

# ANIMAL SCIENCE (AN S)

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## **Any experimental courses offered by AN S can be found at:**

registrar.iastate.edu/faculty-staff/courses/explisting/ (<http://www.registrar.iastate.edu/faculty-staff/courses/explisting/>)

## **Courses primarily for undergraduates:**

### **AN S 101: Working with Animals**

(1-2) Cr. 2. F.S.SS.

An introductory course in skills for proper care, handling, and management of domestic animals. Terminology and skills in working with animals, identification, life-cycle management practices, and animal health management are introduced and examined.

### **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.

Principles of management and care of domestic animals, including genetics, nutrition, and reproduction. Service of domestic animals to society in terms of food, shelter, protection, fuel and emotional well-being. Basic biology, industry structure, management practices and production systems.

### **AN S 116: Practicum in Safe Equine Handling and Welfare**

(0-3) Cr. 1. F.

Development of best practices for safe horse handling and practical equine health care tasks. Course will focus on equine welfare and human safety as well as provide training in necessary every day skills needed to own a horse or to work at a horse farm. Certificate of Safe Equine Handling and Welfare available upon course completion.

### **AN S 190: Livestock Handling, Safety and Welfare**

Cr. 2. F.S.

*Prereq: AN S 101*

Understanding of animal perception to develop best care practices involved in handling of livestock species (beef, sheep, swine, dairy, equine, poultry). Intensive development of skills associated with handling and moving healthy and compromised livestock in respect to human and animal welfare. Integration of scientific and theoretical knowledge of biosecurity and animal-human interactions as it related to livestock handling and movement.

### **AN S 199: Marketing and Management of Livestock Events**

(0-2) Cr. 1. Repeatable. F.S.

*Prereq: Credit or concurrent 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. 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 concurrent 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. 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 concurrent 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. 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 207: The Art and Heritage of Livestock**

(3-0) Cr. 3. F.

Using art as a venue to understand the legacy and heritage of livestock production and livestock's contribution to civilization and society; livestock's contributions to warfare, social class, industry, economies, etc.; history of the impact of livestock on painting, poetry, music, sculpture, advertising, pop culture, movies, religion and sports in society.

### **AN S 210: Career Preparation in Animal Science**

(0-2) Cr. 1. F.S.

*Prereq: Sophomore classification; AN S major*

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.

**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 167 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.

Basic anatomy of domestic animals.

**AN S 216: Equine Science**

(2-2) Cr. 3. F.S.

*Prereq: (AN S 101 or AN S 114); (BIOL 101 or BIOL 211 or BIOL 212)*

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.S.

*Prereq: Credit or concurrent enrollment in AN S 216 or Permission of Instructor*

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, horse health care, weekly farm management, and related topics.

**AN S 223: Poultry Science**

(2-2) Cr. 3. F.

*Prereq: AN S 101; AN S 114*

Introduction to modern production trends with a focus on broiler, layer, and turkey industries. Topics covered include breeds, handling, management, physiology, nutrition, genetics, health & disease, and products. Weekly labs meet off campus.

**AN S 224: Companion Animal Science**

(2-2) Cr. 3. S.

*Prereq: BIOL 101 or BIOL 211 or BIOL 212*

Introduction to the science of managing companion animals through life stages. Topics covered will include human-animal bond, common and uncommon species kept as pets, breeds, behavior, basic training, nutrition, genetics, and breeding.

**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. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

**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 228: Laboratory Animal Science**

Cr. 3. F.

*Prereq: AN S 101; AN S 114*

Introduction to the species, uses, biology, facilities, care, and diseases of animals used in research. AN S 214 recommended.

**AN S 229: Sheep Science**

(2-2) Cr. 3. 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.SS.

*Prereq: BIOL 212; (CHEM 163 or CHEM 167 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 concurrent enrollment in AN S 270*

Determination of composition and quality of meat, eggs and milk based on industry and USDA standards. Fundamentals of processing foods of animal origin to add value, maintain quality and ensure safety.

**AN S 280: Basic Swine Science**

(2-0) Cr. 2.

*Prereq: AN S 101; AN S 114*

Basic disciplines and concepts involved in swine production including; industry structure, trends and statistics; production phases and buildings; genetic improvement; reproduction; nutrition; health and biosecurity; nutrient management; marketing and meat quality and career opportunities in the swine industry. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

**AN S 305: Livestock Evaluation**

(0-6) Cr. 3. F.

*Prereq: Junior classification*

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 270L recommended.

**AN S 306: Equine Evaluation**

(0-6) Cr. 3. S.

*Prereq: Sophomore classification*

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**

(3-0) Cr. 3. F.S.

*Prereq: AN S 214; BIOL 211; (CHEM 163 or CHEM 167 or CHEM 177)*

Physiological adaptations to athletic training in canine and equine athletes. Topics of emphasis include exercise-related adaptations in metabolism, locomotion, the cardiovascular system, musculoskeletal system, and endocrine system. The roles of nutrition and conditioning programs are assessed.

**AN S 316: Equine Reproduction Lab**

Cr. 3. S.

*Prereq: (AN S 116; credit or concurrent enrollment in AN S 331) or Permission of Instructor*

Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care. Participation outside of class time is expected.

**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. F.

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; (BBMB 221 or CHEM 331)*

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. Students may not receive graduation credit for both AN S 219 and AN S 319.

**AN S 320: Animal Feeds and Feeding**

(2-2) Cr. 3. F.S.

*Prereq: AN S 319*

Principles and practices of animal feed evaluation including nutrient composition and physical properties of common feedstuffs. Utilization of nutrient requirements at various physiological stages to formulate diets using manual and software-based computer methodologies. Students may not receive graduation credit for both AN S 219 and AN S 320.

**AN S 324: Food Processing for Companion Animals**

(3-0) Cr. 3. F.

*Prereq: AN S 319; Junior classification*

Food processing and nutrition for carnivorous companion animals. Topics covered include meat processing and meat preservation for companion animal diets, regulatory standards, cutting edge technologies for processing meat for companion animals, dietary needs of carnivorous companion animals, effect of different processing methods on safety and nutrient bioavailability.

**AN S 331: Domestic Animal Reproduction**

(3-0) Cr. 3. F.S.

*Prereq: AN S 214 or (BIOL 255; BIOL 256) or BIOL 335 or B M S 329*

Comparative anatomy, physiology, and endocrinology of domestic mammalian animal reproduction. Techniques for the control and manipulation of reproductive processes.

**AN S 332: Laboratory Methods in Animal Reproduction**

(0-2) Cr. 1. F.S.

*Prereq: Credit or concurrent enrollment in AN S 331*

Reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing.

**AN S 332A: Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals**

(0-2) Cr. 1. F.S.

*Prereq: Credit or concurrent 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 semen collection and artificial insemination; pregnancy testing.

**AN S 332E: Laboratory Methods in Animal Reproduction: Equine**

(0-2) Cr. 1. S.

*Prereq: Credit or concurrent enrollment in AN S 331*

Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care.

**AN S 333: Embryo Transfer and Related Technologies**

(3-0) Cr. 3. F.

*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.

**AN S 334: Embryo Transfer Laboratory**

(0-3) Cr. 1. F.

*Prereq: Credit or concurrent enrollment in AN S 332 or AN S 333; 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.

**AN S 335: Dairy Cattle Evaluation**

(0-6) Cr. 3. S.

*Prereq: Sophomore classification*

Evaluation of dairy heifers and lactating dairy cows. Emphasis placed on familiarity with anatomical terms/structures, the use of comparative terminology, decision-making skills, and presentation of oral reasons. (Introduction and skills development course for AN S 475B.).

**AN S 336: Domestic Animal Behavior and Well-Being**

(2-2) Cr. 3. F.

*Prereq: AN S 214*

Understand how managed animals cope and perceive the environment. Principles of behavior and well-being relative to animal care, management and housing. Methods to objectively assess animal well-being. Awareness of animal protection through education/assessments, audits and law.

**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*

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. Course(s) in nutrition, genetics, meat science and/or biochemistry recommended.

**AN S 352: Genetic Improvement of Domestic Animals**

(2-2) Cr. 3. F.S.Alt. SS., offered odd-numbered years.

*Prereq: BIOL 211; (AN S 351X or BIOL 313 or GEN 320); (STAT 101 or STAT 104)*

Principles of qualitative and quantitative genetics applied to improve domestic animal populations. Impact of selection and mating schemes in achieving breeding program goals. Applications and impacts of biotechnological advancements in genetics and genomics.

**AN S 360: Fresh Meat Science and Applied Muscle Biology**

(3-0) Cr. 3. F.

*Prereq: AN S 270; (BBMB 221 or CHEM 331)*

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.

**AN S 373A: Poultry Products Technology**

Cr. 3. SS.

*Prereq: (CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or 212)) or Permission of Instructor*

Basic principles of meat-producing and egg-laying poultry management, meat science, product functionality, egg quality, and food safety, product quality, product functionality, and food safety. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**AN S 373B: Applied Avian Physiology**

Cr. 3. SS.

*Prereq: ((CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or 212)) or Permission of Instructor*

Introduction of industry-relevant aspects of avian physiology with emphasis on behavior, neurology, muscle, cardiovascular, immunology, digestive, endocrinology, and reproductive systems for egg and meat producing birds. Focus on avian physiology and relevance to production management and outcomes. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**AN S 373C: Avian Health**

Cr. 3. SS.

*Prereq: ((CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or 212)) or Permission of Instructor*

Identification, diagnosis, management, and prevention of diseases in commercial poultry. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**AN S 373D: Poultry Nutrition**

Cr. 3. SS.

*Prereq: ((CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or 212)) or Permission of Instructor*

Commercial poultry-specific nutrition with an emphasis on species and age-specific diet formulation, ingredient selection, feed production, and production system. Use of feed additives and production outcomes. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**AN S 380A: Swine Breeding and Gestation Management**

Cr. 1. S.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Concepts related to: reproductive physiology and endocrinology of boars and sows; genetic selection programs; development programs for future replacement gilts and boars; semen collection, evaluation, and preparation; detection of estrus and artificial insemination; pregnancy diagnosis; feeding and housing programs for gestating sows; environmental management; records; diseases, and development of quality assurance programs for identifying and solving reproductive problems.

**AN S 380B: Contemporary Issues in the Swine Industry**

Cr. 1. S.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Evaluation of issues facing today's swine industry including: welfare, nutrient management, and food safety and security. Development of skills needed for effective community relations such as media interviews and message points.

**AN S 380C: Employee Management for the Swine Industry**

Cr. 1. F.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Effective employee management in swine production units. Principles, policies, and practices related to procurement, development, maintenance, and utilization of employees.

**AN S 380D: Farrowing Management**

Cr. 1. S.SS.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Advanced integration and application of reproductive management concepts during farrowing and lactation. Identification of production trends; formulation of strategies to improve productivity, and parturition and neonatal management.

**AN S 380E: Swine Feed Mill Management**

Cr. 1. F.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Principles of feed manufacturing, equipment operation, feed and ingredient quality assurance and regulatory compliance in a modern feed milling operation. Overview of feed mill regulations and safety.

**AN S 380F: Marketing and Risk Management in the Swine Industry**

Cr. 1. S.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

A comprehensive view of industry structure and trends and marketing options available in the swine industry. Management of risk between markets and/or contracts.

**AN S 380G: Swine Nursery and Finishing Management**

Cr. 1. SS.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Overview of the critical management, housing, and financial considerations relevant to the successful operation of a swine nursery, grow-finish, or wean to finish enterprise, including nutrient requirements; building and facility management; and marketing.

**AN S 380I: Pork Export Markets**

Cr. 1. SS.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Introduction to global markets; cultural preferences and customs associated with the global swine industry. International trade regulations potential impact of foreign animal diseases and bioterrorism affecting the U.S. swine industry.

**AN S 380J: Pork Product Quality and Safety**

Cr. 1. S.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Pre- and post-harvest affecting pork product quality and safety. Overview of pork harvesting process and traits and characteristics of quality pork products.

**AN S 380K: Swine Nutrition**

Cr. 1. F.

*Prereq: AN S 225 or (AN S 280; AN S 280L); AN S 319*

Principles of developing and implementing a swine feeding program. Fundamentals of feeding pigs including nutrients; factors affecting nutrient recommendations; feeding systems and management; feed ingredients, and formulation of swine diets.

**AN S 382: Swine Environment Management**

(1-0) Cr. 1.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Response of swine to thermal environment, ventilation system design and analysis, heating and cooling systems, and examples of various designs for all phases of production. Troubleshooting ventilation systems and energy analysis of production units. TSM 210 Recommended.

**AN S 383: Swine Manure and Nutrient Management**

(1-0) Cr. 1.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Function, application, and advantages and disadvantages of nutrient management systems. Manure production rates, manure handling systems, storage and manure management planning for land application and odor mitigation strategies.

**AN S 384: Swine Health and Biosecurity**

(1-0) Cr. 1.

*Prereq: AN S 225 or (AN S 280; AN S 280L)*

Overview of standard biosecurity protocols and identification of behavior and clinical signs of illness in pigs. Treatment administration and prevention methods. Introduction to immune system function and basic swine disease transmission. Recommended a course in microbiology.

**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 Instructor*

Learning experience focused on professional development for a career related to animal science. Journal, presentation, and scientific component.

**AN S 399B: Animal Science Internship: Supervised Internship Experience**

Cr. R. Repeatable. F.S.SS.

*Prereq: Permission of Instructor*

Learning experience focused on professional development for a career related to animal science. Journal, presentation, and scientific component. This course is designed for those students who are completing a semester long internship located off campus.

**AN S 411: Addressing Issues in Animal Science**

(0-2) Cr. 1. F.S.

*Prereq: Senior classification; AN S major*

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 415: Equine Systems Management**

(2-2) Cr. 3. F.S.

*Prereq: AN S 216; AN S 319; AN S 320; AN S 331*

Identification and development of financial and production goals in a horse business. Scientific approach to make decisions in management of enterprises in the horse industry.

**AN S 419: Advanced Animal Nutrition**

(2-0) Cr. 2. F.

*Prereq: AN S 319*

Detailed consideration of digestion, metabolism, and assimilation of nutrients. Recent advances and developments in basic nutrition.

**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*

Factors that affect managers of a companion animal enterprise. Financial and business goal identification, problem clarification, behavior modification, animal training, humane education, and resource allocation to manage a companion animal system.

**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) or Permission of Instructor*

Decisions facing the administrator of a swine enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the swine enterprise. ECON 230 or equivalent recommended.

**AN S 426: Beef Cattle Systems Management**

(2-2) Cr. 3. F.S.

*Prereq: (AN S 226; AN S 270; AN S 270L; AN S 320) or Permission of Instructor*

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. ECON 230 or equivalent recommended.

**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) or Permission of Instructor*

Decisions facing the administrator of a sheep enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the sheep enterprise. ECON 230 and AGRON 334 or equivalents recommended.

**AN S 434: Dairy Systems Management**

(2-2) Cr. 3. F.

*Prereq: AN S 235; AN S 331; AN S 320; AN S 337; AN S 352*

The scientific foundation of dairy cattle management. The impact of dairy farm management practices on the biological processes of the cow. Integrates concepts from the disciplines of lactation, reproduction, nutrition, genetics, and animal health.

**AN S 435: Applied Dairy Farm Evaluation**

(2-2) Cr. 3. S.

*Prereq: AN S 434*

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. ECON 230 or equivalent recommended.

**AN S 441: International Animal Agriculture**

(Cross-listed with GLOBE). (3-0) Cr. 3. S.

*Prereq: AN S 223 or AN S 225 or AN S 226 or AN S 229 or AN S 235*

An overview of animal agriculture with emphasis in developing countries. Historical, economic, environmental, and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems including alternative livestock species, will be investigated. The role of animal source foods in attainment of global food security will be discussed. Meets International Perspectives Requirement.

**AN S 460: Science and Technology of Value Added Meat Products**

(Dual-listed with AN S 560). (2-2) Cr. 3. S.

*Prereq: AN S 270*

Physical, chemical and biological properties of meat important to achieving value-added meat product characteristics. Ingredients, technology and equipment used for processing, preservation and safety of cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

**AN S 473A: Poultry Enterprise Management**

Cr. 3. SS.

*Prereq: (CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or BIOL 212)*

Business and management aspects of the poultry industry. Emphasis on personal interactions, effective communication, interview skills, poultry management, writing a business plan, and business decisions. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**AN S 473B: Breeder Flock and Hatchery Management**

Cr. 3. SS.

*Prereq: (CHEM 163 or CHEM 167 or CHEM 177); (BIOL 211 or BIOL 212)*

Topics associated with the management of poultry breeder flocks and hatcheries: nutrition, lighting management, reproductive physiology, and husbandry for breeder flocks. Embryology, incubation techniques, biosecurity, and hatchery management. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program.

**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/domesticated animal production management plans. Development and advancement of decision-making skills, comparative techniques, and presentation of oral or written reasons or analyses. Maximum of 6 credits may be applied toward graduation. 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. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of oral reasons. Maximum of 6 credits may be applied toward graduation. 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 of dairy cattle, in particular heifers and lactating dairy cows. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of oral reasons. 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/meat products. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of written reasons. 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. Emphasis placed on the impact of management decisions on marketability and profitability. Development and advancement of decision-making skills, and communication and comparative techniques. 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 of horses and horse events. Emphasis placed on familiarity with anatomical terms/structures, form to function, application of breed association rules and current maneuver scoring, and the use of comparative terminology. Development and advancement of decision-making skills, comparative techniques, and presentation of oral reasons. 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 of livestock/domesticated animal production management plans. Development and advancement of decision-making skills, comparative techniques, and presentation of analyses. Emphasis placed on the impact of management decisions on marketability and profitability. Maximum of 6 credits may be applied toward graduation.



**AN S 480: Animal Industry Leadership Fellows**

Cr. 1. Repeatable. F.S.

*Prereq: AN S 225; 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 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, HSP M, VDPAM). (1-0) Cr. 1. S.

*Prereq: Credit or concurrent enrollment in (FS HN 101 or FS HN 272 or HSP M 233); FS HN 403; (FS HN 419 or FS HN 420)*

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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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 Instructor*

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring 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.

**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*

Limited enrollment. International or domestic tour and study of livestock production systems and impacts of animals on society and the ecosystem. Influence of climate, economics, geography, landscapes, markets, and other factors on both livestock and other domesticated animals. Locations and duration of tours will vary. 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*

Limited enrollment. International tour and study of livestock production systems and impacts of animals on society and the ecosystem. Influence of climate, economics, geography, landscapes, markets, and other factors on both livestock and other domesticated animals. Locations and duration of tours will vary. 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*

Limited enrollment. Domestic tour and study of livestock production systems and impacts of animals on society and the ecosystem. Influence of climate, economics, geography, landscapes, markets, and other factors on both livestock and other domesticated animals. Locations and duration of tours will vary. 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 credits. 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: Applied Data Science and Statistics using Statistical Software in Animal Sciences**

(2-0) Cr. 1. F.

*Prereq: Credit or enrollment in STAT 587 or equivalent*

Introduction to using SAS and R for solving research problems, including organization of data files, transfer of files between different formats, data editing, identifying confounded data, developing statistical models, and techniques for analysis of designed experiments. (1 credit each for 500A and 500B).

**AN S 500A: Applied Data Science and Statistics using Statistical Software in Animal Sciences: SAS**

(2-0) Cr. 1. F.

*Prereq: Credit or enrollment in STAT 587 or equivalent*

First half semester course. Introduction to using SAS for solving research problems, including organization of data files, transfer of files between different formats, data editing, identifying confounded data, developing statistical models, and techniques for analysis of designed experiments.

**AN S 500B: Applied Data Science and Statistics using Statistical Software in Animal Sciences: R**

(2-0) Cr. 1. F.

*Prereq: Credit or enrollment in STAT 587 or equivalent*

Second half semester course. Introduction to using R for data science and statistics to solve research problems, including data entry, data management, merging files, outputting new datasets and reports, data visualization, developing statistical models, and techniques for analysis of designed experiments.

**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 515: Integrated Crop and Livestock Production Systems**

(Cross-listed with A B E, AGRON, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

*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 517: Gut Microbiome: Implications for Health and Diseases**

(Cross-listed with FS HN, MICRO, V MPM). Cr. 3. F.

*Prereq: 2-3 credits in microbiology and/or immunology.*

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health.

**AN S 518: Digestive Physiology and Metabolism of Non Ruminants**

(Cross-listed with NUTRS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*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 even-numbered years.

*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 odd-numbered years.

*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 Animal Behavior, Welfare**

(3-0) Cr. 3.

*Prereq: permission of instructor; M.S. or Ph.D. student*

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

**AN S 537A: Topics in Animal Behavior, Welfare: Animal Behavior**

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: permission of instructor; M.S. or Ph.D. student*

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

**AN S 537B: Topics in Animal Behavior, Welfare: Contemporary Issues.**

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: permission of instructor; M.S. or Ph.D. student*

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

**AN S 537C: Topics in Animal Behavior, Welfare: Animal Welfare**

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: permission of instructor; M.S. or Ph.D. student*

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

**AN S 537D: Topics in Animal Behavior, Welfare: Immune and Stress**

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: permission of instructor; M.S. or Ph.D. student*

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

**AN S 540: Livestock Immunogenetics**

(Cross-listed with MICRO, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.

*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: recommended: an undergraduate physiology course and a biochemistry course*

Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

**AN S 556: Current Topics in Genome Analysis**

(3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: BBMB 405 or GDCB 510*

Introduction to principles and methodology of molecular genetics useful in analyzing and modifying large genomes.

**AN S 560: Science and Technology of Value Added Meat Products**

(Dual-listed with AN S 460). (2-2) Cr. 3. S.

*Prereq: AN S 270*

Physical, chemical and biological properties of meat important to achieving value-added meat product characteristics. Ingredients, technology and equipment used for processing, preservation and safety of 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 587*

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 563: Advanced Processed Meats Technology**

Cr. 3. S.

*Prereq: AN S 270 or equivalent, or at least two undergraduate courses in biology, food science, microbiology or culinology*

Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for fresh and cured meat products. Packaging, preservation and food safety issues critical to processed meat products are emphasized.

**AN S 569: Reproductive and Developmental Toxicology**

(Cross-listed with TOX). Cr. 2. Alt. F., offered even-numbered years.

*Prereq: BBMB 301, BIOL 258 or An S 331*

Chemical agents that target developmental and reproductive systems in animals and humans, both male and female. The influence that timeline of developmental in utero and what part of reproductive organ have on outcome of environmental exposures will be developed. The physiological changes due to exposure, and mechanistic pathways activated by xenobiotics will be defined and the consequences of these changes will be explored.

**AN S 570: Advanced Meat Science and Applied Muscle Biology**

(2-2) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: AN S 460 or equivalent*

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 reports and a written project. Students cannot receive credit for both AN S 570 and AN S 573

**AN S 571: Advanced Meat Processing Principles and Technology**

(2-2) Cr. 3. Alt. F., offered even-numbered years.

*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 573: Fresh Meat Science and Technology**

Cr. 3. F.

*Prereq: AN S 270 or equivalent, or minimum two undergraduate courses in biology, food science, microbiology or culinology.*

Quality, and sensory attributes of fresh meats and how they develop and how they are evaluated. The study of ante and postmortem factors impacting quantity, composition, structure, and chemistry of red meat and poultry muscle/meat. Students cannot receive credit for both AN S 570 and AN S 573

**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 618: Vitamins and Minerals**

(Cross-listed with NUTRS). Cr. 2. Alt. S., offered even-numbered years.

*Prereq: Biochemistry, physiology, basic nutrition*

Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes.

**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. F., offered odd-numbered years.

*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 and seminars on selected topics concerning animal physiology.

**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**

(3-0) Cr. 3. 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 odd-numbered years.

*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 odd-numbered years.

*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. Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs.

**AN S 655B: Computational Strategies for Genetic Parameter Estimation**

(3-1) Cr. 2. Alt. F., offered odd-numbered years.

*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. 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 even-numbered years.

*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**

(Cross-listed with KIN). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: BBMB 405, BBMB 420*

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.