
</tbody>
</table>
AN_SCI 4001W: Topics in Animal Science - Writing Intensive
Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged.

Credit Hour: 1-4
Prerequisites: instructor's consent

AN_SCI 4010: Pasture-Based Dairy Management
(cross-leveled with AN_SCI 7010). The objective of the class is to give a broad overview of pasture-based dairying and instill a confidence for students evaluating if this type of animal agriculture is an occupation they want to pursue after graduation. The class is taught by experts from various departments in CAFNR and covers elements of dairy and forage production needed to be successful. Materials from this class are also cross-species related where information can be used on other ruminant type operations. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: restricted to Junior and Seniors
Recommended: Background in dairy production, nutrition and reproductive physiology for Animal Science students or plant physiology and forage production for Plant Science students

AN_SCI 4011: Pasture Based Dairy Management Lab
This course is a hands-on experience class taught over 4 days during spring break. The objective of the class is to give a broad overview of pasture-based dairying and instill a confidence for students evaluating if this type of animal agriculture is an occupation they want to pursue after graduation. The class is taught by experts from various departments in CAFNR and covers elements of dairy and forage production needed to be successful. Students will have the opportunity to interact with successful pasture-based dairy producers in Missouri and apply their experience from AN_SCI 4010 on real farm situations. Graded on A-F basis only.

Credit Hour: 1
Prerequisites or Corequisites: AN_SCI 4010

AN_SCI 4312: Monogastric Nutrition
(same as NEP 4020; cross-leveled with AN_SCI 7312 and NUTRIT 7020). Principles of nutrition, feed formulation and recent research in poultry feeding. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: AN_SCI 3212

AN_SCI 4314: Physiology of Reproduction
(cross-leveled with AN_SCI 7314). Principles of animal reproduction with emphasis on endocrine control of reproductive processes.

Credit Hours: 3
Prerequisites or Corequisites: AN_SCI 3254

AN_SCI 4314H: Physiology of Reproduction - Honors
Principles of animal reproduction with emphasis on endocrine control of reproductive processes.

Credit Hours: 3
Prerequisites or Corequisites: AN_SCI 3254

AN_SCI 4323: Applied Livestock Genetics
Genetic principles applied to improvement of farm animals. Covers selection, prediction of genetic merit and mating systems. Math Reasoning Proficiency Course.

Credit Hours: 2
Prerequisites: BIO_SC 1010, BIO_SC 1020 or BIO_SC 1500 and MATH 1100

AN_SCI 4324: Genomics of Plants and Animals
(cross-leveled with AN_SCI 7324). Analysis of organisms at the level of the complete genome sequence. Covers genome sequencing, assembly and annotation, as well as functional, evolutionary and computational genomics.

Credit Hours: 2
Recommended: BIO_SC 1010, BIO_SC 1020 or BIO_SC 1500, MATH 1100, AN_SCI 3213 /PLNT_S 3213 or equivalent

AN_SCI 4332: Ruminant Nutrition
(cross-leveled with AN_SCI 7332). Physiology, chemistry, microbiology and pathology of ruminants. Emphasizes the digestion, absorption, metabolism and utilization of nutrients.

Credit Hours: 3
Prerequisites: AN_SCI 4010

AN_SCI 4344: Processing Muscle Foods
(same as F_S 4344; cross-leveled with AN_SCI 7344). Materials and technologies for the manufacture of muscle food products from red meats, poultry and seafood. Experience problem-solving through further processing of complex ingredients and develop skills by practicing operations in a pilot plant facility.

Credit Hours: 3
Recommended: One Chemistry course

AN_SCI 4354: Physiology and Biochemistry of Muscle as Food
(same as F_S 4354; cross-leveled with AN_SCI 7354). Basic concepts in muscle growth and development of livestock evaluating the effects of environment, welfare, nutrition and genetics regarding muscle metabolism, physiology, and the ultimate condition of muscle as food.

Credit Hours: 3
Prerequisites: BIO_SC 1010 or equivalent or AN_SCI 3214 or instructor's consent

AN_SCI 4384: Reproductive Management
Reproductive management of cattle, swine and sheep; estrous synchronization; artificial insemination; embryo development and transfer; assisted reproductive technologies.

Credit Hours: 3
Prerequisites: senior standing and AN_SCI 4314 and instructor's consent

AN_SCI 4386: Equine Reproduction
Focuses on reproductive management techniques and breeding in the horse. Topics include stallion collection and evaluation, artificial...
insemination, interpreting ultrasound images, teasing, parturition, and foal care. Graded on A-F basis only.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 3254 and AN_SCI 4314 or instructor's consent

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**AN_SCI 437: Equine Breeding Management**  
Focuses on practical applications of reproductive management techniques and breeding in the horse. Topics include stallion collection and evaluation, artificial insemination, interpreting ultrasound images, teasing, parturition, and foal care. Students will gain hands-on experience in each of these areas.

**Credit Hours:** 5  
**Prerequisites:** instructor's consent  
**Recommended:** AN_SCI 2175 and AN_SCI 4314

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**AN_SCI 4437: Environmental Physiology**  
Principles of environmental physiology and animal adaptation with emphasis on mechanisms of temperature regulation and related nutritional and metabolic-hormonal functions.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 3254

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**AN_SCI 4910: Senior Seminar in Captive Wild Animal Management**  
(same as F_W 4910). Investigates key issues in captive wild animal management, focusing on the role of animal caretakers in addressing the issues. Students are required to formulate informed opinions regarding these topics and communicate effectively about the subject matter. Graded A-F only.

**Credit Hour:** 1  
**Prerequisites:** AN_SCI 1012 or F_W 1012 or instructor's consent; junior or senior standing

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**AN_SCI 4940: Internship in Animal Science & Technology**  
Off-campus training to develop technical skills and understanding of an area of animal science. Written reports required. Graded on an S/U basis only.

**Credit Hours:** 1-12  
**Prerequisites:** instructor's consent

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**AN_SCI 4950: Undergraduate Research in Animal Science**  
Individually directed field or laboratory research culminating in a poster or oral presentation for upper-class students under faculty supervision.

**Credit Hour:** 1-3  
**Prerequisites:** At least sophomore standing or instructor's consent

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**AN_SCI 4973: Molecular and Cellular Techniques in Animal Science**  
A directed research project that employs current molecular and cellular technologies. Students will generate experimental data, analyze the data and draft a research report in the format of a scientific paper.

**Credit Hours:** 4  
**Prerequisites:** instructor's consent  
**Recommended:** an introductory course in biology and a course in organic chemistry, at least junior standing

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**AN_SCI 4975: Beef Production and Management**  
(cross-leveled with AN_SCI 7975). Systems of beef production: breeding, feeding, management of commercial and purebred beef cattle.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2165 and AN_SCI 3212 or instructor's consent

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**AN_SCI 4975W: Beef Production and Management - Writing Intensive**  
(cross-leveled with AN_SCI 7975). Systems of beef production: breeding, feeding, management of commercial and purebred beef cattle.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2165 and AN_SCI 3212 or instructor's consent

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**AN_SCI 4976: Dairy Production**  
(cross-leveled with AN_SCI 7976). Applied dairy science; emphasis on nutrition and management; herd health, labor-saving equipment, buildings, quality products, organization of dairy enterprise, business and economic aspects.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2165, AN_SCI 3212, and AN_SCI 3232 or instructor's consent

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**AN_SCI 4976W: Dairy Production - Writing Intensive**  
(cross-leveled with AN_SCI 7976). Applied dairy science; emphasis on nutrition and management; herd health, labor-saving equipment, buildings, quality products, organization of dairy enterprise, business and economic aspects.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2165, AN_SCI 3212, and AN_SCI 3232 or instructor's consent

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**AN_SCI 4977: Horse Production**  
(cross-leveled with AN_SCI 7977). Systems of horse production: breeding, feeding and management of horses.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent

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**AN_SCI 4978: Swine Production**  
Systems of pork production: breeding, feeding, management of commercial and purebred swine.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent

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**AN_SCI 4978W: Swine Production - Writing Intensive**  
Systems of pork production: breeding, feeding, management of commercial and purebred swine.

**Credit Hours:** 3  
**Prerequisites:** AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN_SCI 4979</td>
<td>Poultry Production</td>
<td>Principles of housing systems, nutrition, management, business and production of commercial chickens and turkeys.</td>
<td>3</td>
<td>AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 4979W</td>
<td>Poultry Production Writing Intensive</td>
<td>Principles of housing systems, nutrition, management, business and production of commercial chickens and turkeys.</td>
<td>3</td>
<td>AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7001</td>
<td>Topics in Animal Science</td>
<td>Various courses offered on a preliminary basis to determine need for such offering prior to submission as a numbered course. Various topics, credit arranged.</td>
<td>1-4</td>
<td>instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7010</td>
<td>Pasture-Based Dairy Management</td>
<td>The objective of the class is to give a broad overview of pasture-based dairying and instill a confidence for students evaluating if this type of animal agriculture is an occupation they want to pursue after graduation. The class is taught by experts from various departments in CAFNR and covers elements of dairy and forage production needed to be successful. Materials from this class are also cross-species related where information can be used on other ruminant type operations. Graded on A-F basis only.</td>
<td>2</td>
<td>Background in dairy production, nutrition and reproductive physiology for Animal Science students or plant physiology and forage production for Plant Science students</td>
</tr>
<tr>
<td>AN_SCI 7312</td>
<td>Monogastric Nutrition</td>
<td>Principles of nutrition, feed formulation and recent research in poultry feeding.</td>
<td>3</td>
<td>AN_SCI 3212</td>
</tr>
<tr>
<td>AN_SCI 7314</td>
<td>Physiology of Reproduction</td>
<td>Principles of animal reproduction with emphasis on endocrine control of reproductive processes.</td>
<td>3</td>
<td>AN_SCI 3254 and BIO_SC 1500 or equivalent; or AN_SCI 3254 as a co-requisite and instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7323</td>
<td>Applied Livestock Genetics</td>
<td>Genetic principles applied to improvement of farm animals. Covers selection, prediction of genetic merit and mating systems.</td>
<td>3</td>
<td>AN_SCI 3254 or equivalent</td>
</tr>
<tr>
<td>AN_SCI 7324</td>
<td>Genomics of Plants and Animals</td>
<td>Analysis of organisms at the level of the complete genome sequence. Covers genome sequencing, assembly and annotation, as well as functional, evolutionary and computational genomics.</td>
<td>3</td>
<td>BIO_SC 1010, BIO_SC 1020 or BIO_SC 1500 and MATH 1100</td>
</tr>
<tr>
<td>AN_SCI 7332</td>
<td>Monogastric Nutrition</td>
<td>Principles of nutrition, feed formulation and recent research in poultry feeding.</td>
<td>3</td>
<td>AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7344</td>
<td>Processing Muscle Foods</td>
<td>Materials and technologies for the manufacture of muscle food products from red meats, poultry and seafood. Experience problem-solving through further processing of complex ingredients and develop skills by practicing operations in a pilot plant facility.</td>
<td>3</td>
<td>one Chemistry course</td>
</tr>
<tr>
<td>AN_SCI 7354</td>
<td>Physiology and Biochemistry of Muscle as Food</td>
<td>Basic concepts in muscle growth and development of livestock evaluating the effects of environment, welfare, nutrition and genetics regarding muscle metabolism, physiology, and the ultimate condition of muscle as food.</td>
<td>3</td>
<td>BIO_SC 1010 or equivalent or AN_SCI 3214 or instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7384</td>
<td>Reproductive Management</td>
<td>Reproductive management of cattle, swine and sheep; estrous synchronization; artificial insemination; embryo development and transfer; assisted reproductive technologies.</td>
<td>3</td>
<td>AN_SCI 4314 and instructor's consent</td>
</tr>
<tr>
<td>AN_SCI 7437</td>
<td>Environmental Physiology</td>
<td>Principles of environmental physiology and animal adaptation with emphasis on mechanisms of temperature regulation and related nutritional and metabolic-hormonal functions.</td>
<td>3</td>
<td>AN_SCI 3254 or equivalent</td>
</tr>
</tbody>
</table>
AN_SCI 7975: Beef Production and Management
(cross-leveled with AN_SCI 4975). Systems of beef production: breeding, feeding, management of commercial and purebred beef cattle.

Credit Hours: 3
Prerequisites: AN_SCI 1065, AN_SCI 2165 and AN_SCI 3212 or instructor's consent

AN_SCI 7976: Dairy Production
(cross-leveled with AN_SCI 4976). Applied dairy science; emphasis on nutrition and management; herd health, labor-saving equipment, buildings, quality products, organization of dairy enterprise, business and economic aspects.

Credit Hours: 3
Prerequisites: AN_SCI 1065, AN_SCI 2165, AN_SCI 3212 and AN_SCI 3232 or instructor's consent

AN_SCI 7977: Horse Production
(cross-leveled with AN_SCI 4977). Systems of horse production: breeding, feeding and management of horses.

Credit Hours: 3
Prerequisites: AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent

AN_SCI 7978: Swine Production
(same as AN_SCI 4978). Systems of pork production: breeding, feeding, management of commercial and purebred swine.

Credit Hours: 3
Prerequisites: AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent

AN_SCI 7979: Poultry Production
(cross-leveled with AN_SCI 4979). Principles of housing systems, nutrition, management, business and production of commercial chickens and turkeys.

Credit Hours: 3
Prerequisites: AN_SCI 1065, AN_SCI 2175 and AN_SCI 3212 or instructor's consent

AN_SCI 8085: Problems in Animal Science
Advanced independent studies in fields not directly related to thesis or non-thesis degree research program. May be graded on S/U or A-F basis only.

Credit Hour: 1-6
Prerequisites: instructor's consent

AN_SCI 8087: Seminar in Animal Science
Critical consideration of research and other selected subjects in animal breeding, animal nutrition, reproductive physiology, growth and development and livestock production and management.

Credit Hour: 1

AN_SCI 8090: Thesis Research in Animal Science
Investigations in animal breeding, animal nutrition, reproduction physiology, growth and development livestock production and management. Graded on a S/U basis only.

Credit Hour: 1-99

AN_SCI 8413: Reproductive Biology Seminar
Presentation and discussion of selected topics from all phases of reproductive biology. Open to qualified students of graduate standing in the field of Reproductive Biology.

Credit Hour: 1

AN_SCI 8414: Meat Quality
(same as F_S 8414). Discussion of factors affecting meat quality in beef, pork, lamb and poultry. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: AN_SCI 3214 or equivalent

AN_SCI 8415: Survey of Epigenetics
This course will introduce graduate students to the basic concepts in epigenetics, including DNA methylation, histone modifications, epigenetic modifiers/transacting factors, non-coding RNAs, genomic imprinting, and dosage compensation. The course is designed to be a combination of lectures, paper discussions, and research talks by invited faculty speakers from across campus.

Credit Hours: 3
Prerequisites: instructor's consent

AN_SCI 8420: Endocrinology
Hormones of pituitary and endocrine glands; special reference to influence on growth, reproduction, milk secretion.

Credit Hours: 3
Prerequisites: AN_SCI 7314 or equivalent

AN_SCI 8424: Meat Investigations
(same as F_S 8424). Discussions of scientific literature and hands-on experimentation with research techniques customarily used in the field of meat science. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: F_S 3214 /AN_SCI 3214 or equivalent; instructor's consent

AN_SCI 8430: Introduction to Bioinformatics Programming
(same as PLNT_S 8430). This course provides the basics of programming and database development to students in the life sciences who have little prior programming experience. It covers Unix/Linux, Perl, MySQL, the relational database design process, and common data formats used in genome informatics. Students will learn how programming skills can enhance their ability to analyze large biological datasets, and will gain hands on experience with examples focused on genomics and bioinformatics. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: Instructor's consent
Recommended: Undergraduate or graduate course in Genetics
AN_SCI 8431: Nutritional Biochemistry of Lipids
(Same as NEP 8310 and NUTRIT 8310). Current concepts in the nutritional regulations of lipid metabolism. Emphasis on integrating information and interpreting current research data.

Credit Hours: 3
Prerequisites: BIOCHM 4270 and BIOCHM 4272

AN_SCI 8438: Nutrient Regulation of Gene Expression
(same as NUTRIT 8438, NEP 8438 and BIOCHM 8438). This second semester of the graduate nutritional sciences core curriculum will cover nutritional biochemistry of minerals and on research literature, with an emphasis on in-depth coverage of several minerals that illustrate emerging themes in mineral nutritional biochemistry and nutrient regulation of gene expression. The course will be taught in tutorial format.

Credit Hours: 3
Prerequisites: BIOCHM 4270 and BIOCHM 4272 and 1st semester Graduate Nutrition core curriculum

AN_SCI 8441: Livestock Production and Management Research Methods
Techniques of experimentation, with application to livestock production and management. Exercises in methods of planning, conducting, analyzing, evaluating and reporting research.

Credit Hours: 3
Prerequisites: STAT 4530/STAT 7530 or equivalent or instructor's consent

AN_SCI 8443: Functional Genomics of Mammalian Genomes: Focus on Microarray
The curriculum covers methods for functional genomics. It explores experimental designs, data filtering, ANOVA analysis, power calculations, clustering and classification systems, and functional annotation of genes through lectures, and bioinformatics and regular laboratories. May be repeated for credit. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: BIO_SC 4974 and BIO_SC 4374 or equivalent courses, Anova analysis course (STAT 7530) or equivalent experience in using Anova analysis

AN_SCI 8447: Recent Advances in Environmental and Endocrine Physiology
Seminar. Presentation, discussion, and critical evaluation of current status of selected topics in environmental and endocrine physiology.

Credit Hour: 1
Prerequisites: AN_SCI 3254 or equivalent

AN_SCI 8450: Research in Animal Science
Research in Animal Science
Credit Hour: 1-99

AN_SCI 8472: Amino Acid Metabolism
An in-depth study of amino acid metabolism and their relationship to animal nutrition.

AN_SCI 8633: Molecular and Network Evolution
(same as BIO_SC 8633). Evolution of biological macromolecules and networks, including sequence analysis algorithms and theory, phylogenetics, gene duplication, genome evolution, principles of biological networks. Development of computational skills emphasized.

Credit Hours: 3
Prerequisites: Instructor's consent required

AN_SCI 8725: Science Outreach: Public Understanding of Science
(same as BIO_SC 8725, PHYSCS 8350 and LTC 8725). Development of presentations to adult audiences on the science underlying issues of current interest. May be repeated for credit.

Credit Hour: 1-2

AN_SCI 9001: Topics in Animal Science
Credit Hour: 1-99
Prerequisites: Instructor's consent

AN_SCI 9090: Dissertation Research in Animal Science
Investigations in animal breeding, animal nutrition, livestock production and management. Dissertation required. Graded on a S/U basis only.

Credit Hour: 1-99

AN_SCI 9423: Genetics of Populations
Introduction to quantitative genetics with application to animal and plant breeding.

Credit Hours: 4
Prerequisites: STAT 4530 or STAT 7530

AN_SCI 9432: Ruminant Nutrition
(same as NUTRIT 8320). Physiology, chemistry, microbiology, pathology of ruminants. Emphasizes digestion, absorption, metabolism, utilization of nutrients. Lecture, laboratory, assigned readings.

Credit Hours: 3
Prerequisites: AN_SCI 4332/AN_SCI 7332 or equivalent and BIOCHM 4270

AN_SCI 9433: Gamete and Embryo Development
A classical and molecular approach to spermatogenesis, oogenesis, fertilization and preimplantation development in the domestic species.

Credit Hours: 3
Prerequisites: AN_SCI 4314/AN_SCI 7314 or BIO_SC 4984 or equivalent

AN_SCI 9434: Gonadal Function
(same as BIOMED 9434).

Credit Hours: 3
Prerequisites: AN_SCI 4314, biochemistry or cell biology and AN_SCI 8420
AN_SCI 9435: Placentation
Provide students with current and in-depth information about the mechanisms involved in placental development and how the placenta (and placental products) influence maternal physiology - both locally at the placenta-uterine interface and systemically. All course topics will be covered in a comparative cross-species approach whenever possible. Emphasis will be placed on the most recent literature regarding the interactions taking place between the placenta and maternal system and how these interactions lead to the eventual birth of live young.

Credit Hours: 3
Recommended: It is preferred that students take AN_SCI 9433 prior to this class, but this is not an absolute requirement

AN_SCI 9441: Bioenergetics
(same as NUTRIT 8400). Energetic interactions of animals and their physical and nutritional environments.

Credit Hours: 3
Prerequisites: instructor's consent

AN_SCI 9442: Vitamins and Minerals
Designed to provide students with an understanding of the chemical, metabolic, and functional role of vitamins and minerals in nutrition. While the primary focus will be on animals, comparative aspects to human nutrition will be discussed.

Credit Hours: 4
Prerequisites: AN_SCI 3212, BIOCHM 4270 or equivalent

AN_SCI 9452: Mycotoxins
Designed to provide students with an understanding of the occurrence of mycotoxins, mechanisms of toxicity, analytical methodology, and approaches for ameliorating the toxic effects of mycotoxin in animals.

Credit Hours: 3
Prerequisites: instructor's consent and courses in Nutrition and Biochemistry