ANIMAL SCIENCE

The Department of Animal Science Undergraduate Program intends for its graduates to be able to explain the symbiotic relationship of animals and humans, to contribute to the solution of complex problems of animal enterprise management, and to apply their knowledge and skills in a technically demanding global community. Graduates of our program will be knowledgeable about sustainable animal production practices that also ensure animal health and well-being and stewardship of natural resources.

To enable learners to pursue a wide array of career interests, the department offers learning experiences ranging from the basic to the applied sciences. Learner outcomes for these goals, for each of our courses, and other information defining the program can be found at our web site: https://www.ans.iastate.edu/undergraduate-students (https://www.ans.iastate.edu/undergraduate-students/). Our program is designed to provide career skills appropriate to job market needs. Our faculty goals include providing superior academic advising to enable students to fulfill their objectives.

Student Learning Outcomes

Learning outcomes for the Animal and Dairy Science majors dictate that, upon completion of the program, graduates will be able to:

- Apply scientifically based practices for the care, management, and study of managed animals and animal products.
- Communicate in oral and written formats.
- Describe the contemporary domestic and global issues impacting animal science.
- Contribute or lead team efforts to achieve group goals.
- Utilize effective life-long learning skills.
- Evaluate the impacts of animal management practices on economic, sociological, and environmental sustainability.

The department offers the degrees Bachelor of Science in animal science and Bachelor of Science in dairy science. A double major in animal and dairy science is not permitted. However, combining either the animal science or dairy science majors with other curricula is permitted. A limit of 6 credits each in Intercollegiate Judging (Animal Science 4750), or any independent study course (4900 courses) can be applied toward a degree. A limit of 4 credits of Undergraduate Teaching Experience (Animal Science 4970) can be applied toward a degree.

The department offers a minor in Animal Science and a minor in Meat Science. Certificates in Beef Cattle Production Management, Dairy Cattle Management, Swine Production Management, Poultry Production Management, and Equine Science and Management are also offered. Both the animal science curricula and dairy science 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. A program that combines Bachelor of Science and Master of Science in animal science is offered. In addition, a program that combines a Bachelor of Science and Master of Business Administration is offered. The Department facilitates student participation in the Midwest Poultry Consortium and the Swine Science Online program to offer additional training in poultry and swine production, respectively.

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.

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

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 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
SPCM 2120	Fundamentals of Public Speaking	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	
COMST 2140	Professional Communication	
One course from the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	

ENGL 3140	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

One course from the following:		3-4
MATH 1400	College Algebra	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
One course from the following:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	
Total Credits		**6-8**

Physical Sciences

A minimum of 8 credits are required. These requirements are specific to option and are listed with each option below.

Biological Sciences

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
or GEN 3200	Genetics, Agriculture and Biotechnology	
MICRO 2010 & 2010L	Introduction to Microbiology and Introductory Microbiology Laboratory	3-4
or MICRO 3020 & 3020L	Biology of Microorganisms and Microbiology Laboratory	
Total Credits		**14-15**

Business

One course from the following:		3
ACCT 2840	Financial Accounting	
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
Total Credits		**3**

Animal Science Core

ANS 1010	Working with Animals	2
ANS 1100	Orientation in Animal Science and ISU	1
ANS 1140	Survey of the Animal Industry	2
ANS 2100	Career Preparation in Animal Science	1
ANS 2110	Issues Facing Animal Science	1
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
ANS 3190	Animal Nutrition	3
ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4110	Addressing Issues in Animal Science	1
Total Credits		**24**

General Animal Science

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 3310	Organic Chemistry I	3
or BBMB 2210	Structure and Reactions in Biochemical Processes	
Three courses from the following:		9
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2280	Laboratory Animal Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
ANS 3130	Exercise Physiology of Animals	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
BIOL 3140	Principles of Molecular Cell Biology	

BIOL 3520	Vertebrate Histology	
BIOL 3530	Introductory Parasitology	
ENT 3720	Livestock Entomology	
ENT 3740	Insects and Our Health	
MICRO 3100	Medical Microbiology	
VDPAM 4870	Livestock Disease Prevention	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	
AGRON 3340	Forage Crop Management	
One course from the following:		3
ANS 4150	Equine Systems Management	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
One course from the following:		2-3
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
FSHN 4100	Food Analysis	
FSHN 4200	Food Microbiology	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
Total Credits		**27-30**
Additional free electives required for Animal Science		23-29

Pre-Veterinary Medicine Option

BBMB 3010	Survey of Biochemistry	3
or BBMB 3160	Principles of Biochemistry	
or BBMB 4040	Biochemistry I	
or BBMB 4200	Mammalian Biochemistry	
CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5
Three courses from the following:		9
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2280	Laboratory Animal Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
ANS 3130	Exercise Physiology of Animals	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
BIOL 3140	Principles of Molecular Cell Biology	
BIOL 3520	Vertebrate Histology	
BIOL 3530	Introductory Parasitology	
ENT 3720	Livestock Entomology	
ENT 3740	Insects and Our Health	
MICRO 3100	Medical Microbiology	
VDPAM 4870	Livestock Disease Prevention	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	
AGRON 3340	Forage Crop Management	
One course from the following:		3
ANS 4150	Equine Systems Management	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
One course from the following:		2-3
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	

ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
FSHN 4100	Food Analysis	
FSHN 4200	Food Microbiology	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
Total Credits		**39-42**

Additional free electives required for the Pre-veterinary Medicine Option	8-14

* 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 (http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements/)).

Animal Science, B.S. - GENERAL

Freshman

Fall	Credits	Spring	Credits
ANS 1100	1	ANS 1140	2
ANS 1010	2	CHEM 1770 or 1630	4
BIOL 2110	3	CHEM 1770L or 1630L	1
BIOL 2110L	1	Humanities - elective list	3
ENGL 1500	3	SPCM 2120, AGEDS 3110, AGEDS 3270, or COMST 2140	3
LIB 1600	1	STAT 1010, 1040, or 2260	3-4
MATH 1400, 1500, 1600, or 1650	3-4		
Soc. Sci. - elective list	3		
	17-18		**16-17**

Sophomore

Fall	Credits	Spring	Credits
ANS 2110	1	ANS 2100	1
ANS 2000 - elective list	3	ANS 2140	3
ANS 2000 - elective list	3	ANS 2140L	1
BIOL 2120	3	ANS 2000 - elective list	3
BIOL 2120L	1	ENGL 2500	3
BBMB 2210	3	MICRO 2010 or 3020	2-3
ECON 1010, 1020, or ACCT 2840	3	MICRO 2010L or 3020L	1
		Free elective	3
	17		**17-18**

Junior

Fall	Credits	Spring	Credits
ANS 3190	3	ANS 3200	3
ANS 3310	3	ANS 3520	3
GEN 3200 or BIOL 3130	3	ANS 3000 - elective list	3
U.S. Diversity - elective list	3	Ethics -elective list	3
Free elective	3	Free elective	3
	15		**15**

Senior

Fall	Credits	Spring	Credits
ANS 4110	1	ANS 4000 - Option 2	3
ANS 4000 - Option 1	3	International Perspective - elective list	3
ENGL 3020, 3090, 3120, or 3140	3	Free elective	3
Free elective	3	Free elective	3
Free elective	3	Free elective	4
Free elective	3		
	16		**16**

Important Note: This is only one of many equally-sound schedule sequences. Free electives and specified group electives are often chosen to complement the student's career focus. The student's academic advisor assists with developing scheduling schemes that prepare students individually for careers in the animal industry. They are explained fully in ANS 1100 and through appointments with the student's advisor.

Animal Science, B.S. - pre-veterinary medicine

Freshman

Fall	Credits	Spring	Credits
ANS 1100	1	ANS 1140	2
ANS 1010	2	CHEM 1770	4
BIOL 2110	3	CHEM 1770L	1
BIOL 2110L	1	Humanities - elective list	3
ENGL 1500	3	SPCM 2120, AGEDS 3110, AGEDS 3270, or COMST 2140	3
LIB 1600	1	STAT 1010, 1040, or 2260	3-4
MATH 1400, 1500, 1600, or 1650	3-4		
Soc. Sci. - elective list	3		
	17-18		**16-17**

Sophomore

Fall	Credits	Spring	Credits
ANS 2110	1	ANS 2140	3
ANS 2000 - elective list	3	ANS 2140L	1
ANS 2000 - elective list	3	ANS 2000 - elective list	3
BIOL 2120	3	CHEM 3310	3
BIOL 2120L	1	CHEM 3310L	1
CHEM 1780	3	ENGL 2500	3
ECON 1010, 1020, or ACCT 2840	3	Ethics - elective list	3
	17		**17**

Junior

Fall	Credits	Spring	Credits
ANS 2100	1	ANS 3200	3
ANS 3190	3	ANS 3520	3
ANS 3310	3	ANS 3000 - elective list	3
GEN 3200 or BIOL 3130	3	BBMB 3010, 3160, 4040, or 4200	3
CHEM 3320	3	US Diversity - elective list	3
MICRO 2010 or 3020	2-3		
MICRO 2010L or 3020L	1		
	16-17		**15**

Senior

Fall	Credits	Spring	Credits
ANS 4110	1	ANS 4000 - Option 2	3
ANS 4000 - Option 1	3	International Perspective - elective list	3
ENGL 3020, 3090, 3120, or 3140	3	Free elective	3
PHYS 1310	4	Free elective	3
PHYS 1310L	1	Free elective	3
Free elective	3		
Free elective	2		
	17		**15**

Important Note: This is only one of many equally-sound schedule sequences.

* Credits currently required for application to Veterinary Medicine program at ISU (55 credits)

General Chemistry with lab (7)

Organic Chemistry with lab (4)

Biochemistry (3)

General Physics with lab (4)

General Biology with lab (8)

Genetics/Animal Breeding (3)

Mammalian Anatomy and/or Physiology (3)

English Composition (6)

Oral Communication (3)

Humanities and/or Social Sciences (6)

Other Electives (8)

Minors: Animal Science and Meat Science

All minors require at least 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

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

ANS 1010	Working with Animals	2
ANS 1140	Survey of the Animal Industry	2
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
One course from the following:		3
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		3
ANS 3130	Exercise Physiology of Animals	
ANS 3190	Animal Nutrition	
ANS 3310	Domestic Animal Reproduction	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3520	Genetic Improvement of Domestic Animals	
One course from the following:		2-3
ANS 3190	Animal Nutrition	
ANS 3200	Animal Feeds and Feeding	
ANS 3310	Domestic Animal Reproduction	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3520	Genetic Improvement of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	

ANS 4190	Advanced Animal Nutrition	
Total Credits		**16-17**

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 advisor.

Minor - Meat Science

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

ANS 2700	Foods of Animal Origin	2
ANS 2700L	Foods of Animal Origin Laboratory	1
ANS 3600	Fresh Meat Science and Applied Muscle Biology	3
ANS 4600	Science and Technology of Value Added Meat Products	3
One course from the following:		1
ANS 4890	Issues in Food Safety	
ANS 4900C	Independent Study: Meat Science	
5-6 Credits from the following		5-6
ANS 3240	Food Processing for Companion Animals	
FSHN 3050	Food Quality Management and Control	
FSHN 3110	Food Chemistry	
FSHN 4030	Food Laws and Regulations	
FSHN 4060	Sensory Evaluation of Food	
FSHN 4100	Food Analysis	
FSHN 4120	Food Product Development	
FSHN 4200	Food Microbiology	
FSHN 4710	Food Processing	
MICRO 4070	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 (2700, 2700L, 3600, 4600) toward their Animal Science degree. Students interested in the Meat Science minor should contact an Animal Science advisor.

The Department of Animal Science offers certificates in:

- Beef Cattle Production Management
- Dairy Cattle Production Management
- Equine Science and Management
- Poultry Production Management
- Swine Production Management

All certificates require at least 24 credits, including at least 18 credits at the 3000 or 4000 level. At least 9 credits must be unique to the certificate and will not be applied to a major, minor, or another certificate. All courses applied to the certificate must be taken for a grade. A cumulative GPA of 2.0 is required to complete the program and receive the certificate.

Beef Cattle Production Management

Foundation Course (3 credits)

ANS 2260	Beef Cattle Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3

* Course fulfills the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management ^	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

^ Course is a prerequisite for ANS 4260

Beef Cattle Production Emphasis (6 credits)

ANS 4260	Beef Cattle Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Dairy Cattle Production Management Certificate

Foundation Course (3 credits)

ANS 2350	Dairy Cattle Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3370	Lactation	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3350	Dairy Cattle Evaluation	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4190	Advanced Animal Nutrition	2
FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
MICRO 3020	Biology of Microorganisms	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology *	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics *	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management ^	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3
ECON 3370	Agricultural Marketing	3

^ Course is a prerequisite for ANS 4340

Dairy Cattle Production Emphasis (6 credits)

ANS 4340	Dairy Systems Management	3
or ANS 4350	Applied Dairy Farm Evaluation	
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Equine Science and Management Certificate

Foundation Course (3 credits)

ANS 2160	Equine Science	3

Fundamental Disciplines in Animal Science (6 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3

Equine Expertise Expansion (6 credits)

ANS 2170	Equine Farm Practicum	2
ANS 3060	Equine Evaluation	3
ANS 3130	Exercise Physiology of Animals *	3
ANS 3160	Equine Reproduction Lab	3
ANS 3170A	Fundamentals of Equine Behavior and Training: Young Horses at Halter	1
ANS 3170B	Fundamentals of Equine Behavior and Training: Yearlings	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Expertise Expansion (3 credits)

ACCT 2150	Legal Environment of Business	3
AGEDS 4510	Agricultural Law	3
AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3370	Lactation	3
ANS 3450	Growth and Development of Domestic Animals *	3
ECON 3200	Labor Economics	3
ECON 3340	Entrepreneurship in Agriculture	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Equine Management Emphasis (6 credits)

ANS 4150	Equine Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Poultry Production Management Certificate

Foundation Course (3 credits)

ANS 2230	Poultry Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3
ANS 3730A	Poultry Products Technology #	3
ANS 3730B	Applied Avian Physiology #	3
ANS 3730C	Avian Health #	3
ANS 3730D	Poultry Nutrition #	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

\# Courses are held as part of the Midwest Poultry Consortium COE courses during the summer

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

Poultry Production Emphasis (6 credits, to include ANS 3990 and choice of one 4000-level management)

ANS 3990A	Animal Science Internship: Graded Internship Experience	3
ANS 4730A	Poultry Enterprise Management #	3
ANS 4730B	Breeder Flock and Hatchery Management #	3

\# Courses are held as part of the Midwest Poultry Consortium COE courses during the summer

Swine Production Management Certificate

Foundation Course (3 credits)

ANS 2250	Swine Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
ANS 3800C	Employee Management for the Swine Industry	1
ANS 3800D	Farrowing Management	1
ANS 3800E	Swine Feed Mill Management	1
ANS 3800F	Marketing and Risk Management in the Swine Industry	1
ANS 3800G	Swine Nursery and Finishing Management	1
ANS 3820	Swine Environment Management	1
ANS 3830	Swine Manure and Nutrient Management	1
ANS 3840	Swine Health and Biosecurity	1
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

Swine Production Emphasis (6 credits)

ANS 4250	Swine Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

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 (http://catalog.iastate.edu/azindex/)).

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.