813. Problems in Anatomy
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
R: Approval of department.
Fields such as gross anatomy, histology, tissue culture, cytology, neurology and embryology.

814. Graduate Seminar
Spring of even-numbered years. 1 to 3 credits.
R: Open only to graduate students in Anatomy.
Supervised practice in evaluating abstracts and delivering oral presentations of anatomical sciences. Organization, timing and effective illustrations.

820. Advanced Neuroanatomy
Summer of odd-numbered years. 1 to 5 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Approval of department.
Current topics in anatomy and physiology and processes of central nervous system cells.

839. Systems Neuroscience
Spring of odd-numbered years. 4(4-0) Interdepartmental with Pharmacology and Toxicology, and Physiology.
R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Agriculture and Natural Resources, Natural Science, and Veterinary Medicine.
Anatomy, pharmacology, and physiology of multicellular neural systems. Sensory, motor, autonomic, and chemo-regulatory systems in vertebrate brains.

885. Vertebrate Neural Systems
Spring of odd-numbered years. 3(2-2) Interdepartmental with Physiology.
Comparative analysis of major component systems of vertebrate brains. Evolution, ontogeny, structure, and function in fish, amphibians, reptiles, birds and mammals.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to graduate students in Anatomy.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.
R: Open only to graduate students in Anatomy.

ANIMAL SCIENCE ANS

Department of Animal Science
College of Agriculture and Natural Resources

110. Introductory Animal Agriculture
Fall. 3(2-2)
History of animal agriculture and its relationship to human needs, production systems, marketing, environmental considerations. Current goals of and limitations affecting U.S. animal production.

112. Introductory Animal Management
Spring. 3(2-2)
Principles of managing beef and dairy cattle, horses, poultry, sheep and swine throughout their life cycles. Topics include genetics, nutrition, reproduction, health, care, and economically efficient production.

200A. Introductory Judging of Livestock or Carcasses
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. P: ANS 211. R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of functional conformation of beef cattle, sheep and swine and their carcasses. Preparation for intercollegiate competition. Field trips required.

200B. Introductory Judging of Dairy Cattle or Horses
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of functional conformation of dairy cattle or horses. Preparation for intercollegiate competition. Field trips required.

210. Animal Products
Fall. 4(3-3)
P: ANS 112. R: Not open to freshmen.
Edible animal products. Processing, preservation, storage and distribution of dairy, meat, and egg products.

211. Animal and Product Evaluation
Fall of odd-numbered years. 3(1-4)
Evaluation of breeding stock, market animals and carcasses. Production records and soundness of breeding animals. Quality grading, yield grading and pricing of market animals and carcasses.

212. Merchandising Purebred Livestock
Spring of odd-numbered years. 2(1-2)
R: Open only to sophomores, juniors, and seniors.
Purebred livestock industry. Private treaty and auction sales. Advertising, animal selection and budgeting of purebred livestock sales. Field trips required.

262. Sheep Management
Spring. 3(2-2)
R: Open only to sophomores, juniors, and seniors.
Principles of sheep management: genetics, reproduction, nutrition, marketing, and economics. Field trips required.

300A. Advanced Livestock Judging
Fall of even-numbered years. 2 credits.
P: ANS 200A. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of conformation and performance records of beef cattle, swine and sheep. Represent MSU in intercollegiate competition. Field trips required.

300B. Advanced Meat Evaluation and Grading
Fall of odd-numbered years. 2 credits.
P: ANS 200A. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of beef, pork, and lamb carcasses and wholesale cuts according to industry standards. Federal grading standards. Field trips to meat packing operations required. Represent MSU in intercollegiate competition.

300C. Advanced Dairy Cattle Judging
Fall. 2 credits.
P: ANS 200B. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of conformation of various breeds of dairy cattle. Represent MSU in intercollegiate competition. Field trips required.

300D. Advanced Horse Judging
Fall. 2 credits.
P: ANS 200B. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.

310. Livestock and Product Marketing
Fall. 3(2-2) Interdepartmental with Food Systems Economics and Management.
P: ANS 112. R: Not open to freshmen.
Movement of livestock and products into and through market channels. Market structures, futures, options. Current issues. Field trip required.

313. Principles of Animal Feeding and Nutrition
Fall. 4(3-2)
P: CEM 143, BS 111.
Principles and practices of nutrition for cattle, horses, poultry, sheep and swine. Metabolism of protein, minerals, and vitamins. Diet formulation. Performance prediction. Nutritional maladies. Field trip required.

314. Genetic Improvement of Farm Animals
Fall. 4(3-2)
P: BS 111 and MTH 110 or MTH 116.
Qualitative and quantitative inheritance in domestic farm animals. Statistical concepts and probability related to animal breeding. Improvement of dairy cattle, livestock, and horses through genetics and mating systems.

315. Anatomy and Physiology of Farm Animals
Spring. 4(3-2)
P: BS 111.
Gross and microanatomy of farm animals. Structure directed function of tissues. Endocrine integration for homeostasis. Regulation of growth, lactation, and reproduction. Homeorhesis.

401. Issues in Animal Agriculture
Spring. 1(2-0)
P: ANS 313 or ANS 314 or ANS 315. R: Open only to juniors and seniors.
Societal issues related to local, national and international animal agriculture.

405. Endocrinology of Reproduction
Fall. 3(3-0)
P: ANS 315. R: Not open to freshmen and sophomores.
Endocrine regulation of reproduction. Cellular and molecular aspects of gametogenesis, folliculogenesis, sexual cycles, fertilization, sex differentiation, gestation, and parturition. Technology to regulate reproduction.

407. Food and Animal Toxicology
Fall. 3(3-0) Interdepartmental with Food Science.
P: BCH 200 or BCH 401. R: Not open to freshmen and sophomores.
Fate and effects of chemicals in the food chain. Impact on animal production. Residues in food products. Food safety assessment. Control methods.

407L. Toxicology Methods Laboratory
Fall. 2(0-4) Interdepartmental with Food Science.
P: ANS 407 or concurrently. R: Not open to freshmen and sophomores.
Laboratory techniques for evaluating potential toxicity of chemicals to living systems. Field trip to industrial toxicology laboratory required.

413. Non-Ruminant Nutrition
Spring. 4(3-2)
P: ANS 313. R: Not open to freshmen and sophomores.
Nutrition of horses, swine and poultry. Digestive and metabolic development and nutrient requirements. Relationships of genetics, endocrinology, immunology, and environment to nutrition.

414. Advanced Animal Breeding and Genetics
Spring. 3(3-0)
P: ANS 314. R: Not open to freshmen and sophomores.
Application of genetics to animal breeding. Current and potential selection programs and crossbreeding systems of dairy cattle, horse and livestock populations. Expected response to selection methods.

415. Biology of Growth and Lactation
Spring. 3(3-0)
P: ANS 315. R: Not open to freshmen and sophomores.
Principles of growth and lactation in food-producing species. Endocrine regulation of bone, muscle, fat, and mammary tissue. Bioenergetic, nutritional, and metabolic aspects of growth and lactation.

416. Meat Science and Muscle Biology
Fall. 2(2-0)
P: ANS 315. R: Not open to freshmen and sophomores.
Structure, composition, development and function of muscle and its conversion to meat. Properties of fresh and processed meat. Microbiology, preservation, palatability, inspection and sanitation, nutritive value, and by-products.

417. Topics in Toxicology
Spring. 1(1-0) Interdepartmental with Food Science.
P: ANS 407. R: Not open to freshmen and sophomores.
Selected topics including regulatory toxicology, risk assessment, environmental toxicology, food safety, and safe handling of toxic substances.

422. Beef Cattle Management
Fall. 3(2-2)
P: ANS 313, ANS 314, ANS 315. R: Not open to freshmen and sophomores.
Management practices and systems for beef herds. Feed requirements, reproduction, breeding, performance testing, housing, and diseases. Costs and returns. Field trips required.

432. Dairy Cattle Management
Fall. 3(2-2)
P: ANS 313, ANS 314, ANS 315. R: Not open to freshmen and sophomores.
Management techniques for operating a dairy herd. Mastitis control, reproductive and nutrition management, records, waste management, and facilities. Field trips required.

442. Horse Management
Spring. 3(2-2)
P: ANS 313, ANS 314, ANS 315. R: Not open to freshmen and sophomores.
Management of stables and breeding farms. Pedigree and conformational selection, reproduction. Promotion, marketing, economics. Nutrition and feeding, facilities, and herd health. Field trips required.

455. Avian Physiology
Spring. 4(3-3)
P: ANS 315. R: Open only to juniors, seniors and graduate students.
Systemic and comparative physiology of birds: respiration, reproduction, endocrinology, digestion, urination, and the senses.

464. Statistical Methods for Biologists I
Fall. 3(3-0) Interdepartmental with Statistics and Probability, and Crop and Soil Sciences. Administered by Statistics and Probability.
P: STT 421.
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression (prediction). Analyses of counted and measured data to compare several biological groups (contingency tables and analysis of variance).

465. Statistical Methods for Biologists II
Spring. 3(3-0) Interdepartmental with Statistics and Probability, and Crop and Soil Sciences. Administered by Statistics and Probability.
P: STT 464.
Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.

472. Swine Management
Fall. 3(2-2)
P: ANS 313, ANS 314, ANS 315. R: Not open to freshmen and sophomores.
Integrated management practices of swine enterprises. Facilities and environmental needs, genetics, nutrition, reproduction, disease control. Economics and marketing. Field trips required.

480. Animal Systems in International Development
Spring. 3(2-2)
P: ANS 313, ANS 314, ANS 315 or approval of department. R: Not open to freshmen and sophomores.
Animal systems in various global regions. Output, land and resource conservation, and socio-economic factors.

481. Agricultural Research Systems in Developing Countries
Summer. 2(2-0) Interdepartmental with Agriculture and Natural Resources, Agricultural Economics, and Crop and Soil Sciences. Administered by Agriculture and Natural Resources.
R: Open only to seniors and graduate students in the College of Agriculture and Natural Resources.
Planning, organizing and managing agricultural research systems. Problems and alternative reforms to improve research productivity. Adapting new agricultural technology in developing countries.

483. Ruminant Nutrition
Spring. 3(3-0)
P: ANS 313, ANS 315. R: Not open to freshmen and sophomores.
Physiology and metabolism in ruminants. Prehension, digestion, metabolism, absorption, and distribution of nutrients for productive functions. Feeding management strategies and diet formulation. Field trip may be required.

490. Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: ANS 210; ANS 313 or ANS 314 or ANS 315. R: Open only to juniors and seniors. Approval of department; application required.
Independent study in genetics, nutrition, physiology, toxicology, meat science, or management of poultry, livestock, or horses.

498. Advanced Enterprise Management
Spring. 3(2-2)
P: ANS 262 or ANS 422 or ANS 432 or ANS 442 or ANS 472 or concurrently. R: Open only to seniors.
Husbandry and business management skills applied to commercial livestock enterprise management. Goal-directed decisions and actions. Field trip required.

499. Senior Thesis in Animal Science
Fall, Spring, Summer. 3 to 9 credits. A student may earn a maximum of 9 credits in all enrollments for this course.
P: ANS 313, ANS 314, ANS 315. R: Open only to seniors. Approval of department; application required. Maximum of 10 credits may be earned in ANS 499 and ANS 490.
Individual studies in an area of choice with both oral and written final communications. Topic to be determined by student and guidance committee.

511. Animal Science for Veterinarians
Fall. 2(2-0)
R: Open only to graduate-professional students in the College of Veterinary Medicine.
Husbandry of domestic, laboratory, and zoo animals. Managerial systems in animal agriculture. Production and management goals.

513. Animal Nutrition for Veterinarians
Spring. 2(2-0)
R: Open only to graduate-professional students in the College of Veterinary Medicine.
Nutrition for domestic animals and wildlife. Comparative nutrient digestion and metabolism. Nutritive requirements for maintenance, growth, reproduction, lactation, and work.

807. Advanced Food Toxicology
Fall of even-numbered years. 3(3-0) Interdepartmental with Food Science. Administered by Food Science.
R: Approval of department.
Toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, and chemical carcinogenesis. Risk assessment.

810. Gastrointestinal Microbiology of Domestic Animals
Fall. 3(3-0)
Microbial ecology of gastrointestinal tract. Microbial role in nutrition, health, and productivity. Environmental applications. Livestock species emphasized.

812. Research Techniques in Animal Nutrition and Metabolism
Fall of odd-numbered years. 3(1-4)
R: Open only to graduate students in Animal Science.
Nutrient analyses, digesta flow kinetics, and digestion-balance trials. Hormone analyses, tissue culture, enzyme assays, metabolite fluxes, tracer methodology, and nucleic acid isolation and analysis.

813. Techniques in Animal Biotechnology
Summer of odd-numbered years. 3(2-2)
P: BCH 462 or BCH 472. R: Approval of Department; Application Required.
Basic molecular biology procedures with emphasis on mammalian systems.

817. Advanced Neurotoxicology
Summer of odd-numbered years. 3(3-0) Interdepartmental with Pharmacology and Toxicology. Administered by Pharmacology and Toxicology.
P: PHM 814 or ZOL 827.
Types of damage occurring in the nervous system. Unique forms of neurotoxicity associated with specific groups of neurotoxicants.

825. Animal Biotechnology
Spring of even-numbered years. 3(3-0)
R: Approval of deptartment; application required.
Basic concepts in animal biotechnology. Application of molecular biology to animal studies. Current topics in animal biotechnology and use of animals in pharmaceutical development.

827. Integrated Risk Assessment of Environmental Hazards
Spring. 3(3-0)
R: Open only to graduate students in the colleges of Agriculture and Natural Resources, Engineering, Human Medicine, Natural Science, Osteopathic Medicine, or Veterinary Medicine.
Alternative approaches to assessing environmental and health risk. Analyzing, interpreting, and using scientific data from ecology, agriculture, environmental chemodynamics, biology, geological sciences, and toxicology in the risk assessment process.

841. Advanced Endocrine Physiology and Pharmacology
Fall. 4(4-0) Interdepartmental with Physiology, and Pharmacology and Toxicology, and Psychology. Administered by Physiology.
P: BCH 461, PSL 432. R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources.
Basic and advanced concepts of endocrine and reproductive physiology and pharmacology.

890. Advanced Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
R: Approval of department; application required.
Investigation of topics of special interest.

898. Master's Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 10 credits in all enrollments for this course.
R: Open only to master's students in Animal Science. Approval of department. Application required.
Scholarly project for non-thesis (Plan B) master's degree.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to master's students in Animal Science. Approval of department.

935. Nutrition: Lipid and Carbohydrate Metabolism
Fall of even-numbered years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Human Nutrition and Foods.
R: Open only to graduate students in Food Science, Human Nutrition, Animal Science, and Nursing, and to graduate-professional students.
Regulatory aspects of lipid and carbohydrate metabolism as influenced by nutritional status.

936. Protein Nutrition and Metabolism
Spring of even-numbered years. 3(3-0) Interdepartmental with Human Nutrition and Foods.
Nutritional and endocrine regulation of protein synthesis and degradation, protein quality assessment, protein status, protein-energy malnutrition. Protein metabolism during exercise. Metabolism, digestion, and absorption of amino acids and proteins.

937. Mineral Nutrition and Metabolism
Fall of even-numbered years. 3(3-0) Interdepartmental with Human Nutrition and Foods.
Forms and locations of mineral elements in the body, metabolic functions, deficiencies, and toxicities, interrelationships and quantitative requirements.

938. Nutrition: Metabolism and Function of Vitamins
Spring of odd-numbered years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Human Nutrition and Foods.
R: Open only to graduate students in Food Science, Human Nutrition, Animal Science, and Nursing, and to graduate-professional students.
Regulatory roles of vitamins at cellular and molecular levels.

943. Techniques of Analyzing Unbalanced Research Data
Spring. 4(4-0) Interdepartmental with Forestry, Crop and Soil Sciences, Horticulture, and Fisheries and Wildlife.
P: STT 464. R: Open only to graduate students in the College of Agriculture and Natural Resources.
Linear model techniques to analyze research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Estimable comparisons. Hypothesis testing. Computational strategies. Variance and covariance components. Breeding values.

976. Multivariate Methods in Agriculture and Natural Resources
Spring. 4(4-0) Interdepartmental with Forestry, and Fisheries and Wildlife. Administered by Forestry.
P: STT 422, MTH 314. R: Open only to graduate students in the College of Agriculture and Natural Resources and in the Interdepartmental Graduate Specializations in Ecology and Evolutionary Biology.
Application of multivariate methods to research problems. Hotelling's T-test, profile analysis, discriminant analysis, canonical correlation, principal components, principal coordinates, correspondence analysis, and cluster analysis.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to doctoral students in Animal Science. Approval of department.

ANTHROPOLOGY ANP

Department of Anthropology
College of Social Science

101. Introduction to Anthropology
Fall, Spring, Summer. 3(3-0)
Human culture worldwide and throughout human history. Major subfields, methods, theories, and issues. World cultural diversity. Culture and world problems.

201. Sociocultural Diversity
Fall, Spring, Summer. 3(3-0)
Origins and diversity of cultural systems. Theories of culture. Patterns of kinship. Religious, economic, and political institutions.

202. Biocultural Evolution
Fall, Spring, Summer. 3(3-0)
Nature and function of culture and its relationship to human biology. Principles of change from hominid origins to present.

220. Gender Relations in Comparative Perspective
Fall. 3(3-0)
Gender relations in different cultures. Economic and domestic division of labor between the sexes as a factor underlying power differentials.

264. Great Discoveries in Archaeology
Spring. 3(3-0)
Great discoveries in archaeology that have captured the public's imagination and shaped Western thought, from Olduvai Gorge and Stonehenge to Macchu Pichu.

270. Women and Health: Anthropological and International Perspectives
Fall. 3(3-0)
Cross cultural perspectives on the health implications of differing life circumstances for women. Women as health-care consumers and providers. Health and women's life cycles.

280. The Anthropological Film
Spring. 3(2-2)
Ethnographic film as a record of vanishing cultures, as a tool for ethnological analysis, and as a source of perspectives on different cultures and variability within cultures.

320. Social and Cultural Analysis
Fall, Spring. 4(4-0)
P: ANP 101 or ANP 201. R: Completion of Tier I writing requirement.
Major theoretical traditions of cultural anthropology. Functionalism, symbolism, structuralism, and contemporary developments.

321. Anthropology of Social Movements
Fall. 3(3-0)
P: ANP 101 or ANP 201.
How social movements within different cultures around the world organize, create or impede change on the basis of class, religion, race, ethnicity, language, and territory.

322. Peasants and Social Change in the Developing World
Spring. 3(3-0)
P: ANP 101 or ANP 201.
Cross-cultural perspective on patterns and variations in peasant systems worldwide. Social mechanisms with which they respond to change.

340. Introduction to Physical Anthropology
Spring. 4(3-2)
P: ANP 101 or ANP 202.
Problems, data, and methods of physical anthropology. Human genetics, hominid evolution, primate studies, human osteology, and human diversity. Field trips at the student's expense may be required.

360. Introduction to Archaeology
Fall. 3(3-0)
Theory, methodology, and techniques of archaeology. Applications to questions about past human behavior. History and concepts of archaeology as an anthropological subdiscipline.

361. Paleolithic Archaeology
Fall. 3(3-0)
P: ANP 101 or ANP 264 or ANP 360.
Stone Age archaeology from the dawn of tool making to the specialized hunters and cave artists of the late Ice Age.

362. Evolution of Agrarian Society
Spring. 3(3-0)
P: ANP 101 or ANP 202 or ANP 264 or ANP 360. R: Not open to freshmen and sophomores.
Food production as adaptive strategy. Archaeological evidence for the appearance and development of food production in prehistory. Theories, problems, and issues in the study of food production evolution.