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 101	Working with Animals	2
AN S 114	Survey of the Animal Industry	2
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
One course from the following:		3
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 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
Two courses from the following:		6
AN S 319	Animal Nutrition	
AN S 331	Domestic Animal Reproduction	
AN S 352	Genetic Improvement of Domestic Animals	
AN S 360	Fresh Meats	
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:		1
AN S 489	Issues in Food Safety	
AN S 490C	Independent Study: Meat Science	
Two courses from the following:		5-6
FS HN 311	Food Chemistry	
FS HN 403	Food Laws, Regulations, and the Regulatory Process	
FS HN 405	Food Quality Assurance	
FS HN 406	Sensory Evaluation of Food	
FS HN 410	Food Analysis	
FS HN 412	Food Product Development	
FS HN 419	Foodborne Hazards	
FS HN 420	Food Microbiology	
FS HN 471	Food Processing I	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
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/#animalsciencebs)

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	3

U.S. Diversity:

Approved U. S. Diversity course	3

Communications Proficiency (with a C or better):

English composition	6
Speech fundamentals	3
Total Credits	9

Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One of		3
SP CM 212	Fundamentals of Public Speaking	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
COMST 214	Professional Communication	
One of:		3
ENGL 302	Business Communication	
ENGL 309	Report and Proposal Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
Total Credits		13

Humanities and Social Sciences:

Approved Humanties course	3
Approved Social Science course	3
Total Credits	6

Ethics:

Approved Ethics course	3

Mathematical Sciences:

Note: some options may restrict choices.

One course from the following:		3-4
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
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences:

Note: some options may restrict choices

One course from the following:		5
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
Or		
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
One course from the following:		3
BBMB 221	Structure and Reactions in Biochemical Processes	
CHEM 331	Organic Chemistry I	
Total Credits		8

Biological Sciences:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
One course from the following:		2-3
MICRO 201	Introduction to Microbiology	
MICRO 302	Biology of Microorganisms	
One course from the following:		1
MICRO 201L	Introductory Microbiology Laboratory	
MICRO 302L	Microbiology Laboratory	
Total Credits		14-15

Business:

One course from the following:		3
ACCT 284	Financial Accounting	
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
Total Credits		3

Animal Science Core:

AN S 101	Working with Animals	2
AN S 110	Orientation in Animal Science and ISU	1
AN S 114	Survey of the Animal Industry	2
AN S 210	Career Preparation in Animal Science	1
AN S 211	Issues Facing Animal Science	1
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
AN S 319	Animal Nutrition	3
AN S 320	Animal Feeds and Feeding	3
AN S 331	Domestic Animal Reproduction	3
AN S 352	Genetic Improvement of Domestic Animals	3
AN S 411	Addressing Issues in Animal Science	1
Total Credits		24

General Animal Science:

Animal Science Core		24
Three courses from the following:		9
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 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
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	
One course from the following:		3
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	
One course from the following:		2-3
AN S 415	Equine Systems Management	
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		40-43

Pre-Veterinary Medicine Option

Animal Science Core		24
BBMB 301	Survey of Biochemistry	3
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
PHYS 111	General Physics	5
Three courses from the following:		9
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 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
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	
One course from the following:		3
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	
One course from the following:		2-3
AN S 415	Equine Systems Management	
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		58-61

* 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).

Livestock Management Option

Animal Science Core		24
ACCT 284	Financial Accounting	3
AGEDS 451	Agricultural Law	4
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
ECON 230	Farm Business Management	3
ECON 334	Entrepreneurship in Agriculture	3
VDPAM 487	Livestock Disease Prevention	3
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 Cattle 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	
One course from the following:		3
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:		2-3
AN S 415	Equine Systems Management	
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		57-58

Animal Products Option

Animal Science Core		24
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
AN S 360	Fresh Meats	3
AN S 460	Processed Meats	3
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 Cattle Science	
One course from the following:		3
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:		3
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		24
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
One course from the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Three courses from the following:		9
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 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
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	
One course from the following:		3
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	
One course from the following:		2-3
AN S 415	Equine Systems Management	
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	
Three courses from the following:		9-13
BBMB 301	Survey of Biochemistry	
BBMB 404	Biochemistry I	
BBMB 405	Biochemistry II	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 351	Comparative Chordate Anatomy	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
BIOL 365	Vertebrate Biology	
BIOL 423	Developmental Biology	
BIOL 434	Endocrinology	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 332	Organic Chemistry II	
MATH 166	Calculus II	
or MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	
MICRO 475	Immunology	
PHYS 111	General Physics	
PHYS 112	General Physics	
STAT 401	Statistical Methods for Research Workers	
STAT 402	Statistical Design and the Analysis of Experiments	
Total Credits		60-67

Companion Animal Management Option

Animal Science Core		24
AN S 224	Companion Animal Science	3
AN S 336	Domestic Animal Behavior and Well-Being	3
AN S 424	Companion Animal Systems Management	3
Nine credits of Business and economics electives		9
Two courses from the following:		6
AN S 216	Equine Science	
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 Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from:		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
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

Equine Management Option

Animal Science Core		24
AN S 216	Equine Science	3
AN S 415	Equine Systems Management	3
Nine credits from:		9
AN S 199E	Marketing and Management of Livestock Events: Horses	
AN S 217	Equine Farm Practicum	
AN S 306	Equine Evaluation	

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		6
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 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from:		2-3
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	3

U.S. Diversity:

Approved U.S. Diversity course	3

Communications Proficiency:

English composition	6
Speech fundamentals	3
Total Credits	9

Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One course from the following:		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
COMST 214	Professional Communication	
SP CM 212	Fundamentals of Public Speaking	
LIB 160	Information Literacy	1
Total Credits		10

Humanities and Social Sciences:

Approved Humanities course	3
Approved Social Science course	3
Total Credits	6

Ethics:

Approved Ethics course	3

Mathematics and Business Sciences:

ECON 101	Principles of Microeconomics	3
One course from the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
One course from the following:		3-4
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	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
One course from the following:		2-3
MICRO 201	Introduction to Microbiology	
MICRO 302	Biology of Microorganisms	
One course from the following:		1
MICRO 201L	Introductory Microbiology Laboratory	
MICRO 302L	Microbiology Laboratory	
Total Credits		14-15

Physical Sciences:

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
BBMB 221	Structure and Reactions in Biochemical Processes	3
or CHEM 331	Organic Chemistry I	
Total Credits		8

Dairy Sciences:

AN S 110	Orientation in Animal Science and ISU	1
AN S 114	Survey of the Animal Industry	2
AN S 101	Working with Animals	2
AN S 210	Career Preparation in Animal Science	1
AN S 211	Issues Facing Animal Science	1
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
AN S 235	Dairy Cattle Science	3
One course from the following:		
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
or FS HN 101	Food and the Consumer	
AN S 319	Animal Nutrition	3
AN S 320	Animal Feeds and Feeding	3
AN S 331	Domestic Animal Reproduction	3
AN S 337	Lactation	3
AN S 352	Genetic Improvement of Domestic Animals	3
AN S 411	Addressing Issues in Animal Science	1

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.

AN S 114. Survey of the Animal Industry.
(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.

AN S 210. Career Preparation in Animal Science.
(0-2) 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.

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.

AN S 224. Companion Animal Science.
(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.

AN S 226. Beef Cattle Science.
(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.

AN S 270. Foods of Animal Origin.
(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 orgin 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 320. Animal Feeds and Feeding.
(2-2) Cr. 3. F.S. *Prereq: AN S 319*
Composition, physical properties, and storage and processing of feedstuffs. Nutrient requirements of and diet formulation, and preparation systems for food and companion animal species at varying stages of age, activity or production. Manual and computer methodologies for diet formulation.

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 335. Dairy Cattle Evaluation.
(0-6) Cr. 3. S. *Prereq: Sophomore classification*
Evaluation of breeding animals for dairy herds. Comparative terminology, decision making, and presentation of oral reasons. Trips to dairy cattle farms. Livestock handling.

AN S 336. Domestic Animal Behavior and Well-Being.
(2-2) Cr. 3. F. *Prereq: One course in physiology*
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 337. Lactation.
(3-0) Cr. 3. S. *Prereq: AN S 214*
The structure, development and evolution of the mammary gland. Mammary metabolism, milk synthesis; neural and endocrine regulation of mammary function. Immune function and health of the mammary gland. Current events related to lactation.

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 399. Animal Science Internship.
Cr. arr. Repeatable. F.S.SS.

AN S 399A. Animal Science Internship: Graded Internship Experience.
Cr. 2-6. Repeatable. F.S.SS. *Prereq: Permission of the instructor*
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

AN S 399B. Animal Science Internship: Supervised Internship Experience.
Cr. 2-6. Repeatable. F.S.SS. *Prereq: Permission of the instructor*
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

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.

AN S 414. Equine Nutrition and Feeding.
(2-0) Cr. 2. Alt. S., offered 2012. *Prereq: AN S 319*
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*
Application of advanced horse management - nutrition, reproduction, exercise physiology and business. Computer-aided management. Explore topics of current concern in the horse industry. Computer aided study. Nonmajor graduate credit.

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*
Decisions facing the administrator of a swine enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the swine enterprise. Computer aided study. Nonmajor graduate credit.

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*
Decisions facing the administrator of a sheep enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the sheep enterprise. Computer aided study. Nonmajor graduate credit.

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*
Decisions facing the administrator of a dairy enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the dairy enterprise. Computer aided study. Nonmajor graduate credit.

AN S 435. Applied Dairy Farm Evaluation.
(2-2) Cr. 3. S. *Prereq: AN S 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.

AN S 475D. Intercollegiate Judging Training and Competition: Meat Animal Evaluation.
(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 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 475F. Intercollegiate Judging Training and Competition: Management Systems.
(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 480C. 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 480G. Animal Industry Leadership Fellows: Poultry.
Cr. 1. Repeatable. F.S. *Prereq: AN S 223; 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, VDPAM). (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.SS. *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 490A. Independent Study: Animal Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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 490G. Independent Study: Poultry Science.
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS. *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.SS. *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.SS. *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 production. 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.
Meets International Perspectives Requirement.

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.SS. *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.

AN S 515. Integrated Crop and Livestock Production Systems.
(Cross-listed with A E, AGRON, SUSAG). (3-0) Cr. 3. Alt. F., offered 2011. *Prereq: SUSAG 509*
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 518. 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 preruminant animals.

AN S 533. Physiology and Endocrinology of Animal Reproduction.
(2-0) Cr. 2. Alt. S., offered 2012. *Prereq: General physiology course*
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 575 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.

AN S 562B. Methodologies for Population/Quantitative Genetics: Advanced Genetic Prediction&Parameter Estimation.
(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 570. Advanced Meat Science and Applied Muscle Biology.
(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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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.SS. *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 599B. Creative Component: Animal Nutrition.
Cr. 1-8. F.S.SS. *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.SS. *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.SS. *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.SS. *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:

AN S 603. Seminar in Animal Nutrition.
(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.

AN S 620. Advanced Nutrition and Metabolism - Energy.
(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.

AN S 633. Seminar in Animal Reproduction.
(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.

AN S 652. Animal Breeding Strategies.
(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.

AN S 652B. Animal Breeding Strategies: Design and Evaluation of Animal Breeding Programs.
(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 653. Applied Animal Breeding Strategies.
(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.

AN S 653A. Applied Animal Breeding Strategies: Swine and Poultry.
(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.

AN S 653B. Applied Animal Breeding Strategies: Beef and Dairy.
(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.

AN S 655. Advanced Computational Methods in Animal Breeding and Genetics.
(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 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.

AN S 656. Statistical Methods for Mapping Quantitative Trait Loci.
(2-0) Cr. 2. Alt. S., offered 2012. *Prereq: AN S 562, STAT 447*
Statistical methods for mapping quantitative trait loci in out-bred populations. Methods based on modeling covariances between relatives. Likelihood based methods using half-sib and full-sib families and extended pedigrees. Bayesian methods applied.

AN S 658. Seminar in Animal Breeding and Genetics.
(1-0) Cr. 1. Repeatable. F.S.
Presentation of current research related to animal breeding and genetics.

AN S 670. Molecular Biology of Muscle.
(3-0) Cr. 3. Alt. F., offered 2012. *Prereq: BBMB 405, BBMB 420, or BBMB 502*
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

AN S 684. Seminar in Meat Science.
(1-0) Cr. 1. Repeatable. S. *Prereq: Permission of instructor*
Discussion and evaluation of current topics in research publications in meat science.

AN S 685. Seminar in Muscle Biology.
(1-0) Cr. 1. Repeatable. S. *Prereq: Permission of instructor*
Reports and discussion of recent literature and current investigations.

AN S 695. Seminar in Animal Science.
(1-0) Cr. 1. Repeatable. S.
Reports and discussion of current issues and research in animal science. One credit is required for all M.S. degree candidates with graduate majors in the Department of Animal Science, and two credits are required for all Ph.D. candidates with graduate majors in the Department of Animal Science. Offered on a satisfactory-fail basis only.

AN S 699. Research.
Cr. arr. Repeatable.

AN S 699A. Research: Animal Breeding.
Cr. arr. Repeatable.

AN S 699B. Research: Animal Nutrition.
Cr. arr. Repeatable.

AN S 699C. Research: Meat Animal Production.
Cr. arr. Repeatable.

AN S 699D. Research: Dairy Production.
Cr. arr. Repeatable.

AN S 699E. Research: Meat Science.
Cr. arr. Repeatable.

AN S 699F. Research: Physiology of Reproduction.
Cr. arr. Repeatable.

AN S 699G. Research: Muscle Biology.
Cr. arr. Repeatable.

AN S 699H. Research: Poultry Nutrition.
Cr. arr. Repeatable.

AN S 699I. Research: Poultry Products.
Cr. arr. Repeatable.

AN S 699J. Research: Animal Ethology.
Cr. arr. Repeatable.