

**802. Clinical Surgical Anatomy**  
Spring. 6(4-4) Master's student in surgery or approval of department. Interdepartmental with and administered by the Department of Surgery.

Review of surgical anatomy; the opportunity to obtain detailed anatomical information through lecture and dissection sessions; and the Clinical interpretation of anatomy and surgical approaches.

**813. Problems in Anatomy**  
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 15 credits. Basic disciplines in various areas and approval of department.

Various anatomical fields such as gross anatomy, histology, hematology, tissue culture, cytology, neurology and embryology will be studied.

**814. Graduate Student Seminar**  
Spring. 1 to 3 credits. May reenroll for a maximum of 6 credits. Admittance to Ph.D. program in Department of Anatomy.

Supervised practice in delivering and evaluating written abstracts and public oral presentations of anatomical science; techniques of organization, timing, and effective illustrations.

**820. Advanced Neuroanatomy: Structure and Function of Cells of CNS**

Summer. 1 to 5 credits. May reenroll for a maximum of 15 credits. ANT 815 and approval of instructor.

Correlated anatomy and physiology of CNS cells and their processes including current concepts and principles of cytology, ultrastructure, development and plasticity, axonal transport mechanisms, electrical properties and functional connections.

**839. Systems Neuroscience**  
(PSL 839.) Winter of odd-numbered years. 5(4-2) Approval of department. Interdepartmental with the departments of Pharmacology and Toxicology, and Physiology.

Physiology, anatomy and pharmacology of sensory, somatomotor and autonomic neural systems.

**885. Vertebrate Neural Systems I**  
Winter of odd-numbered years. 5(3-4) ANT 815, ANT 865 recommended. Interdepartmental with the departments of Physiology, Psychology, and Zoology.

Structure and function of major component systems of vertebrate brains, their evolution, ontogeny and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical and physiological studies.

**886. Vertebrate Neural Systems II**  
Spring of odd-numbered years. 5(3-4) ANT 885. Interdepartmental with the departments of Physiology, Psychology, and Zoology.

Continuation of ANT 885. Major component systems of vertebrate brains, their evolution, ontogeny, and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical, and physiological studies.

**899. Master's Thesis Research**  
Fall, Winter, Spring, Summer. Variable credits. Majors.

**999. Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Majors.

## ANIMAL SCIENCE      ANS

### College of Agriculture and Natural Resources

**110. Introductory Animal Science**  
Fall. 3(3-0)

History of breeds and their use, production techniques, marketing. Current goals and limitations affecting U.S. animal production.

**132. Dairy Production Laboratory**  
(ANS 232.) Spring. 1(0-3) ANS 110.

Physical characteristics of cows and facilities. Anatomy. Experience in estrous detection, milking equipment, feeds and rations and records. Normal cow behavior.

**142. Horse Production Laboratory**  
Spring. 1(0-3) ANS 110.

Handling and care of horses. Structural anatomy, reproduction, nutrition and management practices.

**152. Livestock Production Laboratory**  
(ANS 252.) Fall. 1(0-3) ANS 110 or concurrently.

Anatomy, care, feeding, management, handling and slaughter of commercial livestock species. Evaluation of livestock relating skeletal structure to animal performance.

**156. Introductory Meat Science**  
Spring. 4(2-6) ANS 110.

Systems of meat and poultry evaluation, meat cuts, identification, merchandising, processing, storage and handling. Eggs and egg products.

**162. Poultry Production Laboratory**  
(ANS 262.) Winter. 1(0-3) ANS 110.

Breeds of poultry. Processing poultry and products. Anatomy and physiology. Facilities, feeds and rations. Evaluation and incubation of eggs. Managerial skills.

**211. Principles of Animal Science**  
Spring. 3(3-0) ANS 110, B S 211.

Principles of nutrition, reproduction, lactation, genetics and meat science. Comparative anatomy and physiology of food animals.

**217. Evaluation of Animal and Carcass**  
Fall. 3(1-4) ANS 110, ANS 152.

Evaluation of breeding stock, market animals, and carcasses. Emphasis on production records and soundness of breeding animals, quality grading, yield grading and pricing market animals and carcasses.

**256. Meats, Poultry and Fishery Products I**  
Fall. 3(2-2) Interdepartmental with and administered by Food Science.

Principles of evaluation and nutritive value. Identification of grades and cuts of beef, pork, lamb and poultry products.

**257A. Meat Evaluation and Grading**  
Winter. 1(0-3) ANS 217. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of beef, pork and lamb carcasses and wholesale cuts according to industry and consumer demands. Federal grading standards. Field trips to meat packing operations required.

**257B. Meat Evaluation and Grading**  
Fall. 1 to 3 credits. ANS 257A. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of beef, pork and lamb carcasses and wholesale cuts according to industry and consumer demands. Federal grading standards. Field trips to meat packing operations required.

**310. Animal Science Seminar**  
Fall. 1(2-0) Juniors, ANS 110 or concurrently.

Current production and policy issues in animal science.

**313A. Principles of Animal Nutrition**  
(ANS 313.) Fall. 4(4-0) BCH 200 or BCH 401, MPH 200, PSL 241.

Requirements for and metabolism of nutrients. Feeding practices and diets for beef and dairy cattle, horses, poultry, sheep and swine.

**313B. Feeds and Diet Formulation**  
Winter. 2(1-2) ANS 313A.

Feed processing, premixes and feed additives. Feed manufacture. Net energy system. Diet and least cost formulation for cattle, sheep, horses, poultry and swine. Field trips required.

**314. Principles of Animal Breeding**  
Winter. 3(3-0) B S 211 or a course in Mendelian genetics.

Quantitative inheritance. Gene frequency. Statistical tools used in animal breeding. Effect of selection and mating systems on animal population.

**315. Principles of Farm Animal Physiology**  
Spring. 4(3-2) ANS 211, PSL 241.

Anatomy and physiology emphasizing endocrine integration for homeostasis and homeorhesis. Regulatory interaction among growth, lactation and reproduction during different productive states of farm animals.

**318. Merchandising Purebred Livestock**  
Spring of odd-numbered years. 2(1-2) ANS 132, ANS 142, or ANS 152; or approval of department.

Purebred livestock industry structure. Methods of merchandising breeding livestock including private treaty and auction sales. Advertising, sale selection, and budgeting of a purebred livestock sale.

**337. Judging Dairy Cattle**  
Spring. 3(0-6) Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Desired type in dairy cattle. Judging and show ring procedures. Competitive judging. Teams selected to represent Michigan State University in national competition.

**347A. Judging Horses**  
Spring. 2(0-6) ANS 217. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of conformation. Productive and functional merits of individual horses. Field trips to prominent equine establishments and events required.

## Descriptions — Animal Science

### of Courses

#### 347B. Judging Horses

Fall. 1(0-6) ANS 347A. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Course to be completed in the first half of the quarter. Evaluation of conformation. Productive and functional merits of individual horses. Field trips to prominent equine establishments and events required.

#### 357A. Judging Livestock

Winter. 1 to 3 credits. ANS 217 or approval of department. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of conformation of cattle, pigs and sheep. Productive and functional merits of individual food animals. Field trips to prominent livestock establishments required.

#### 357B. Judging Livestock

Spring. 1 to 3 credits. ANS 357A. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of conformation of cattle, pigs and sheep. Productive and functional merits of individual food animals. Field trips to prominent livestock establishments and to major livestock events required.

#### 357C. Judging Livestock

Fall. 1 to 3 credits. ANS 357B. Students may not earn more than 10 credits from the following courses: ANS 257A, ANS 257B, ANS 337, ANS 347A, ANS 347B, ANS 357A, ANS 357B, ANS 357C.

Evaluation of conformation of cattle, pigs and sheep. Productive and functional merits of individual food animals. Field trips to prominent livestock establishments and to major livestock events required.

#### 400. Independent Study

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Students are limited to a combined total of 12 credits in ANS 400 and ANS 490. Approval of department.

Independent study in genetics, nutrition, physiology, toxicology, meat science, or management of poultry or livestock.

#### 412A. Intensive Livestock Systems

(ANS 312A.) Fall. 2(1-3) Juniors, ANS 110, FSM 200 or approval of department.

Comprehensive systems in livestock production. Livestock enterprise planning and budgeting. Management decisions relative to purchasing livestock, feeding techniques and record analysis. Students manage livestock. Field trips required.

#### 412B. Intensive Livestock Systems

(ANS 312B.) Winter. 2(1-3) ANS 412A. Continuation of ANS 412A. Computer based surveillance and evaluation of livestock enterprise. Students manage livestock. Field trips required.

#### 413. Toxicology of Food Producing Animals

Spring. 4(4-0) PSL 240, BCH 200.

Fate and effects of toxic chemicals in food-producing animals: impact on animal production, residues in food products, safety assessment and control methods.

#### 415. Animal Reproduction Laboratory

Winter. 1(0-3) ANS 455 or concurrently.

Reproductive anatomy of mammals and poultry. Estrous detection and synchronization. Artificial insemination, manual examination of reproductive organs and embryo transfer. Evaluation of semen. Reproductive management.

#### 416. Growth Biology of Meat Animals

Spring of even-numbered years. 3(3-0) B S 211, PSL 241, BCH 200.

Fetal and postnatal growth and development in meat animals. Bioenergetic, hormonal, nutritional and metabolic aspects of growth. Criteria for measuring growth of meat animals.

#### 418. Livestock Product Marketing

Spring. 4(3-3) ANS 110, FSM 200. Interdepartmental with Food Systems Economics and Management.

Structure and product values in livestock market channels. Field study analysis of alternative marketing strategies, futures marketing, and the components of the livestock marketing chain. Field trips required.

#### 422. Beef Production and Management

Spring. 4(3-2) ANS 152, ANS 313B, ANS 314, ANS 315 or approval of department.

Management practices and systems for beef herds. Emphasis on feed requirements, reproduction, breeding, performance testing, housing, diseases, costs and returns. Field trips required.

#### 432. Dairy Production and Management

Spring. 4(3-3) ANS 132, ANS 313B, ANS 314, ANS 315 or approval of department.

Management practices for dairy herds. Systems for records, housing, milking, reproduction, nutrition and health. Economics and efficient use of resources. Field trip required.

#### 433. Ruminant Nutrition

Winter. 4(3-2) ANS 313B or concurrently.

Principles of ruminant nutrition and application to actual feeding practices in commercial dairy and beef operations. Rumen fermentation as related to feed utilization, growth, milk production and milk composition.

#### 434. Dairy Cattle Breeding

Spring. 4(2-4) ANS 314.

Applications of population genetics to improving dairy cattle. Use of selection, aids to selection, and systems of mating to formulate breeding plans. Inheritance of economic traits. Breed improvement programs.

#### 435. Mammary Physiology

Fall. 4(3-2) PSL 241, BCH 200 or BCH 401. Interdepartmental with the Department of Physiology.

Anatomy of mammary gland. Hormonal and nervous control of mammary growth, initiation and maintenance of lactation. Biochemistry of milk secretion. Physiology of milking; physiological, pathological and management factors affecting lactation.

#### 442. Horse Production and Management

Spring. 4(3-2) ANS 142, ANS 313B, ANS 314, ANS 315 or approval of department.

Management of stables and horse breeding farms. Pedigree and conformational selection, reproduction, promotion, marketing, economics, facilities, disease and parasite control, lameness and footcare. Field trip required.

#### 454. Meat Animal Breeding

Spring. 3(2-2) ANS 314.

Uses and effects of different breeding systems with beef cattle, sheep, and swine. Formulating breeding plans.

#### 455. Principles of Animal Reproduction

Winter. 4(5-0) PSL 241, BCH 200 or BCH 401. Interdepartmental with the Department of Physiology.

Processes of reproduction and endocrinology with special emphasis on anatomy of reproductive systems, folliculogenesis, gametogenesis, reproductive cycle, fertilization, sex determination, gestation and artificial regulation of these reproductive events for economic benefit.

#### 456. Meat Science and Muscle Biology

Winter. 4(4-0) BCH 200, PSL 240.

Structure, composition and function of muscle, its conversion to meat, animal growth and fattening. Properties of fresh and processed meat, microbiology, preservation, palatability, inspection and sanitation, by-products, nutritive value.

#### 462. Poultry Production and Management

Spring of even-numbered years. 4(3-2) ANS 162, ANS 313B, ANS 314, ANS 315 or approval of department.

Practical application of economic and management principles to commercial poultry enterprises. Field trips required.

#### 463. Poultry Nutrition

Winter of odd-numbered years. 4(3-3) ANS 313B or concurrently.

Factors affecting digestion and utilization of dietary ingredients. Nutrient requirements and formulation of practical poultry feeds. Nutritional problems and assay methods. Food and drug laws influencing poultry feeds.

#### 464. Poultry Breeding and Incubation

Winter of even-numbered years. 4(3-2) ANS 314.

Genetic and biological factors affecting economic characteristics including egg production, egg size, hatchability, growth and viability and factors involved in the hatching of eggs.

#### 465. Avian Physiology

Spring. 4(3-3) Approval of department. Interdepartmental with the Department of Physiology.

Systemic physiology of birds emphasizing respiration, circulation, temperature regulation, the endocrines, and reproduction.

#### 469. Avian Diseases and Health

Winter of even-numbered years. 4(3-2) MPH 200 or B S 212 or approval of department.

Microbiological concepts; causes, preventive and therapeutic methods for poultry diseases, laboratory diagnosis and experiments.

#### 472. Sheep Production and Management

Winter of odd-numbered years. 4(3-2) ANS 152, ANS 313B, ANS 314, ANS 315 or approval of department.

Management of sheep enterprises. Emphasis on selection, reproduction, nutrition, health, housing, marketing and economics. Field trips required.

**482. Swine Production and Management**

Fall. 4(3-2) ANS 152, ANS 313B, ANS 314, ANS 315 or approval of department.

Historical aspects and current trends of breeds, breeding selection, nutritional requirements, management practices, marketing, housing, and environmental needs, disease and parasite control. Field trips required.

**483. Swine Nutrition**

Spring of odd-numbered years. 3(3-0) ANS 313B; ANS 482.

Digestive and metabolic development and nutrient requirements of swine. Interactions of genetics, disease, endocrinology and environment with nutrition. Critical evaluation of swine feeds and feed formulation. Recent swine nutrition research.

**488. Animal Systems in International Development**

Spring. 4(4-0) Juniors, ANS 211 or approval of department.

Animal production systems in diverse climatic, geographical and socio-economic environments. Emphasizes species efficiency in human food production and resource use in Africa, Latin America and Asia.

**490. Senior Thesis in Animal Science**

Fall, Winter, Spring, Summer. 6 to 12 credits. May reenroll for a maximum of 12 credits. Students are limited to a combined total of 12 credits in ANS 400 and ANS 490. Senior Animal Science Majors, approval of department. Not open to graduate students.

Individual study of selected topic and preparation of a senior thesis.

**511. Animal Science for Veterinarians**

Fall. 4(4-0) First year Veterinary Medicine students.

Husbandry and management of food animals, horses, companion animals, zoo animals and laboratory animals.

**512. Physical Examination and Animal Handling II**

Spring. 2(0-6) First year Veterinary Medicine students.

Techniques for restraint and examination of cattle, sheep, goats, and swine. Inspections of production units.

**525. Animal Nutrition**

Spring. 5(4-2) BCH 401.

Principles of nutrition. Nutrients and their metabolism. Nutritive requirements for maintenance, growth, reproduction, lactation and work. Nutrient sources and their use in preparing diets for domestic animals.

**800. Advanced Independent Study**

(A H 890.) Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits. Approval of department.

Investigation of areas within animal science of special interest to graduate students.

**830. Rumen and Gastrointestinal Microbiology**

Fall of odd-numbered years. 3(3-0) MPH 303, BCH 452 or approval of department.

Microbial activities in the rumen and gastrointestinal ecosystems of major livestock species. Microbial types, classification, distribution, degradation and fermentation of substrates, interactions, manipulation and cultivation.

**832. Research Methods in Nutrition**

(A H 827.) Winter of odd-numbered years. 2(2-0) Approval of department.

Experimental techniques in nutrition: ration formulation, animal management, sampling procedures, balance trials, bioassays, tracer methodology, determination of nutrient requirements.

**871. Design of Animal Experiments**

(854.) Spring. 4(4-0) STT 423.

Choice, implementation and statistical analysis of experimental plans for research with animals. Designs for reduction of experimental error. Analysis of experiments with complex structure or unequal subclass numbers.

**872. Analysis of Unbalanced Multifactor Data**

(855.) Spring. 4(4-0) STT 423.

Applied analysis techniques of field or survey data in biological sciences with unbalanced subclass numbers. Building models to fit data and research goals. Interpretation of analysis.

**873. Statistical Packages for Analysis of Experiments**

Fall. 3(2-2) STT 423 or approval of instructor.

Recording data for computer analysis. Computer files and the EDITOR. Methods include SPSS, SAS, BMDP and GENSTAT.

**899. Master's Thesis Research**

(A H 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**931. Advanced Ruminant Nutrition**

(DRY 925.) Fall of even-numbered years. 4(4-0) PSL 811, ANS 830, approval of department.

Biochemistry, physiology, and microbiology of ruminant digestion. Absorption and metabolism of rumen fermentation products.

**935. Comparative Nutrition—Lipids and Carbohydrates**

(HNF 926.) Winter of odd-numbered years. 4(4-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with and administered by Human Nutrition and Foods.

Regulatory aspects of carbohydrate and lipid metabolism as influenced by nutrition in mammals. Emphasis on normal and abnormal physiological states such as obesity, ketosis and diabetes.

**936. Comparative Nutrition—Protein Metabolism and Developmental Biology**

(HNF 927.) Winter of even-numbered years. 4(4-0) PSL 811 or approval of department. Interdepartmental with Human Nutrition and Foods.

Protein quality assessment, protein status, protein calorie malnutrition, amino acid metabolism, protein turnover, digestion and absorption, hormonal control of protein metabolism, developmental aspects of protein metabolism and growth.

**937. Comparative Nutrition—Minerals**

(A H 928.) Fall of even-numbered years. 3 credits. PSL 811 or approval of department. Interdepartmental with Human Nutrition and Foods.

Forms and location in body, metabolic roles, deficiency and toxicity signs, interrelationships, requirements and biological availability of sources.

**938. Comparative Nutrition—Vitamins**

(A H 929.) Spring of odd-numbered years. 3(3-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with and administered by Human Nutrition and Foods.

Chemical and physical properties, standards of activity, occurrence, metabolic roles, anti-vitamins, deficiency and toxicity signs, requirements and factors affecting requirements.

**941. Genetics of Breed Improvement**

(A H 963.) Winter of odd-numbered years. 3(3-0) ANS 314, STT 421.

Breed improvement. Changing gene frequency. Genetic and environmental subdivision of phenotypic variance.

**942. Breeding Systems and Plans**

(A H 964.) Spring of odd-numbered years. 3(3-0) ANS 941.

Biometric relations between related animals. Role of selection in changing populations. The effects of different mating systems.

**943. Biometrical Genetics**

(965.) Fall. 4(4-0) ANS 872.

Estimation of variance and covariance components. Best linear unbiased prediction of breeding values and selection index. Genetic models for quantitative traits. Correlation of relatives. Selection theory.

**999. Doctoral Dissertation Research**

(A H 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**ANTHROPOLOGY ANP**

**College of Human Medicine  
College of Social Science**

**100. Human Evolution**

Fall, Winter, Spring, Summer. 4(4-0)

Scientific fossil and archaeological evidence on human cultural and biological origins; anticipation of culture in other animals; place of humans among the primates; processes of organic evolution; modern human genetic variability; culture as an adaptive mechanism; cultural development to the dawn of civilization.

**171. Introduction to Sociocultural Anthropology (S)**

Fall, Winter, Spring, Summer. 4(4-0)

Comparison of ways of life among primitive, peasant and civilized peoples. Implications of these styles of life for understanding of human behavior in general and exotic cultures in particular.

**210. The Anthropological Film**

Winter. 3(2-2)

Ethnographic film as a preserver of vanishing cultures worldwide, as a tool for ethnological analysis and as a creator of perspectives about other cultures and cultural variability.

**221. Social and Cultural Analysis**

Fall, Spring. 4(4-0) ANP 171 or approval of department.

Basic theoretical framework of socio-cultural analysis: structural functionalism, evolutionism, and cultural ecology.