Animal Science

Undergraduate Study

The Department of Animal Science Undergraduate Program intends for its graduates to be able to detail the symbiotic relationship of animals and humans, to contribute to the solution of complex problems of animal enterprise management using a sustainable model, and to apply their knowledge and skills in a technically demanding global community. To enable learners to pursue a wide array of career interests, the department offers learning experiences ranging from the basic to the applied sciences. The department’s undergraduate degree program has 10 major program goals. They are to provide a comprehensive animal science education in:

- science
- animal management
- agri-business

In addition, our program strives to create an environment developing:

- effective communication skills
- skills enabling students to gather and integrate information to solve problems
- self learners
- leaders and team builders
- awareness of domestic and global issues driving changes in the animal industries.

Our program also works to

- provide career skills appropriate to job market needs
- provide superior counseling for fulfilling individual student objectives.

Learner outcomes for each of these goals, for each of our courses, and other information defining the program can be found at our web site: www.ans.iastate.edu .

The department offers the degrees bachelor of science in animal science and bachelor of science in dairy science. These curricula allow complementary work toward admission to veterinary medical school and other professional schools which may be done while satisfying requirements for the bachelor of science degree (see Index ). Specialized options in Animal Products, Companion Animal Management, Equine Management, Livestock Management, Pre-Professional Studies, and Pre-Veterinary Medicine are available. A combined bachelor of science and master of science in animal science is also offered.

Minor

The department offers a minor in Animal Science. The minor requires:

- AN S 214 Domestic Animal Physiology 3
- AN S 214L Domestic Animal Anatomy and Physiology Lab 1
- AN S 216 Equine Science 3
- AN S 223 Poultry Science 2
- AN S 224 Companion Animal Science 3
- AN S 225 Swine Science 2
- AN S 226 Beef Cattle Science 2
- AN S 229 Sheep Science 2
- AN S 235 Dairy Cattle Science 2
- AN S 270 Foods of Animal Origin 3
- AN S 270L Foods of Animal Origin Laboratory 6
- AN S 319 Animal Nutrition 2
- AN S 331 Domestic Animal Reproduction 3
- AN S 352 Genetic Improvement of Domestic Animals 3
- AN S 360 Fresh Meats 3

Total Credits 17

A total of 9 credits must be earned at Iowa State University in animal science coursework that meets a degree requirement for the B.S. degree in animal science. Students interested in the Animal Science minor should contact an Animal Science adviser.

Minor - Meat Science

The department offers a minor in Meat Science. The minor requires:

- AN S 270 Foods of Animal Origin 2
- AN S 270L Foods of Animal Origin Laboratory 1
- AN S 360 Fresh Meats 3
- AN S 460 Processed Meats 3

One course from the following:
- AN S 489 Issues in Food Safety 1
- AN S 490C Independent Study: Meat Science 1

Two courses from the following:
- FS HN 311 Food Chemistry 2
- FS HN 403 Food Laws, Regulations, and the Regulatory Process 2
- FS HN 405 Food Quality Assurance 2
- FS HN 406 Sensory Evaluation of Food 2
- FS HN 410 Food Analysis 2
- FS HN 412 Food Product Development 2
- FS HN 419 Foodborne Hazards 2
- FS HN 420 Food Microbiology 2
- FS HN 471 Food Processing I 2
- MICRO 407 Microbiological Safety of Foods of Animal Origins 2

Total Credits 15-16

Students majoring in Animal Science will not be allowed to count the 9 required credits (270, 270L, 360, 460) toward their Animal Science degree. Students interested in the Meat Science minor should contact an Animal Science adviser.

The Department also facilitates student participation in the Midwest Poultry Consortium and the Swine Science Online program to offer additional training in poultry and swine production, respectively.

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in animal breeding and genetics; meat science; animal physiology; animal science; and an interdepartmental program in nutritional sciences which has an option in animal nutrition. Minor work is offered in these areas to students taking major work in other departments.

A strong undergraduate program is required for students interested in graduate study. Fundamental training in biology, chemistry, mathematics, and statistics is requisite to a satisfactory graduate program. Graduate programs in animal science include supporting work in areas such as agricultural engineering, agronomy; anatomy; biochemistry; chemistry; economics; environmental science; food science and human nutrition; genetics; microbiology; physics; physiology; and statistics. Students may choose graduate programs involving a co-major with one of these areas. Graduate work in meat science is offered as a co-major in animal science and food science and human nutrition.

The department also cooperates in the interdepartmental program in professional agriculture and interdepartmental majors in genetics, immunobiology, microbiology, MCDB (molecular, cellular, and developmental biology), neuroscience, nutritional sciences, and toxicology (see Index ). The foreign language requirement, if any, is established on an individual basis by the program-of-study committee appointed to guide the work of the student.

Curriculum in Animal Science

Students majoring in animal science will complete the degree requirements listed below. If desired, a student may also choose a specialized option. To earn a degree in Animal Science from Iowa State University a minimum of 15 credits in Animal Science must be earned from courses taught in the Animal Science department at ISU. A minimum of 15 credits of animal science coursework must be earned at Iowa State University. A minimum of 15 credits must be completed from the courses listed to meet the Ethics, International Perspectives, U.S. Diversity, and Humanities and Social Sciences requirements.

See Also: A 4-year plan of study grid showing course template by semester. (https://nextcatalog.registrar.iastate.edu/planofstudy/agricultureandlifesciences/animalscienceb)
Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

### International Perspectives:
- Approved International Perspectives course: 3 cr.

### U.S. Diversity:
- Approved U.S. Diversity course: 3 cr.

### Communications Proficiency (with a C or better):
- English composition: 6 cr.
- Speech fundamentals: 3 cr.
- Total Credits: 9 cr.

### Communication/Library:
- ENGL 150 Critical Thinking and Communication: 3 cr.
- ENGL 250 Written, Oral, Visual, and Electronic Composition: 3 cr.
- LIB 160 Information Literacy: 1 cr.
- One of:
  - SP CM 212 Fundamentals of Public Speaking: 3 cr.
  - AQEDS 311 Presentation and Sales Strategies for Agricultural Audiences: 3 cr.
  - COMST 214 Professional Communication: 3 cr.
- Total Credits: 13 cr.

### Humanities and Social Sciences:
- Approved Humanities course: 3 cr.
- Approved Social Science course: 3 cr.
- Total Credits: 6 cr.

### Ethics:
- Approved Ethics course: 3 cr.

### Mathematical Sciences:
- Note: some options may restrict choices.
- One course from the following: 3-4 cr.
  - MATH 140 College Algebra
  - MATH 150 Discrete Mathematics for Business and Social Sciences
  - MATH 160 Survey of Calculus
  - MATH 165 Calculus I
  - MATH 181 Calculus and Mathematical Modeling for the Life Sciences I
- One course from the following: 3-4 cr.
  - STAT 101 Principles of Statistics
  - STAT 104 Introduction to Statistics
  - STAT 226 Introduction to Business Statistics I
- Total Credits: 6-8 cr.

### Physical Sciences:
- Note: some options may restrict choices

#### One course from the following: 5 cr.
- CHEM 177 General Chemistry I & 177L and Laboratory in General Chemistry I
- Or
  - CHEM 163 College Chemistry & 163L and Laboratory in College Chemistry

#### One course from the following: 3 cr.
- BBMB 221 Structure and Reactions in Biochemical Processes
- CHEM 331 Organic Chemistry I

#### Total Credits: 8 cr.

### Biological Sciences:
- BIOL 211 Principles of Biology I: 3 cr.
- BIOL 211L Principles of Biology Laboratory I: 1 cr.
- BIOL 212 Principles of Biology II: 3 cr.
- BIOL 212L Principles of Biology Laboratory II: 1 cr.
- BIOL 313 Principles of Genetics: 3 cr.
- or GEN 320 Genetics, Agriculture and Biotechnology: 2-3 cr.
  - MICRO 201 Introduction to Microbiology: 1 cr.
  - MICRO 302 Biology of Microorganisms: 3 cr.

#### One course from the following: 1 cr.
- MICRO 201L Introductory Microbiology Laboratory: 1 cr.
- MICRO 302L Microbiology Laboratory: 3 cr.

#### Total Credits: 14-15 cr.

### Business:
- One course from the following: 3 cr.
  - ACCT 284 Financial Accounting: 3 cr.
  - ECON 101 Principles of Microeconomics: 3 cr.
  - ECON 102 Principles of Macroeconomics: 3 cr.

#### Total Credits: 3 cr.

### Animal Science Core:
- AN S 101 Working with Animals: 2 cr.
- AN S 110 Orientation in Animal Science and ISU: 1 cr.
- AN S 114 Survey of the Animal Industry: 2 cr.
- AN S 210 Career Preparation in Animal Science: 1 cr.
- AN S 211 Issues Facing Animal Science: 1 cr.
- AN S 214 Domestic Animal Physiology: 3 cr.
- AN S 214L Domestic Animal Anatomy and Physiology Lab: 1 cr.
- AN S 319 Animal Nutrition: 3 cr.
- AN S 320 Animal Feeds and Feeding: 3 cr.
- AN S 331 Domestic Animal Reproduction: 3 cr.
- AN S 352 Genetic Improvement of Domestic Animals: 3 cr.
- AN S 411 Addressing Issues in Animal Science: 1 cr.

#### Total Credits: 24 cr.

### General Animal Science:
- Animal Science Core: 24 cr.

#### Three courses from the following: 9 cr.
- AN S 216 Equine Science: 3 cr.
- AN S 223 Poultry Science: 3 cr.
- AN S 224 Companion Animal Science: 3 cr.
- AN S 225 Swine Science: 3 cr.
- AN S 226 Beef Cattle Science: 3 cr.
- AN S 229 Sheep Science: 3 cr.
- AN S 235 Dairy Cattle Science: 3 cr.

#### One course from the following: 2-4 cr.
- AN S 336 Domestic Animal Behavior and Well-Being: 2 cr.
- AN S 337 Lactation: 1 cr.
- AN S 345 Growth and Development of Domestic Animals: 2 cr.
- AN S 360 Fresh Meats: 2 cr.
- BIOL 314 Principles of Molecular Cell Biology: 3 cr.
- BIOL 352 Vertebrate Histology: 3 cr.
- BIOL 353 Introductory Parasitology: 3 cr.
- ENT 372 Livestock Entomology: 3 cr.
- ENT 374 Insects and Our Health: 3 cr.
- MICRO 310 Medical Microbiology: 3 cr.
- VDPAM 487 Livestock Disease Prevention: 3 cr.

#### One course from the following: 3 cr.
- AN S 415 Equine Systems Management: 3 cr.
### Pre-Veterinary Medicine Option

#### Animal Science Core
- BSMB 101 Survey of Biology
- CHEM 178 General Chemistry I
- CHEM 179 General Chemistry II
- PHYS 111 Principles of Physics

#### Animal Science Core
- AN S 216 Animal Behavior
- AN S 223 Poultry Science
- AN S 224 Companion Animal Science
- AN S 225 Swine Science
- AN S 226 Beef Cattle Science
- AN S 229 Sheep Science
- AN S 235 Dairy Science
- AN S 240 Animal Production Management

One course from the following: 2-3
- AN S 411 Equine Systems Management
- AN S 419 Companion Animal Systems Management
- AN S 421 Swine Systems Management
- AN S 424 Beef Cattle Systems Management
- AN S 426 Sheep Systems Management
- AN S 429 Dairy Systems Management

#### Total Credits: 61-63

### Livestock Management Option

#### Animal Science Core
- AN S 222 Poultry Science
- AN S 225 Swine Science
- AN S 229 Sheep Science
- AN S 235 Dairy Science

One course from the following: 3
- AN S 336 Domestic Animal Behavior and Well-Being
- AN S 337 Lactation
- AN S 345 Growth and Development of Domestic Animals
- AN S 360 Fresh Meats

Two courses from the following: 6
- AN S 223 Poultry Science
- AN S 225 Swine Science
- AN S 226 Beef Cattle Science
- AN S 229 Sheep Science
- AN S 235 Dairy Science

#### Total Credits: 57-60

### Animal Products Option

#### Animal Science Core
- AN S 222 Poultry Science
- AN S 225 Swine Science
- AN S 229 Sheep Science
- AN S 235 Dairy Science

One course from the following: 3
- AN S 336 Domestic Animal Behavior and Well-Being
- AN S 337 Lactation
- AN S 345 Growth and Development of Domestic Animals
- AN S 360 Fresh Meats

Two courses from the following: 6
- AN S 223 Poultry Science
- AN S 225 Swine Science
- AN S 226 Beef Cattle Science
### Pre-Graduate/Preprofessional Studies Option

**Animal Science Core**
- BCHM 100L
- CHEM 178
- CHEM 331
- CHEM 331L

**Three courses from the following:**
- AN S 229 Sheep Science
- AN S 235 Dairy Cattle Science

**One course from the following:**
- AN S 425 Swine Systems Management
- AN S 426 Beef Cattle Systems Management
- AN S 429 Sheep Systems Management
- AN S 434 Dairy Systems Management

**One course from the following:**
- FS HN 405 Food Quality Assurance
- FS HN 410 Food Analysis
- FS HN 420 Food Microbiology
- MICRO 407 Microbiological Safety of Foods of Animal Origins

**Total Credits**
- 45

### Pre-Graduate/Preprofessional Studies Option

**Animal Science Core**
- BCHM 100L
- CHEM 178
- CHEM 331
- CHEM 331L

**Three courses from the following:**
- AN S 229 Sheep Science
- AN S 235 Dairy Cattle Science

**One course from the following:**
- AN S 425 Swine Systems Management
- AN S 426 Beef Cattle Systems Management
- AN S 429 Sheep Systems Management
- AN S 434 Dairy Systems Management

**One course from the following:**
- FS HN 405 Food Quality Assurance
- FS HN 410 Food Analysis
- FS HN 420 Food Microbiology
- MICRO 407 Microbiological Safety of Foods of Animal Origins

**Total Credits**
- 45

### Pre-Graduate/Preprofessional Studies Option

**Animal Science Core**
- BCHM 100L
- CHEM 178
- CHEM 331
- CHEM 331L

**Three courses from the following:**
- AN S 229 Sheep Science
- AN S 235 Dairy Cattle Science

**One course from the following:**
- AN S 425 Swine Systems Management
- AN S 426 Beef Cattle Systems Management
- AN S 429 Sheep Systems Management
- AN S 434 Dairy Systems Management

**One course from the following:**
- FS HN 405 Food Quality Assurance
- FS HN 410 Food Analysis
- FS HN 420 Food Microbiology
- MICRO 407 Microbiological Safety of Foods of Animal Origins

**Total Credits**
- 45

### Companion Animal Management Option

**Animal Science Core**
- AN S 224 Companion Animal Science
- AN S 336 Domestic Animal Behavior and Well-Being
- AN S 424 Companion Animal Systems Management

**Nine credits of Business and economics electives**
- AN S 216 Equine Science
- AN S 223 Poultry Science
- AN S 224 Companion Animal Science
- AN S 225 Swine Science
- AN S 226 Beef Cattle Science
- AN S 229 Sheep Science
- AN S 235 Dairy Cattle Science
- AN S 270 Foods of Animal Origin
- AN S 270L Foods of Animal Origin Laboratory

**Two courses from the following:**
- AN S 336 Domestic Animal Behavior and Well-Being
- AN S 337 Lactation
- AN S 345 Growth and Development of Domestic Animals
- AN S 360 Fresh Meats
- BIOL 314 Principles of Molecular Cell Biology
- BIOL 352 Vertebrate Histology
- BIOL 353 Introductory Parasitology
- ENT 372 Livestock Entomology
- ENT 374 Insects and Our Health
- MICRO 310 Medical Microbiology
- VDPAM 487 Livestock Disease Prevention

**Three courses from the following:**
- AN S 415 Equine Systems Management
- AN S 424 Companion Animal Systems Management
- AN S 425 Swine Systems Management
- AN S 426 Beef Cattle Systems Management
- AN S 429 Sheep Systems Management
- AN S 434 Dairy Systems Management
- AN S 435 Advanced Animal Nutrition
- AN S 460 Processed Meats
- FS HN 405 Food Quality Assurance
- FS HN 410 Food Analysis

**Total Credits**
- 60-67

### Equine Management Option

**Animal Science Core**
- AN S 216 Equine Science
- AN S 223 Poultry Science
- AN S 224 Companion Animal Science
- AN S 225 Swine Science
- AN S 226 Beef Cattle Science
- AN S 229 Sheep Science
- AN S 235 Dairy Cattle Science
- AN S 270 Foods of Animal Origin
- AN S 270L Foods of Animal Origin Laboratory

**Nine credits from:**
- AN S 425 Swine Systems Management
- AN S 426 Beef Cattle Systems Management
- AN S 429 Sheep Systems Management
- AN S 434 Dairy Systems Management
- AN S 460 Processed Meats
- FS HN 405 Food Quality Assurance
- FS HN 410 Food Analysis
- FS HN 420 Food Microbiology
- MICRO 407 Microbiological Safety of Foods of Animal Origins

**Total Credits**
- 50-51
AN S 313 Exercise Physiology of Animals  
AN S 417 Equine Reproductive Management  
AN S 475E Intercollegiate Judging Training and Competition: Horses  
AN S 490E Independent Study: Equine Science  

Two courses from the following:  
AN S 223 Poultry Science  
AN S 224 Companion Animal Science  
AN S 225 Swine Science  
AN S 226 Beef Cattle Science  
AN S 229 Sheep Science  
AN S 235 Dairy Cattle Science  
AN S 270 Foods of Animal Origin  
& 270L and Foods of Animal Origin Laboratory  

One course from:  
AN S 419 Advanced Animal Nutrition  
AN S 424 Companion Animal Systems Management  
AN S 425 Swine Systems Management  
AN S 426 Beef Cattle Systems Management  
AN S 429 Sheep Systems Management  
AN S 434 Dairy Systems Management  
AN S 460 Processed Meats  
FS HN 405 Food Quality Assurance  
FS HN 410 Food Analysis  
FS HN 420 Food Microbiology  
MICRO 407 Microbiological Safety of Foods of Animal Origins  

Total Credits 47-48  

**Curriculum in Dairy Science**  

Students majoring in Dairy Science will complete the degree requirements listed below. If desired, a student may also include the specialized option in pre-veterinary medicine. A minimum of 15 credits of animal science coursework must be earned at Iowa State University. A minimum of 15 credits must be completed from the courses listed to meet the Ethics, International Perspectives, U.S. Diversity, and Humanities and Social Sciences requirements.  

See Also: A 4-year plan of study grid showing course template by semester  

**Total Degree Requirement: 128 cr.**  

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.  

**International Perspective:**  
Approved International Perspectives course  

**U.S. Diversity:**  
Approved U.S. Diversity course  

**Communications Proficiency:**  
English composition  
Speech fundamentals  

Total Credits 9  

**Communication/Library:**  
ENGL 150 Critical Thinking and Communication  
ENGL 250 Written, Oral, Visual, and Electronic Composition  
One course from the following:  
AGEDS 311 Presentation and Sales Strategies for Agricultural Audiences  
COMST 214 Professional Communication  
SP CM 212 Fundamentals of Public Speaking  
LIB 160 Information Literacy  

Total Credits 10  

**Humanities and Social Sciences:**  
Approved Humanities course  
Approved Social Science course  

Total Credits 6  

**Ethics:**  
Approved Ethics course  

**Mathematics and Business Sciences:**  
ECON 101 Principles of Microeconomics  
One course from the following:  
STAT 101 Principles of Statistics  
STAT 104 Introduction to Statistics  
STAT 226 Introduction to Business Statistics I  

One course from the following:  
MATH 150 Discrete Mathematics for Business and Social Sciences  
MATH 140 College Algebra  
MATH 160 Survey of Calculus  
MATH 181 Calculus and Mathematical Modeling for the Life Sciences I  

Total Credits 9-11  

**Biological Sciences:**  
BIOL 211 Principles of Biology I  
BIOL 211L Principles of Biology Laboratory I  
BIOL 212 Principles of Biology II  
BIOL 212L Principles of Biology Laboratory II  
BIOL 313 Principles of Genetics  
or GEN 320 Genetics, Agriculture and Biotechnology  
One course from the following:  
MICRO 201 Introduction to Microbiology  
MICRO 302 Biology of Microorganisms  

One course from the following:  
MICRO 201L Introductory Microbiology Laboratory  
MICRO 302L Microbiology Laboratory  

Total Credits 14-15  

**Physical Sciences:**  
CHEM 163 College Chemistry  
or CHEM 177 General Chemistry I  
CHEM 163L Laboratory in College Chemistry  
or CHEM 177L Laboratory in General Chemistry I  
BBMB 221 Structure and Reactions in Biochemical Processes  
or CHEM 331 Organic Chemistry I  

Total Credits 8  

**Dairy Sciences:**  
AN S 110 Orientation in Animal Science and ISU  
AN S 114 Survey of the Animal Industry  
AN S 101 Working with Animals  
AN S 210 Career Preparation in Animal Science  
AN S 211 Issues Facing Animal Science  
AN S 214 Domestic Animal Physiology  
AN S 214L Domestic Animal Anatomy and Physiology Lab  
AN S 235 Dairy Cattle Science  
One course from the following:  
AN S 270 Foods of Animal Origin  
& 270L and Foods of Animal Origin Laboratory  
or FS HN 101 Food and the Consumer  
AN S 319 Animal Nutrition  
AN S 320 Animal Feeds and Feeding  
AN S 331 Domestic Animal Reproduction  
AN S 337 Lactation  
AN S 352 Genetic Improvement of Domestic Animals  
AN S 411 Addressing Issues in Animal Science  

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AN S 434  Dairy Systems Management  3
AN S 435  Applied Dairy Farm Evaluation  3
Select 2 courses from an approved list  4-6

Total Credits  43-45

Pre-Veterinary Medicine Option

CHEM 177  General Chemistry I  4
CHEM 177L  Laboratory in General Chemistry I  1
CHEM 178  General Chemistry II  3
CHEM 331  Organic Chemistry I  3
CHEM 331L  Laboratory in Organic Chemistry I  1
CHEM 332  Organic Chemistry II  3
BBMB 301  Survey of Biochemistry  3
PHYS 111  General Physics  5

Total Credits  23

* The Iowa State University College of Veterinary Medicine academic requirements are met by completion of this option (http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements).

Courses primarily for undergraduates:

AN S 101. Working with Animals.
(1-2) Cr. 2. F.S.
A hands-on introductory course in skills for proper care and management of domestic animals. Husbandry skills including health observation, animal movement, identification, management procedures, and environmental assessment are covered.

AN S 110. Orientation in Animal Science and ISU.
(2-0) Cr. 1. F.S.
Orientation to the university and Department of Animal Science. Challenges and opportunities available to the professional animal agriculturalist. Professional goal setting, portfolio development, and development of interpersonal skills in the context of pursuing a career in animal science.

(2-0) Cr. 2. F.S.SS.
Ways domestic animals serve the basic needs of humans for food, shelter, protection, fuel, and emotional well-being. Terminology, basic structures of the industries surrounding the production, care, and marketing of domestic animals in the U.S.

AN S 199. Marketing and Management of Livestock Events.
(0-2) Cr. 1. Repeatable. F.S. Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199A. Marketing and Management of Livestock Events: Beef.
(0-2) Cr. 1. Repeatable. F.S. Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199E. Marketing and Management of Livestock Events: Horses.
(0-2) Cr. 1. Repeatable. F.S. Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

(0-3) Cr. 1. F.S. Prereq: Sophomore classification in An S
Life skill development emphasized in the context of career preparation. Assist students with career goal clarification, interview skills, resume and cover letter preparation. Internship development, job shadowing, and exploration of career option. Offered on a satisfactory-fail basis only.

(2-2) Cr. 3. F.S.SS. Prereq: AN S 101 or AN S 114; one course in biology
Introduction to contemporary concepts, and basic practices and decisions necessary when managing horses through stages of their lives.

AN S 211. Issues Facing Animal Science.
(0-2) Cr. 1. F.S. Prereq: AN S 114, sophomore classification
Overview of the factors that define contemporary ethical and scientifically based issues facing animal agriculture. Life skill development (including interactive skills, communication ability, organization, information gathering, and leadership skills) emphasized in the context of issues study. Offered on a satisfactory-fail basis only.

AN S 214. Domestic Animal Physiology.
(3-0) Cr. 3. F.S. Prereq: BIOL 212, CHEM 163 or CHEM 177
Introduction to anatomy and physiology of the muscular, renal, skeletal, neural, mammary, cardiovascular, respiratory, immune, endocrine, reproductive, and digestive systems of domestic animals.

AN S 214L. Domestic Animal Anatomy and Physiology Lab.
(0-2) Cr. 1. F.S. Prereq: Concurrent enrollment in AN S 214
Basic anatomy of domestic animals.

AN S 216. Equine Science.
(2-2) Cr. 3. F.S.SS. Prereq: AN S 101 or AN S 114; one course in biology
Introduction to contemporary concepts, and basic practices and decisions necessary when managing horses through stages of their lives.

AN S 217. Equine Farm Practicum.
(1-2) Cr. 2. F. Prereq: Student majoring in Animal Science, riding experience An S, credit or concurrent enrollment in AN S 216
Intensified management of the equine farm. Provide students with experiential learning in all phases of horse production and management. Students assist with general farm management, preparing horses for sale, marketing techniques and web design.

AN S 223. Poultry Science.
(2-2) Cr. 3. F.S. Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising poultry through their production cycle.

(2-2) Cr. 3. S. Prereq: Course in biology
Introduction of students to contemporary concepts, and basic practices and decisions necessary when caring for the companion animal through stages of its life.

AN S 225. Swine Science.
(2-2) Cr. 3. F.S. Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising swine through the vertically integrated production cycle.

(2-2) Cr. 3. F.S. Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising beef cattle through the vertically integrated production cycle.

AN S 229. Sheep Science.
(2-2) Cr. 3. F.S. Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising sheep through their production cycle.

AN S 235. Dairy Cattle Science.
(2-2) Cr. 3. F. Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising dairy cattle through the vertically integrated production cycle.

(2-0) Cr. 2. F.S. Prereq: BIOL 212, CHEM 163 or CHEM 177
Principles, practices and issues impacting the production, processing and preservation of safe, wholesome, nutritious, and palatable meat, dairy, and egg products. Product evaluation, classification, value, and utilization.

AN S 270L. Foods of Animal Origin Laboratory.
(0-2) Cr. 1. F.S. Prereq: Credit or current enrollment in AN S 270
Determination of composition and quality of meat, eggs and milk based on industry and USDA standards. Fundamentals of processing foods of animal origin to add value, maintain quality and ensure safety.
AN S 305. Livestock Evaluation. (0-6) Cr. 3. F. Prereq: Junior classification; AN S 270L recommended. Fall semester leads to 475A or D. Breeding animal and market animal evaluation of beef, swine and sheep using contemporary techniques and tools. Communication and decision-making skills are practiced in the context of making selection decisions.

AN S 306. Equine Evaluation. (0-6) Cr. 3. S. Prereq: sophomore classification or permission of instructor. Detailed visual evaluation of conformation and performance of the equine athlete. Decision-making skills are practiced in the context of making selection choices. Development of written and oral communication skills as students defend their judgments. Industry trends will be addressed.

AN S 313. Exercise Physiology of Animals. (2-0) Cr. 2. Alt. S.; offered 2013. Prereq: AN S 214, BIOL 211, one course in chemistry. Interaction of physiological development relative to athletic performance in domestic animals, primarily equine performance.

AN S 317. Fundamentals of Equine Behavior and Training. (0-6) Cr. 1-3. Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317A. Fundamentals of Equine Behavior and Training: Young horses at halter. (0-6) Cr. 1-3. Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317B. Fundamentals of Equine Behavior and Training: Yearlings. (0-6) Cr. 3. Prereq: Permission of instructor. Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317C. Fundamentals of Equine Behavior and Training: Two-year olds and older. (0-6) Cr. 3. Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 319. Animal Nutrition. (3-0) Cr. 3. F.S. Prereq: AN S 214, course in organic chemistry or biochemistry. Structure and function of organic and inorganic nutrients. Digestion, absorption, metabolism and utilization of nutrients for maintenance and productive functions. Essential nutritive requirements of domestic livestock, poultry, and companion animals. Sources of nutrients, application of energy systems and concepts, and regulation of feed intake in animals. Nonmajor graduate credit.


AN S 325. Biorenewable Systems. (Cross-listed with A E, AGRON, TSM, BSE, BUSAD, ECON). (3-0) Cr. 3. F. Prereq: ECON 101, CHEM 163 or higher, MATH 140 or higher. Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

AN S 331. Domestic Animal Reproduction. (3-0) Cr. 3. F.S. Prereq: Course in physiology. Comparative anatomy, physiology, and endocrinology of domestic mammalian animal reproduction. Techniques for the control and manipulation of reproductive processes. Nonmajor graduate credit.

AN S 332. Laboratory Methods in Animal Reproduction. (0-2) Cr. 1. F.S. Prereq: Credit or enrollment in AN S 331. Comparative reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of artificial insemination in farm animals; pregnancy testing; selected laboratory exercises with written report.

AN S 333. Embryo Transfer and Related Technologies. (2-0) Cr. 2. F.S. Prereq: AN S 331 or AN S 332. Application of embryo transfer and related technologies to genetic improvement of mammalian livestock. Techniques for control of female reproduction, embryo collection and transfer, embryo cryopreservation, and embryo manipulation. Gender selection. Economic and genetic aspects of embryo transfer. Nonmajor graduate credit.

AN S 334. Embryo Transfer Laboratory. (0-3) Cr. 1. F. Prereq: Credit or concurrent enrollment in AN S 333; AN S 332 or VDPAM 416; permission of instructor. Selected laboratory exercises related to embryo transfer such as synchronization of estrus, superovulation, detection of estrus, artificial insemination, embryo collection, embryo evaluation, microscopy, embryo cryopreservation, in vitro fertilization, embryo sexing, rectal palpation, and ultrasonography will be demonstrated and/or performed. Nonmajor graduate credit.


AN S 336. Domestic Animal Behavior and Well-Being. (2-2) Cr. 3. F. Prereq: One course in psychology. Principles of behavior relative to animal care, management and environmental design to ensure animal well-being. Examination of basic neural-endocrine mechanisms involved in the animal’s response to its environment. Awareness of animal protection, law and legislation. Methods to objectively assess animal well-being.


AN S 345. Growth and Development of Domestic Animals. (3-0) Cr. 3. S. Prereq: AN S 214; BIOL 313 or GEN 320. Basic principles of animal growth and development covered at the tissue, cellular and molecular level. Emphasis placed on skeletal muscle, adipose, bone, and immune system growth and development. The effects of genetics, nutrition, and pharmaceuticals on growth.

AN S 352. Genetic Improvement of Domestic Animals. (2-2) Cr. 3. F.S. Prereq: One course in statistics, BIOL 211, course in genetics. Principles of qualitative and quantitative genetics applied to creating change in domestic animals. Impact of selection and mating schemes in achieving breeding program goals. Applications and impacts of biotechnological advancements in genetic manipulation. Nonmajor graduate credit.

AN S 360. Fresh Meats. (2-2) Cr. 3. F. Prereq: AN S 270; a course in organic or biochemistry. Impact of muscle structure, composition, rigor mortis, inspection, fabrication, handling, packaging and cooking on the palatability, nutritional value, yields, market value, and safety of fresh meat. Nonmajor graduate credit.


AN S 411. Addressing Issues in Animal Science. (0-2) Cr. 1. F.S. Prereq: Senior classification in An S
Life skill development emphasized in the context of exploring one’s perspective of the most pressing moral and scientific issues facing animal agriculture. Clarification and communication of personal conclusions in small and large group settings expected.

Total ration assessment for the equine including forage management, pasture management, and concentrates. Skill development for nutritional assessment using computer programs.

AN S 415. Equine Systems Management. (2-2) Cr. 3. S. Prereq: AN S 216, AN S 319, AN S 320, AN S 331

AN S 417. Equine Reproductive Management. (2-2) Cr. 3. S. Prereq: AN S 216, AN S 331, AN S 415 or concurrent and permission of instructor
Practical application of managing a breeding farm including servicing the mare, handling stallions, breeding problems, foaling mares, and marketing techniques.

AN S 419. Advanced Animal Nutrition. (2-0) Cr. 2. F. Prereq: AN S 214, AN S 319, AN S 320
Detailed consideration of digestion, metabolism, and assimilation of nutrients. Recent advances and developments in basic nutrition. Nonmajor graduate credit.

AN S 424. Companion Animal Systems Management. (2-2) Cr. 3. S. Prereq: AN S 224, AN S 319, AN S 320, AN S 331, AN S 352
Decisions facing the administrator of a companion animal enterprise. Financial and business goal identification, problem clarification, and resource allocation to manage the companion animal system. Nonmajor graduate credit.

AN S 425. Swine Systems Management. (2-2) Cr. 3. F. Prereq: AN S 225, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended

AN S 426. Beef Cattle Systems Management. (2-2) Cr. 3. F.S. Prereq: AN S 226, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended
Decisions facing the administrator of a beef cow-calf or feedlot enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the beef enterprise. Computer aided study. Nonmajor graduate credit.

AN S 429. Sheep Systems Management. (2-2) Cr. 3. S. Prereq: AN S 229, AN S 319, AN S 320, AN S 331, AN S 352; AGRON 334 recommended; ECON 230 or equivalent recommended

AN S 434. Dairy Systems Management. (3-0) Cr. 3. F. Prereq: AN S 235, AN S 319, AN S 331, AN S 320, AN S 337, AN S 352; ECON 230 or equivalent recommended

AN S 435. Applied Dairy Farm Evaluation. (2-2) Cr. 3. S. Prereq: AN S 434; ECON 230
Evaluate nutrition, reproduction, milk quality, breeding, and related management practices of commercial dairy herds in a case study format. Students will apply knowledge gained in the classroom to commercial dairy farm situations and develop skills in information gathering, decision making, problem solving, and interpersonal communications. Nonmajor graduate credit.

AN S 460. Processed Meats. (Dual-listed with AN S 560). (2-2) Cr. 3. S. Prereq: AN S 270 and AN S 270L
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products. Nonmajor graduate credit.

AN S 475. Intercollegiate Judging Training and Competition. (0-4) Cr. 1-2. Repeatable. F.S. Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475A. Intercollegiate Judging Training and Competition: Meat Animals. (0-4) Cr. 1-2. Repeatable. F.S. Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475B. Intercollegiate Judging Training and Competition: Dairy Cattle. (0-4) Cr. 1-2. Repeatable. F.S. Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475C. Intercollegiate Judging Training and Competition: Meats. (0-4) Cr. 1-2. Repeatable. F.S. Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475E. Intercollegiate Judging Training and Competition: Horses. (0-4) Cr. 1-2. Repeatable. F.S. Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 480. Intercollegiate Judging Training and Competition: Animal Industry Leadership Fellows. Cr. 1. Repeatable. F.S. Prereq: A. AN S 226; permission of instructor C. AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480A. Animal Industry Leadership Fellows: Beef. Cr. 1. Repeatable. F.S. Prereq: AN S 226; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480B. Animal Industry Leadership Fellows: Pork. Cr. 1. Repeatable. F.S. Prereq: AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480C. Animal Industry Leadership Fellows: Poultry. Cr. 1. Repeatable. F.S. Prereq: AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. Central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.
AN S 489. Issues in Food Safety.
(Cross-listed with FS HN, HRI, VOPAM). (1-0) Cr. 1. S. Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HRI 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

AN S 490. Independent Study.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490B. Independent Study: Dairy Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490C. Independent Study: Meat Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490D. Independent Study: Companion Animal Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490E. Independent Study: Equine Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490F. Independent Study: Poultry Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490H. Independent Study: Honors.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490I. Independent Study: Entrepreneurship.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.S.S. Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 493. Workshop in Animal Science.
Cr. 1-3. Repeatable. Prereq: Permission of instructor
Workshop in livestock animal science. Includes current concepts in breeding, nutrition, reproduction, meats, and technologies that impact the animal industry. Nonmajor graduate credit.

AN S 495. Agricultural Travel Course Preparation.
Cr. R. Repeatable. F.S. Prereq: Permission of instructor
Limited enrollment. Students enrolled in this course will also register for Agron 495 and intend to register in Agron 496 and An S 496 the following term. Topics will include the agricultural industries, climate, crops, culture, history, livestock, marketing, soils, and preparation for travel to locations to be visited. Information normally available 9 months before departure.

AN S 496. Agricultural Travel Course.
Cr. arr. Repeatable. Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 496A. Agricultural Travel Course: International tour.
Cr. arr. Repeatable. Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 496B. Agricultural Travel Course: Domestic tour.
Cr. arr. Repeatable. Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 497. Undergraduate Teaching Experiences in Animal Science.
Cr. 1-2. Repeatable, maximum of 4 times. F.S.S.S. Prereq: Permission of instructor
Development of oral and written communication skills of technical concepts in animal science. Emphasis on organizational skills, conducting activities and interpersonal communication skills. Responsibilities in a class under direct supervision of a faculty member. A maximum of 4 credits of An S 497 may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

AN S 500. Computer Techniques for Biological Research.
(2-0) Cr. 1. F.
Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500A. Computer Techniques for Biological Research: UNIX and SAS.
(2-0) Cr. 1. F.
First half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500B. Computer Techniques for Biological Research: Problem solving using matrix algebra.
(2-0) Cr. 1. F.
Second half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.
AN S 501. Survey of Animal Disciplines. (1-0) Cr. 1. F.
Required for Animal Science graduate students. Orientation to departmental and graduate school policies and procedures. Discussion of programs of research and outreach in Animal Science. Issues impacting the animal industry. Offered on a satisfactory-fail basis only.

AN S 503. Seminar in Animal Production. (1-0) Cr. 1. Repeatable. F. Prereq: Permission of instructor
Discussion and evaluation of current topics in animal production and management.

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AN S 519. Digestive Physiology and Metabolism of Non Ruminants. (Cross-listed with NUTRS). (3-0) Cr. 3. Alt. S., offered 2013. Prereq: AN S 419 or NUTRS 501
Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

AN S 520. Digestive Physiology and Metabolism of Ruminants. (Cross-listed with NUTRS). (2-2) Cr. 3. Alt. S., offered 2012. Prereq: AN S 419 or NUTRS 501
Digestive physiology and nutrient metabolism in ruminant and prerniinant animals.

Development of structure and function of the reproductive system. Physiologic and endocrine aspects including puberty, gametogenesis, estrous cycle, pregnancy, maternal recognition, fertilization and early embryonic development.

AN S 536. Perinatology. (2-0) Cr. 2. S. Prereq: One course in physiology; one course in biochemistry
Regulation of metabolism and development in the mammalian fetus and neonate is explored in a comparative manner. Emphasis will be on the dynamic changes in these relationships occurring at birth.

AN S 537. Topics in Farm Animal Environmental Physiology, Behavior, Stress, and Welfare. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537A. Animal rights and philosophies. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537B. Brain mechanisms of stress. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537C. Measuring behavior and welfare. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537D. Environmental stressors. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537E. Stress and the immune system. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 537F. Other related topics. (3-0) Cr. 3. Repeatable, maximum of 6 times. F.S. Prereq: permission of instructor; M.S. or Ph.D. student
Each semester students focus on different topics related to farm animal environmental physiology, behavior, stress, and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line cooperative course involving instructors at Iowa State University, Texas Tech University, and the University of Illinois. Each topic may be taken only one time.

AN S 540. Livestock Immunogenetics. (Cross-listed with MICRO, V MPM). (2-0) Cr. 2. Alt. S., offered 2013. Prereq: AN S 561 or MICRO 579 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

AN S 549. Advanced Vertebrate Physiology I. (Cross-listed with KIN, NUTRS). (4-0) Cr. 4. F. Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

AN S 552. Advanced Vertebrate Physiology II. (Cross-listed with KIN, NUTRS). (3-0) Cr. 3. S. Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

AN S 556. Current Topics in Genome Analysis. (3-0) Cr. 3. Alt. S., offered 2012. Prereq: BBMB 405 or GDCB 510
Introduction to principles and methodology of molecular genetics useful in analyzing and modifying large genomes.

AN S 560. Processed Meats. (Dual-listed with AN S 460). (2-2) Cr. 3. S. Prereq: AN S 270
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

AN S 561. Population and Quantitative Genetics for Breeding. (Cross-listed with AGRON). (4-0) Cr. 4. F. Prereq: STAT 401
Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AN S 562. Methodologies for Population/Quantitative Genetics. (2-0) Cr. 2. S. Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.
AN S 562A. Methodologies for Population/Quantitative Genetics: Linear Models and Genetic Prediction.  
(2-0) Cr. 2. S. Prereq: AN S 561, STAT 402  
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

(2-0) Cr. 2. S. Prereq: AN S 561, STAT 402  
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

(2-2) Cr. 3. S. Prereq: AN S 460  
Ante and postmortem factors impacting composition, structure, and chemistry of red meat and poultry muscle/meat, the conversion of muscle to meat, and the sensory and nutritional attributes of fresh meats. Oral research reports and a research proposal.

AN S 571. Advanced Meat Processing Principles and Technology.  
(2-2) Cr. 3. Alt. F., offered 2012. Prereq: AN S 460 or AN S 570  
Physical/chemical relationships during processing. Effects of modern technology, non-meat additives and preservation techniques on quality and safety of processed meat. Laboratory demonstration of principles and technology.

AN S 590. Special Topics.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590A. Special Topics: Animal Breeding.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590B. Special Topics: Animal Nutrition.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590C. Special Topics: Meat Animal Production.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590D. Special Topics: Dairy Production.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590E. Special Topics: Meat Science.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590F. Special Topics: Physiology of Reproduction.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590G. Special Topics: Muscle Biology.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590H. Special Topics: Poultry Nutrition.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590I. Special Topics: Poultry Products.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590J. Special Topics: Experimental Surgery.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590K. Special Topics: Professional Topics.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590L. Special Topics: Teaching.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590M. Special Topics: Molecular Biology.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590N. Special Topics: Ethology.  
Cr. 1-3. Repeatable. F.S.S. Prereq: Permission of instructor  
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 599. Creative Component.  
Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

AN S 599A. Creative Component: Animal Breeding and Genetics.  
Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

AN S 599C. Creative Component: Animal Physiology.  
Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

AN S 599D. Creative Component: Animal Science.  
Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

AN S 599E. Creative Component: Meat Science.  
Cr. 1-8. F.S.S. Prereq: Nonthesis M.S  
A written report based on research, library readings, or topics related to the student’s area of specialization and approved by the student’s advisory committee.

Courses for graduate students:

(1-0) Cr. 1. Repeatable. F.S. Prereq: Permission of instructor  
Discussion of current literature; preparation and submission of abstracts.

AN S 619. Advanced Nutrition and Metabolism - Protein.  
(Cross-listed with NUTRS.) (2-0) Cr. 2. F. Prereq: BBMB 405  
Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

(Cross-listed with NUTRS.) (2-0) Cr. 2. Alt. S., offered 2012. Prereq: BBMB 405  
Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology; interpretations of classical and current research.

(1-0) Cr. 1. Repeatable. F. Prereq: Permission of instructor  
Discussion of current literature and preparation of reports on selected topics concerning physiology of reproduction.
(2-0) Cr. 2. Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 652A. Animal Breeding Strategies: Breeding Goals and Response to Selection.
(2-0) Cr. 2. Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

(2-0) Cr. 2. Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

(2-0) Cr. 2. F. Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

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(3-1) Cr. 2. Alt. F., offered 2011. Prereq: AN S 500, AN S 562, COM S 207
Computational methods for analysis of large data sets with animal breeding data for use in research and industry applications. Course A (1st half semester) Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Course B (2nd half semester) Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 655A. Computational Strategies for Predicting Breeding Values.
(3-1) Cr. 2. Alt. F., offered 2011. Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Course A (1st half semester) Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Course B (2nd half semester) Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 655B. Computational Strategies for Genetic Parameter Estimation.
(3-1) Cr. 2. Alt. F., offered 2011. Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Course A (1st half semester) Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Course B (2nd half semester) Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.