## Fall 2020 Course Descriptions as of 04/05/2020 08:10 PM

Information in Browse Course Catalog is subject to change. Information is term specific. Please refer to the appropriate term when searching for course content. Key to Course Descriptions may be found at: **http://rcs.registrar.arizona.edu/course_descriptions_key**.

**Animal & Comp Biomed Sciences (ACBS)**

**ACBS 102L: Introduction to Animal Science Laboratory** (1 unit)
**Description:** This course will expose students to various production practices and procedures in the animal industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $100
**Course Components:** Laboratory Required
**Course typically offered:**
Main Campus: Fall, Spring

**ACBS 102R: Introduction to Animal Science** (3 units)
**Description:** This course is a comprehensive review of the livestock industries and production procedures. The course is team taught with one lead instructor and is designed to allow faculty who have expertise in the various areas teach about those areas.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ANS 102
**Course typically offered:**
Main Campus: Fall

**ACBS 142: Introduction to Animal Racing Industry** (2 units)
**Description:** Overview of the history, terminology, personnel, equipment and breeds of animals utilized in the racing industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**ACBS 160D1: Human and Animal Interrelationships from Domestication to the Present** (3 units)
**Description:** This course will examine the relationships of humans with animals throughout the ages. From evolution through domestication, the relationships of animals with humans throughout Europe and the New World will be studied. The modern relationships will also be examined and analyzed and compared to those of ancient and historical times.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Discussion — May Be Offered
Lecture — Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** Enrollment not allowed if you have previously taken TRAD 104 "Human and Animal Interrelationships from Domestication to the Present" (Topic 1).
**General Education:** TRAD 104

**ACBS 193: Internship** (1 - 8 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study — Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 195D: Colloquium: This Wormy World** (1 unit)
**Description:** This Wormy World is a course designed to introduce students to various types of parasites and other infectious agents that affect humans and animals around the world.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Colloquium — Required
**Equivalent to:** MIC 195D
**Also offered as:** MIC 195D
**Course typically offered:**
Main Campus: Fall

**Freshman Colloquia:** Freshman Colloquia

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 195F: Careers in Veterinary Science** (1 unit)
**Description:** This course is a colloquium to introduce students to the various careers and animal industries associated with the fields of veterinary/animal science and veterinary medicine. This class will also provide a guide in the preparation for application to a professional school of veterinary medicine.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Colloquium Required
**Course typically offered:**
Main Campus: Fall

**Freshman Colloquia:** Freshman Colloquia

**ACBS 199: Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 199H: Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**Enrollment requirement:** Student must be active in the Honors College.
**Honors Course:** Honors Course
**Honors Course:** Honors Course

**ACBS 202: Introduction to Livestock Production** (3 units)
**Description:** Students will become familiar with the production and management of beef cattle, swine, sheep and goats. Topics discussed will include handling and facilities, nutrition, anatomy and physiology, breeding and genetics, reproduction, record keeping and economics.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $100
**Course Components:** Laboratory Required
Lecture Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ANS 102R and ANS 102L.

**ACBS 210: Introduction to Live Animal and Carcass Evaluation** (3 units)
**Description:** A practical, hands-on look at live animal evaluation of market and breeding beef, swine, sheep, and goats as related to contemporary industry issues that drive modern production practices.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $50
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Field trip:** One or more
**Enrollment requirement:** ANS 102R.

**ACBS 215: Physiology and Anatomy of Domestic Animals** (3 units)
**Description:** Systemic physiology and functional anatomy of domestic animals with emphasis on physiological systems of importance to animal production.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** MCB 181R.

**ACBS 220: Introduction to Dairy Science** (3 units)
**Description:** Students will become familiar with biology of the dairy cow, various physiological processes that affect milk production, technology utilized in modern dairies, physical considerations for choosing a dairy site, and environmental issues that face today's dairies.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Field trip:** Trip to Dairy Research Center.

**ACBS 270: Introductory Horse Science** (3 units)
**Description:** An introduction to the fundamental aspects of horse science; ownership responsibilities, economics, anatomy, physiological systems and careers in the horse industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**ACBS 271A: Training and Management of the Weanling** (3 units)
**Description:** The course will focus on the management of the young growing horse. Students will acquire hands on instruction in handling and training foals and information regarding current management practices in all aspects of raising young horses.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory May Be Offered
Lecture Required
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** Preference given to students fulfilling degree requirements in Animal Sciences.

**ACBS 272: Introduction to Horsemanship Programs** (2 units)
**Description:** Course focuses on establishing a program that develops the secure, balanced seat in the beginning rider. Students will gain information that allows them to interact with clientele in a professional manner and to develop a program that encourages future learning.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $200
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** Enrollment is limited. Preference given to students fulfilling degree requirements in Animal Sciences.

**ACBS 273: Developing the Training Foundation in Yearlings** (3 units)
**Description:** This course will focus on the handling and management of the Thoroughbred yearling. Students will acquire hands-on knowledge of how to prepare the yearling animal for future training under saddle.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Course typically offered:**
Main Campus: Spring

**ACBS 285L: Principles of Microbiology Laboratory** (1 unit)
**Description:** The course is the laboratory course to accompany MIC 285R.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $40
**Course Components:** Laboratory — Required
**Equivalent to:** MCB 285L, PLP 285L, SWES 285L, VSC 285L
**Also offered as:** ENVS 285L, MCB 285L, MIC 285L, PLP 285L
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MCB 181R, MCB 181L, ECOL 182R, ECOL 182L, CHEM 103A, CHEM 103B, CHEM 104A, CHEM 104B. Concurrent registration, MIC 285R for MIC and V SC majors. Strongly recommended: MIC 285L, MIC 285R be taken together by all others.
**Home department:** Veterinary Science & Microbiology

**ACBS 285R: Principles of Microbiology** (4 units)
**Description:** The course is an introductory microbiology class for majors, emphasizing cellular, biochemical and molecular aspects of metabolism, genetics, cell structure, and host-parasite interactions
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** MCB 285R, PLP 285R, SWES 285R, VSC 285R
**Also offered as:** ENVS 285R, MCB 285R, MIC 285R, PLP 285R
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MCB 181R, MCB 181L, ECOL 182R, ECOL 182L, CHEM 103A, CHEM 103B, CHEM 104A, CHEM 104B. Concurrent registration, MIC 285R for MIC and V SC majors. Strongly recommended MIC 285L, MIC 285R be taken together by all others.
**Home department:** Veterinary Science & Microbiology

**ACBS 291: Animal and Comparative Biomedical Sciences Preceptorship** (1 - 4 units)
**Description:** A preceptorship involves specialized work on an individual basis, consisting of instruction and practice in service to the Animal Sciences Department for one of its programs; primarily assisting other students in the better understanding of the target course content. Actual duties may vary depending on the enrollment status of the preceptor student in the target course.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated for a maximum of 6 units.
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** Knowledge and experience in the target course area of study.

**ACBS 293: Internship** (1 - 8 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 297B: Intro to Competitive Livestock Judging** (2 units)
**Description:** This class will focus on the evaluation of both market and breeding cattle, sheep, goats, and swine with an added emphasis placed on oral reasons as related to collegiate livestock judging competition.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Workshop Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** ANS 210 or consent of instructor.
**Field trip:** One or more.

**ACBS 299: Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Some sections have special fees. Check with the department.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 299
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 299H: Honors Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 299H
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**Enrollment requirement:** Student must be active in the Honors College.
**Honors Course:** Honors Course
**Honors Course:** Honors Course

**ACBS 301: Financial and Economic Strategy** (3 units)
**Description:** The course offers a presentation of financial and economic organizational strategic decision making. Class subject matter relates these general business practices to animal racing and animal science/production organizations. This course will not count toward a Business Minor.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**ACBS 302: Management and the Human Side of Organizations** (3 units)
**Description:** The course offers a presentation of organizational and human asset management practice and theory in small to large businesses. Class subject matter relates these general business practices to animal racing and animal science/production organizations. This course will not count toward a Business Minor.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**ACBS 310: Living in Symbiosis** (3 units)
**Description:** This course will provide an overview of the diversity of associations that exist between microbes and eukaryotic hosts. The course will span from highly integrated obligatory symbioses to loose associations. Emphasis will be placed on symbiotic associations with relevance to human medicine, veterinary sciences, and agriculture.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 310, MIC 310, VSC 310
**Also offered as:** ECOL 310, ENTO 310, MIC 310
**Course typically offered:**
Main Campus: Fall

**Home department:** Entomology

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 311: Understanding Dog and Cat Behavior** (3 units)
**Description:** This course will provide the student with a basic understanding of species typical companion animal behavior and its application in an applied environment. Topics and discussion will focus primarily on domestic dogs and cats in a home environment. The topics covered will include domestication and genetics, developmental periods, learning, emotional states, communication and social systems. A brief overview of common problem behaviors that companion animals exhibit in a home environment will also be explored.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall, Summer

**Student Engagement Activity:** Discovery
**Student Engagement Competency:** Professionalism

**ACBS 312: Animal and Plant Genetics** (4 units)
**Description:** The course is designed to help students learn and use the basic concepts of the very broad field of genetics, including the sub-fields of transmission genetics, cytogenetics, cytoplasmic inheritance, quantitative inheritance, population genetics and evolution, and molecular genetics. Students will be able to solve a wide variety of genetics problems by utilizing the basic concepts and selecting an appropriate and effective approach. Students will also acquire some basic laboratory skills that will enhance their understanding of the concepts presented in the course.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $29
**Course Components:** Laboratory May Be Offered
Lecture Required
**Equivalent to:** ANS 312, VSC 312
**Also offered as:** PLS 312
**Course typically offered:**
Main Campus: Spring
Distance Campus: Spring

**Recommendations and additional information:** PLS 130 or PLS 240 or MCB 182R and MCB 182L; CHEM 103A, CHEM 104A.
**Home department:** School of Plant Science

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 313: Principles of Animal Genetic Systems** (3 units)
**Description:** Basic concepts involved in the improvement of economically important traits of livestock through application of genetic principles.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ANS 213, MATH 263.
**Field trip:** Field trip
**Writing Emphasis:** Writing Emphasis Course

**ACBS 315L: Physiology of Reproduction Laboratory** (1 unit)
**Description:** Reproductive anatomy, evaluation, semen collection, artificial insemination, and estrus detection and synchronization. Students will work in small groups for 8 weeks on a specific topic.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $20
**Course Components:** Laboratory Required
**Equivalent to:** VSC 315L
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** Prerequisite or concurrently enrolled in ANS 315R.

**ACBS 315R: Physiology of Reproduction** (3 units)
**Description:** Study of the organs of reproduction and their accessories; physiology and endocrinology as related to the process of reproduction and milk secretion.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** VSC 315R
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** ANS 215 or (ECOL 182R and CHEM 152).

**ACBS 316: Equine Reproductive Physiology and Management** (3 units)
**Description:** The course will provide a review of basic equine reproductive physiology, and introduce students to the common reproductive management practices found in the industry today.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ANS 315R.

**ACBS 317: One Health: A Microbial Perspective** (3 units)
**Description:** ACBS 317 is a case study-driven course where students will learn the general concepts of one health, which examines how human, animal and environmental health are all interconnected.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MCB 181R and ECOL 182R.

**ACBS 320: Principles of Dairy Product Processing and Safety** (3 units)
**Description:** This course will introduce students with milk-producing animals and basic factors that impact the quantity, quality, and safety of raw milk. Students will learn how raw milk is withdrawn from the animal and handled for further processing. The functional and compositional characteristics of raw milk and milk products will be addressed. Students will get a comprehensive review of the quality and safety standards for a wide range of consumable end products (e.g., fluid, solid, and dry milk products, cultured and acidified products, and cheeses). The relationship between the Pasteurized Milk Ordinance (PMO) and the preventive controls rule associated with the Food Safety Modernization Act (FSMA) will be addressed.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Field trip:** Voluntary participation in local field trips will be encouraged (e.g., local dairy production operations and dairy food manufacturer operations).

**ACBS 329A: Microbial Diversity** (3 units)
**Description:** Microbial diversity is a course offered to students in Microbiology, and to other majors with an interest in the remarkable genetic, species-level, phylogenetic, functional, and ecological diversity of prokaryotic and eukaryotic microorganisms.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 329A, MIC 329, MIC 329A, PLP 329, VSC 329, VSC 329A
**Also offered as:** ECOL 329A, MIC 329A, PLP 329A
**Course typically offered:**
Main Campus: Fall
Distance Campus: Fall

**Recommendations and additional information:** MCB 181R.
**Home department:** Plant Pathology

**ACBS 334: Principles of Animal Nutrition** (3 units)
**Description:** To become acquainted with and learn basic nutrition concepts including: classification and function of Nutrients, deficiency and toxicity symptoms, digestive processes, feedstuff characterization, and diet formulation for domestic animals. This course will cover everything related to the nutrition and feeding of domestic animals and is intended for both majors needing a prerequisite Animal Nutrition class and non-majors desiring a stand alone course in Animal Nutrition.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** CHEM 152.

**ACBS 336A: Applied Animal Nutrition** (3 units)
**Description:** Application of principles of nutrition to the feeding of livestock and poultry, nutrient composition and characteristics of feeds, nutrient requirements and diet formulation.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ANS 336
**Course typically offered:**
Main Campus: Fall

**ACBS 340: Race Track Marketing and Media Relations** (3 units)
**Description:** Concepts and issues related to the marketing and promotion of the animal racing facility and industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ANS 142.

**ACBS 342: Organization and Administration of the Racing Department** (3 units)
**Description:** Basic duties and functions of the racing office and department. Personnel required and procedures utilized in developing the racing program.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Field trip:** Field trip.
**Enrollment requirement:** ANS 142.

**ACBS 345: Racing Laws and Enforcement** (3 units)
**Description:** Presentation of the regulatory framework of the Constitution, federal and state statutes, administrative rules and their relationship to the regulation of pari-mutuel racing.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** Prerequisite or concurrently enrollmented in ANS 142.

**ACBS 355: Introduction to Food Processing and Food Safety Preventive Controls** (3 units)
**Description:** This course will introduce students with the equipment, process flow charts, quality assurance measures, shelf-life considerations, and food safety system designs for a range of human and animal food processes. The course is divided into two modules. One module will focus on familiarizing the students with the similarities of these processes, as well as their unique processing requirements. Nutrient content changes as a result of processing and shelf life will also be emphasized. The second module will focus on familiarizing the students with the design of effective food safety systems. Students will learn the prerequisite programs and Hazard Analysis and Critical Control Point (HACCP) rules enforced by the Food Safety and Inspection Service (FSIS). In addition, students will learn the risk-based Preventive Controls rules of the Food Safety Modernization Act (FSMA) enforced by the Food and Drug Administration (FDA). Students will be introduced to the concepts of data collection and analysis to support monitoring, verification, and validation activities incorporated into the FSIS and FDA food safety system requirements. Students may elect to also complete additional training requirements relative to HACCP and FSMA. This training is designed to meet regulatory expectations of FSIS and FDA for the production of human and animal food. Such students will pay a pre-determined fee and participate in mandatory activity built into the regular course schedule. Students that elect this additional training and successfully complete all requirements, including evidence of full participation, will receive a certificate of record. This record can be presented to an employer, as well as to FSIS and FDA.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** This course also is designed to address the topics of microbiology, nutrition, and pre- and post-harvest production of food from animal and produce sources. Regardless, completion of a basic course covering these topics may be helpful.
**Field trip:** None
**Enrollment requirement:** CHEM 152

**ACBS 370: Form and Function of the Equine Athlete** (3 units)
**Description:** This course will consist of lecture and live evaluation of equine conformation as it relates to athletic ability and soundness. Equine physiology, therapy for injuries and preventive techniques (sports medicine) will be discussed.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ANS 270.

**ACBS 371: Sales and Marketing Strategies for Performance and Race Horse Prospects** (3 units)
**Description:** This course focuses on developing and marketing the Thoroughbred racing prospect. Students will condition yearlings to be presented at the annual Arizona Thoroughbred Breeders Association sale, as well as develop a business and marketing plan based on current industry standards.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $225
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Course typically offered:**
Main Campus: Fall

**ACBS 372: Intermediate Horsemanship and Training Techniques** (2 units)
**Description:** This course is designed to further the skills obtained in AN S272, Introduction to Horsemanship. Riders will be exposed to more technical and theoretical knowledge of riding in both hunt seat and stock seat. Students will also become acquainted with anatomical, physiological and psychological factors affecting both the horse and rider. Students will each ride for one hour during the two-and-a-half hour lab sessions. During the hours the student is not riding, they will observe an assigned partner and keep a riding journal.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $200
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ANS 272. Preference is given to students fulfilling degree requirements in Animal Sciences.

**ACBS 377: Food Toxicology** (3 units)
**Description:** During this course, students will differentiate between allergen issues, storage issues and harmful microbiological by-products. Also, topics such as toxins produced by bacteria, fungal toxins, seafood toxins, chemical and natural preservatives and additives will be discussed. Students will learn about the impact of the environments and processing in the formation of these toxins in raw and processed foods. Students will formulate corrective and preventive strategies to avoid harmful reactions in raw materials and finished products, mitigating risk of pathogens or other environmental factors negatively affecting the food supply. Students will examine food toxicosis in both dose-dependent and time-dependent manners as well as assess manifestations of toxicosis in order to suggest corrective measures and cures.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** MIC 205A

**ACBS 380: Food Safety and Microbiology** (4 units)
**Description:** To acquaint the student with contamination and microbiology of foods, and to discuss food safety issues regarding all types of food. The major focus is on procedures to produce safe food products for consumers and for all segments of the food industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $50
**Course Components:** Laboratory Required
Lecture Required
**Course typically offered:**
Main Campus: Fall, Summer

**ACBS 380L: Food Safety and Microbiology Laboratory** (1 unit)
**Description:** During this course, students will use laboratory techniques in food safety to assess microbial contamination of food. Food safety laboratories will include detecting potential disease-causing microbes, spoilage microorganisms. Prevention methods for safe food will be applied.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** MIC 205L or (MIC 285R and MIC 285L)

**ACBS 380R: Food Safety and Microbiology** (3 units)
**Description:** During this course, students will explore food safety and microbial contamination of food. Food safety issues including potential disease-causing microbes, spoilage microorganisms, and prevention methods for safe food will be covered for each food category: beef and pork, poultry, produce, dairy, dry food products, and seafood. Procedures to ensure the production of safe food by food type will be analyzed and applied in case studies.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** MIC 205A or (MIC 285R and MIC 285L)

**ACBS 391: Animal and Comparative Biomedical Sciences Preceptorship** (1 - 4 units)
**Description:** A preceptorship involves specialized work on an individual basis, consisting of instruction and practice in service to the Animal Sciences Department for one of its programs; primarily assisting other students in the better understanding of the target course content. Actual duties may vary depending on the enrollment status of the preceptor student in the target course.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated for a maximum of 6 units.
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** Knowledge and experience in the target course area of study.

**ACBS 393: Internship** (1 - 8 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 395A: Professional Development in Animal Agriculture** (1 unit)
**Description:** Preparation of resumes and letters of introduction. Instruction often includes lectures by several different persons from related animal industries.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Colloquium Required
**Course typically offered:**
Main Campus: Spring

**ACBS 395B: Topics in Applied Animal Behavior** (1 unit)
**Description:** This course will explore the various issues facing companion animals in today's society. Semester topics will include the dog meat trade, puppy mills, dog fighting, horse slaughter, feral cats and cat declawing. Discussion will take place in a small group setting and each discussion will be led by 1-2 assigned students.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Colloquium Required
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 311
**Student Engagement Activity:** Discovery
**Student Engagement Competency:** Civic and Community

**ACBS 396A: Junior Livestock Judging Team** (1 unit)
**Description:** The development and discussion based exchange of scholarly information concerning livestock evaluation in relation to contemporary industry standards, in a small group setting.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Seminar Required
**Course typically offered:**
Main Campus: Spring

**Field trip:** One or more field trips.
**Enrollment requirement:** ANS 297B.

**ACBS 397A: Calving Management** (2 units)
**Description:** Students will be provided with basic background information on range cattle reproductive management, and the opportunity for hands on experience at a working cattle ranch. Students will assist in calving management at the V-V Ranch, Camp Verde, AZ. Students will learn the phases of calf delivery, assistance for dystocia management, and post-partum calf care. While at the ranch housing is provided. Students will assist in all phases of ranch operation. This course is designed and recommended for students without extensive livestock/ranch experience. Class is limited to 24 students. Enrollment is by consent of instructor.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Workshop Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ACBS 102R or ACBS 195F. Enrollment by consent of instructor.
**Field trip:** Mandatory 2-days at V-V Ranch, Rimrock AZ, late February/early March (Students in groups of 6). 1-day trip to the V-V in early May for all students to assist in vaccination and process of calves born during the February calving session.

**ACBS 397C: Equitation Workshop** (1 unit)
**Description:** The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles. This course is designed for the student who after taking AN S272 wishes to continue in their learning of the art of equitation inside the show ring. There is no minimum level of riding experience necessary to participate in either this class or IHSA competition.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Workshop Required
**Repeatable:** Course can be repeated a maximum of 7 times.
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** ANS 272.

**ACBS 399: Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Some sections have special fees. Check with the department.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 399
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 399H: Honors Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 399H
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**Enrollment requirement:** Student must be active in the Honors College.
**Honors Course:** Honors Course
**Honors Course:** Honors Course

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 400A: Animal Anatomy and Physiology** (3 units)
**Description:** This is one of two 3-unit lecture/demonstration courses which comprise a 2-semester sequence of animal anatomy and physiology course work which is required for graduation with a major in Veterinary Science. They may be completed in any order. The anatomy portion of these courses is not a traditional type anatomy course which requires that the student name each and every vessel or muscle, etc. and where it originates and terminates. It is more a treatise on "functional anatomy" which will give the learner an appreciation of how the body component is put together (morphology) thus dictating how it may properly function (physiology). Emphasis is placed upon the systemic or whole animal operational levels rather than the precise biochemical and physical intricacies associated with the individual parts or cells which make up that whole. Students will gain an appreciation of how the various domestic species are put together and how they function and the interrelationships of the parts and systems which allow the individuals to thrive in their environment. Some consideration will also be given to what happens to the individual when form or function goes awry to illustrate the importance of the norm. Emphasis will be placed upon the common domestic and pet mammalian species with selected references to wild species, birds and primates where appropriate.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 500A
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** MCB 181R, ECOL 182R, and CHEM 151.

**ACBS 400B: Animal Anatomy and Physiology** (3 units)
**Description:** This is one of two 3-unit lecture/demonstration courses which comprise a 2-semester sequence of animal anatomy and physiology course work which is required for graduation with a major in Veterinary Science. They may be completed in any order. The anatomy portion of these courses is not a traditional type anatomy course which requires that the student name each and every vessel or muscle, etc. and where it originates and terminates. It is more a treatise on "functional anatomy" which will give the learner an appreciation of how the body component is put together (morphology) thus dictating how it may properly function (physiology). Emphasis is placed upon the systemic or whole animal operational levels rather than the precise biochemical and physical intricacies associated with the individual parts or cells which make up that whole. Students will gain an appreciation of how the various domestic species are put together and how they function and the interrelationships of the parts and systems which allow the individuals to thrive in their environment. Some consideration will also be given to what happens to the individual when form or function goes awry to illustrate the importance of the norm. Emphasis will be placed upon the common domestic and pet mammalian species with selected references to wild species, birds and primates where appropriate.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 422L
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MCB 181R, ECOL 182R, and CHEM 151.

**ACBS 401L: Domestic Animal Anatomy & Physiology Laboratory** (1 unit)
**Description:** Study of the anatomy of various animals, including the nervous, cardiovascular, respiratory, skeletal, muscular, reproductive, and digestive systems and their relationship to physiological processes.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $60
**Course Components:** Laboratory Required
**Course typically offered:**
Main Campus: Spring

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 403L: Parasitology Laboratory** (1 unit)
**Description:** Parasite morphology and diagnostic laboratory techniques.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory Required
**Equivalent to:** ECOL 403L, ENTO 403L, MIC 403L, MICR 403L
**Also offered as:** ECOL 403L, ENTO 403L, MIC 403L
**Co-convened with:** VSC 503L
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** Twelve units of biology and microbiology.

**ACBS 403R: Biology of Animal Parasites** (3 units)
**Description:** Biology of host-parasite relationships with emphasis on parasites of veterinary and human importance. Parasite morphology and physiology, life cycles, epidemiology, pathogenesis and zoonotic potential.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 403R, ENTO 403R, MIC 403R, MICR 403R
**Also offered as:** ECOL 403R, ENTO 403R, MIC 403R
**Co-convened with:** VSC 503R
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** Twelve units of biology and microbiology.

**ACBS 405: Principles of Livestock Health Management** (3 units)
**Description:** Survey of selected diseases of horses, cattle, sheep, goats and pigs. Includes basic coverage of mechanisms of infectious disease, immunology, infectious agents, diagnostic techniques as well as the relationship of husbandry and management to the occurrence of livestock disease. Disease topics covered will include a wide range of infectious and non-infectious diseases (including nutritional deficiencies and important toxins and toxicants) affecting livestock. A basic course covering the animal industry (e.g. Animal Science 102 or equivalent) is recommended.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 505
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ANS 215 or equivalent, or consent of the instructor.

**ACBS 406: Diseases of Companion Animals** (3 units)
**Description:** This course is a challenging one-semester lecture for students interested in studying disease processes commonly seen in a small animal Veterinary practice. The course will highlight anatomical locations, pathological processes, diagnosis, treatment and prevention of a variety of disease conditions. Special emphasis will be placed on diseases commonly seen in the southwestern states.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MIC 205A; VSC 400A or ANS 215.

**ACBS 409: Environmental Physiology of Domestic Animals** (3 units)
**Description:** Overview of environmental variables that influence thermal environments around domestic animals and their physiological responses to those environments. Evaluation of physiological response will include the sub-cellular, cellular, systemic and whole animal levels. Emphasis will be placed on how biological systems are coordinated to respond to environmental change.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 509
**Course typically offered:**
Main Campus: Spring

**ACBS 410: Animal Toxicology** (3 units)
**Description:** This course is focused on how animals are affected by toxic substances. The lectures will cover the principles of toxicology, factors affecting response to chemicals, common mechanisms of toxicity, toxicity to key organs, and the toxicity of substances relevant to small and large domestic animals.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 510
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** Two semesters of biology (MCB 181R and ECOL 182R, or MCB 184 and ECOL 182R) and one semester of chemistry (CHEM 151), or instructor consent.

**ACBS 411: Agriculture, Environmental and Legal Issues** (3 units)
**Description:** Students will be introduced to fundamental concepts associated with modern day agricultural industries to help them understand legal concepts as well as public policy that affects the commodities markets, natural resources in their "raw form", consumer attitudes, and market forces that affect various agribusiness industries of the west. Students will receive exposure to the framework of the United States legal system, with a brief review of the three distinct branches of government and how each branch impacts the development of law and policy as related to the production agriculture. The majority of the course will focus on four (4) primary areas: 1.) Animal welfare, law and policy, 2) Food safety regulations and organic growing standards in production agriculture and organic livestock standards, 3.) An overview of Environmental law, policy and 4.) Water law and policy. Students will be able to demonstrate how science, law and policy impact the modern day agriculturist as well as natural resource users.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Also offered as:** LAW 411
**Course typically offered:**
Main Campus: Spring

**ACBS 412: Introduction to Equine-Assisted Therapy and Learning** (2 units)
**Description:** In the last four decades, the use of horses for the delivery of therapeutic and learning services has emerged as a growth industry in the equine sector. Equine-assisted therapy and learning (EAT/L) have unique underpinnings in equine behavior, learning theory, and therapeutic approaches. By understanding both the entomologic and theoretical foundations, it is possible to appreciate, evaluate, and learn how EAT/L is applied in the clinical, therapeutic, and educational realms. This course serves as an introduction to the theory, practice, and application of EAT/L as well as documentation and legal issues that arise in developing EAT/L-related equine enterprises. The selection and training of horses for EAT/L and the specific responsibilities and certification of horse professionals for EAT/L will be explored. The course will also explore the implications of the marketplace forces that shape the roles for therapists, educators, counselors, rehabilitation experts, and horse professionals.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory Required
**Course typically offered:**
Main Campus: Spring

**ACBS 416: Assisted Reproductive Technologies in Horses** (3 units)
**Description:** Course will focus on aspects of equine reproduction, with an emphasis placed on current assisted reproductive technologies. Students will gain experience with artificial insemination practices and develop an understanding of recent, cutting-edge biotechnology.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Co-convened with:** ANS 516
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** Graduate majors given enrollment preference.
**Enrollment requirement:** ANS 315R and ANS 316.

**ACBS 419: Immunology** (4 units)
**Description:** Basic concepts of immunity. Molecular and cellular composition of the immune system and immune processes that are responsible for defense against pathogens and tumors, and for allergic and autoimmune reactions. Honors section convened with V SC 519.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Discussion — May Be Offered
Lecture — Required
**Equivalent to:** MICR 419, VSC 419
**Also offered as:** MIC 419
**Co-convened with:** MIC 519
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** MIC 285R, CHEM 241B.
**Home department:** Veterinary Science & Microbiology
**Writing Emphasis:** Writing Emphasis Course

**ACBS 420: Meat Animal Composition** (3 units)
**Description:** Evaluation of meat animals for carcass merit and economical value using visual, electronic and chemical technologies.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $49
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Co-convened with:** ACBS 520
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ANS 102R, ANS 102L, and ANS 210.

**ACBS 422L: Applied Histology Laboratory** (1 unit)
**Description:** This one credit laboratory course consists of two 2 hours laboratory sessions. During the laboratory, the students will be introduced to microscopic examination and identification of tissues and organ systems using histological specimens.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Laboratory — Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** MCB 181R, ECOL 182R, ECOL 182L; Concurrent registration, VSC 422R.

**ACBS 422R: Applied Histology** (3 units)
**Description:** This three credit course consists of three hours of didactic lecture. The course is a microscopic survey of tissues and organs. The microanatomy of the major organ systems in mammals will be examined in detail with emphasis on the comparative anatomy of the domestic animal species (dog, cat, horse, cow). In addition, comparison to avian tissues will be included in selected organ systems.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture — Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** MCB 181R, ECOL 182R, ECOL 182L; Concurrent registration, VSC 422L.

**ACBS 423: Mechanisms of Disease** (3 units)
**Description:** This course focuses on the fundamental pathogenetic mechanisms and lesions which are common to all mammalian species and which are manifested as disease. The course is centered upon General Pathology and focuses on how different types of disease develop and their consequences. The material is presented using a comparative (i.e. animal and human) approach that emphasizes the commonalities between disease processes rather than the exceptions. Successful integration of course concepts will provide the necessary foundation on which competency in clinical, diagnostic, or experimental medicine and biomedical research can be built. Further, the course will provide the general mechanistic knowledge required for the subsequent study and understanding of specific disease entities, categorized by organ system, in Systemic Pathology. The course stresses general mechanisms of disease common to all mammalian species and is divided into 5 major sections: tissue injury and adaptation; inflammation and repair; disorders of circulation; disorders of immunity; and disorders of cell growth with emphasis on neoplasia. Available for honors credit.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Also offered as:** MIC 423, PCOL 423
**Co-convened with:** ACBS 523
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** Six units of upper division ACBS and/or MIC credit, or consent of instructor.
**Enrollment requirement:** Prerequisites: ACBS 400A (or 500A) and ACBS 400B (or 500B) or concurrent enrollment, or PSIO 201 and PSIO 202 or concurrent enrollment, or ACBS 215 or concurrent enrollment, or consent of instructor.

**ACBS 427R: General Mycology** (3 units)
**Description:** An exploration of the diversity of fungi and fungus like organisms covering general biology and roles as pathogens (of humans and plants), saprobes and symbionts. Fungi as models for eukaryotic molecular research and their uses in industry will be covered.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Repeatable:** Course can be repeated a maximum of 2 times.
**Equivalent to:** MIC 427R, VSC 427R
**Also offered as:** MIC 427R, PLP 427R
**Co-convened with:** PLP 527R
**Course typically offered:**
Main Campus: Fall
Distance Campus: Fall

**Recommendations and additional information:** MCB 181R, MIC 285R.
**Home department:** Plant Pathology

**ACBS 428L: Microbial Genetics Laboratory** (2 units)
**Description:** Laboratory associated with lecture course on Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Biology of plasmids and bacteriophages.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Flat Fee:** $70
**Course Components:** Laboratory Required
**Equivalent to:** ECOL 428L, MCB 428L, MIC 428L, MICR 428L, PLS 428L, SWES 428L, VSC 428L
**Also offered as:** ECOL 428L, ENVS 428L, MIC 428L, PLP 428L, PLS 428L
**Co-convened with:** ACBS 528L
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ECOL 320, PLS 312 and PLP 428R.
**Home department:** Plant Pathology
**Writing Emphasis:** Writing Emphasis Course

**ACBS 428R: Microbial Genetics** (3 units)
**Description:** Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Biology of plasmids and bacteriophages.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 428, ECOL 428R, GENE 428R, MCB 428, MIC 428, MIC 428R, MICR 428, MICR 428R, PLP 428, PLS 428R, SW 428, SWES 428, SWES 428R, VSC 428, VSC 428R
**Also offered as:** ECOL 428R, ENVS 428R, MIC 428R, PLP 428R, PLS 428R
**Co-convened with:** ACBS 528R
**Course typically offered:**
Main Campus: Spring
Distance Campus: Spring

**Home department:** Plant Pathology
**Writing Emphasis:** Writing Emphasis Course

**ACBS 431: Equine Nutrition and Management** (3 units)
**Description:** This course will focus on nutritional requirements of horses for growth, reproduction, lactation and work in addition to maintenance.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 531
**Course typically offered:**
Main Campus: Fall

**ACBS 432: Comparative Immunology** (3 units)
**Description:** How have vertebrate immune systems evolved from simple origins? We will cover comparative immunology of prokaryotes, protozoans, plants, fungi, invertebrates, and "lower" vertebrates. By studying the origins and evolution of immunity across the history of life, and following the progression of immune system complexity across different lineages, we begin to see patterns that help explain how our immune system developed from those of our ancestors. Such comparative study will highlight the strengths and weaknesses of our immune system, and point to ways in which other organisms have overcome the same pathogenic stresses we currently face. This class will pull together data from many fields, including immunology, molecular and cell biology, ecology, and evolution.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Also offered as:** ECOL 432, ENTO 432, MCB 432, MIC 432
**Co-convened with:** ACBS 532
**Course typically offered:**
Main Campus: Fall

**Home department:** Entomology
**Enrollment requirement:** MCB 181R and MCB 181L, ECOL 182R and ECOL 182L, or instructor consent.

**ACBS 433: Advanced Racing Laws and Enforcement** (3 units)
**Description:** Building on the framework presented in "Racing Laws and Enforcement" course, an in-depth presentation of select components of the regulation of the pari-mutuel industry. The course will also involve presentation and discussion of the current and evolving regulatory issues and challenges facing the industry.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 533
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** Completion of ANS 345 with a grade of C or better.

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**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 437: Food Safety Laws and Legal Policies** (3 units)
**Description:** The class is recommended for Junior and Senior year students. Students will learn about food safety policy, including the laws and associated implementing regulations, and how they are developed by Congress and enforced by the primary Federal public health agencies. Although specific focus will be on food safety, related consumer protection policies will be addressed, including food labeling and the humane handling of animals prior to slaughter. Students will assess scenarios involving how the Administrative Procedure Act guides Federal food safety policy development in order to withstand legal challenge from stakeholders, including consumers, the food industry, and foreign governments. Scenarios also will be assessed on how exported and imported food policy is established and enforced in order to comply with international treaties and trade policies. Students will learn how to find resources on how to comply with food safety policy. Students will be able to use this knowledge to bridge the gap between stakeholders and facilitate development of compliant food products that expand both domestic and global trade.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**ACBS 438: Ecology of Infectious Disease** (3 units)
**Description:** Ecology of the major infectious diseases of humans and animals.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** MIC 438, MICR 438
**Also offered as:** MIC 438
**Co-convened with:** MIC 538
**Course typically offered:**
Main Campus: Spring

**ACBS 441: Race Track Organization, Structure and Financial Management** (3 units)
**Description:** Organizational structure and financial management issues involved in the administration of the animal racing facility.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 541
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** (ANS 142, ANS 301 and ANS 345) and (ACCT 200 or ACCT 250).

**ACBS 442: Racing Business, Strategies and Global Perspectives.** (3 units)
**Description:** Strategies and management issues involved in the operations and administration of the animal racing facility. The focus is the strategic management of facilities, other uses for the facilities and the racing business internationally.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:**
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** ANS 433 and ANS 441.

**ACBS 443: Research Animal Methods** (3 units)
**Description:** Regulations, care, diseases and techniques involving common laboratory animals used in research and teaching programs.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ANS 443, BIOC 443, MIC 443, MICR 443
**Also offered as:** BIOC 443, MIC 443
**Co-convened with:** VSC 543
**Course typically offered:**
Main Campus: Fall

**ACBS 444: Development and Management of Racing Animals** (3 units)
**Description:** Presentation of theoretical and applied management practices in the development and marketing of racing animals in the commercial sector.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** ANS 142 and ANS 270.

**ACBS 445: Nutritional Physiology and Metabolic Biochemistry** (3 units)
**Description:** This course is designed to enhance understanding of the principles of animal nutrition and metabolic biochemistry to explain the nutritional requirement, metabolic, and physiological differences between animal species. As such, this course will focus on the most basic molecules of nutrition (carbohydrates, fats, and amino acids) and their digestion, absorption, metabolism, and assimilation into the body. Therefore, a basic understanding of biology and chemistry are expected upon entering this course.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 545
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** CHEM 151/152 and MCB 181R

**ACBS 446: Human Resource Management** (3 units)
**Description:** This course will examine the importance of human resources as a competitive advantage. The course will also familiarize students with the essential human resource managerial issues in today's business world. The purpose of the course is to assist students in understanding the principles, policies, and practices related to procurement, development, maintenance and utilization of human resources. Topics include: overview - human resources in perspective; human resource management and the law; personnel planning and recruiting; interviewing; candidate training & development of employees; performance evaluation - retention, compensation & benefits/services; employee safety & health labor relations - unions and negotiations.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** Sophomores with consent of instructor. Preference given to students fulfilling degree requirements in Animal Sciences.
**Enrollment requirement:** Junior & Senior status only.

**ACBS 447: Legal Environment of Business** (3 units)
**Description:** The necessary foundation and a working knowledge of the legal system, regulatory law, employment law, consumer law and international law will be presented and studied. Case studies are used extensively.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**ACBS 449: Diseases of Wildlife** (3 units)
**Description:** Important diseases of wildlife. Immunity, disease mechanisms, infectious agents, diagnostic procedures, and post-mortem techniques as well as a survey of selected but generally well-recognized diseases of wildlife.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ANS 449, WFSC 449
**Also offered as:** WFSC 449
**Co-convened with:** VSC 549
**Course typically offered:**
Main Campus: Fall

**ACBS 454: Host-Microbial Interactions** (3 units)
**Description:** Review of bacterial-host interactions with the emphasis on mucosal immunity following bacterial infection. Important issues such as molecular mechanisms of virulence factors, bacterial resistance to host factors, immune modulation, and regulation of the host response to bacterial assault will be discussed.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** MIC 454
**Also offered as:** MIC 454
**Co-convened with:** MIC 554
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** MIC 420 or consent of instructor.

**ACBS 456: Aquaculture** (3 units)
**Description:** Overview lectures and assigned readings on the theory and practice of aquaculture. Includes the culture of seaweeds, mollusks, crustaceans, and finfish.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** WFSC 456
**Also offered as:** WFSC 456
**Co-convened with:** VSC 556
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ECOL 181R, ECOL 182R, ECOL 182L, CHEM 103A, CHEM 103B, CHEM 104A, CHEM 104B.
**Field trip:** Field trips

**ACBS 457: Medical-Veterinary Entomology** (3 units)
**Description:** An overview of medically important arthropods and the diseases they transmit. Special attention will be paid to newly emerging and locally important vectors and diseases. Basic coursework in biology or entomology is required.
**Grading basis:** Student Option ABCDE/PF
**Career:** Undergraduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 457, INSC 457, VSC 457
**Also offered as:** ECOL 457, ENTO 457
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ECOL 182R, ECOL 182L.
**Home department:** Entomology

**ACBS 460: Physiology of Lactation** (3 units)
**Description:** This class will be a comprehensive survey of the biology of the mammary gland. Lectures will cover: 1) basic aspects such as anatomy and development of the mammary gland, biochemistry and hormone regulation of milk synthesis and regulation of gene expression in the mammary cells; 2) practical aspects such as the impact of lactation on nutrition, reproduction, and diseases. Lactation in the dairy cow provides the primary context to the course, but examples from other mammals including humans will be used.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 560
**Course typically offered:**
Main Campus: Spring

**ACBS 464A: Physical Sciences for One Health** (3 units)
**Description:** This course provides students with a working knowledge of the application of the principals of physics and chemistry as they pertain to veterinary sciences. This half of a two-semester class will be animal system based and will cover the mechanics of locomotion, flow dynamics, thermodynamics, optics, electrophysiology and applied radiation in the context of biological systems. It will also provide a foundation on biochemistry and biochemical mechanisms that underlie metabolism, homeostasis, acid base, and common causes of metabolic diseases. By breaking down the class into animal systems students will understand the physical and chemical relationships within and between systems, from the DNA/RNA level with proteins and phenotypes to the basic underlying chemical mechanisms, maintenance of biological fluids. The class will include the application of physics and chemistry to the understanding of basic health, including immunology and vaccines, and how pharmaceutical agents and toxins impact them. Interactions with biochemical pathways and physiological processes will also be covered. Where applicable One Health examples will be incorporated into the class, as will the knowledge of experimental models for research.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 564A
**Course typically offered:**
Main Campus: Fall

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**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 464B: Physical Sciences for One Health** (3 units)
**Description:** Provide students with a working knowledge of the application of the principals of physics and chemistry as they pertain to veterinary sciences. This the second half of a two-semester course that will be based on animal systems. This course will pick up where 464A left off, but will be focused more on the biochemistry and biochemical mechanisms that underlie metabolism, homeostasis, acid base interactions, and common causes of metabolic diseases. Fundamental chemistry topics including but not limited to, reaction kinetics, activation energy, binding affinity, pH, buffers, and oxidation/reduction potential will be covered as they pertain to the animal systems. By breaking down the class into animal systems students will understand the chemical relationships within and between systems, from the DNA/RNA level with proteins and phenotypes to the basic underlying chemical mechanisms, maintenance of biological fluids. The class will include the application of chemistry to the understanding of basic health, including immunology and vaccines, and how they are impacted by pharmaceutical agents and toxins. Interactions with biochemical pathways and physiological processes will also be covered. Where applicable One Health examples will be incorporated into the class, as will the knowledge of experimental models for research.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 564B
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 464A.

**ACBS 465: Advanced Nutrition and Management - Feedlot** (3 units)
**Description:** The overall objective of this course is for students to become acquainted with and learn important principles of nutrition and management of cattle fed from weaning to harvest. Students will have an opportunity to meet and interact with feedlot owners and (or) managers, feed industry representatives, and private consultants either by guest lecture or field trips. Field trips will be as an extracurricular activity and as such, attendance is not required.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 565
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ANS 336, NSC 408.

**ACBS 466: Principles of Disease** (3 units)
**Description:** Principles of disease will be divided into 6 major sections: Introduction to fundamentals of pathology and pathogenesis of infectious and non- infectious diseases, both acute and chronic; Introduction to types of infectious agents (bacterial, viral, fungal, parasitic, prions; disease vectors) with emphasis on zoonotic agents; general principles of microbial pathogenesis; Introduction to non-infectious causes of disease (genetic disorders, toxins, and injury by physical agents); Introduction to principles of therapeutics and their application to health promotion and disease prevention and treatment; Introduction to genomics in health research and evolution; Introduction to principles of diagnostic testing in clinical cases.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 566
**Course typically offered:**
Main Campus: Fall

**ACBS 467: Computation in Biomedicine** (3 units)
**Description:** In this course, students will study the basic relationship between biostatistics, experimental design and analysis to critically evaluate and understand the scientific literature. They will learn principles of data management, understand how public biomedical databases are designed and integrated to support knowledge generation and apply principles of statistical and experimental design to critically review scientific articles for their applicability to clinical, real-life scenarios. Students will gain a working knowledge of how data science affects traditional animal sciences, veterinary science and biomedicine.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Also offered as:** BE 467
**Co-convened with:** ACBS 567
**Course typically offered:**
Main Campus: Fall

**ACBS 468A: Bioeconomy, Marketing and Business Principles** (3 units)
**Description:** Students will demonstrate an understanding of small business and corporate structure and be able to understand and explain the differences of sole proprietorship, Limited Liability Corporation, S Corporation and C Corporation. Students will study accounting principles and be able to differentiate between an income statement, balance sheet, and cash flow statement and summarize and interpret what each financial statement represents. Students will learn to prepare budgets and forecasts, and a cash flow statement. Students will discuss the meaning of the basic requirements of a contract while also comparing and contrasting various negotiation tactics. Students will learn to utilize risk management tools and solve problems using basic risk assessment tools. They will learn to demonstrate an understanding of human resource law and indicate the policy implications of those laws (including but not limited to: civil rights, sexual harassment, protected classes, ADA, OSHA, FMLA, etc.) Students will learn to recognize communication skills needed for clients (education, customer service), employees (interviewing, team building, and managing personnel interactions), investors, and media. They will be able to compare and contrast the difference between selling and marketing and describe why both selling and marketing are essential to selling to markets.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 568A
**Course typically offered:**
Main Campus: Fall

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 468B: Bioeconomy, Marketing and Business Principles** (3 units)
**Description:** Students will be able to demonstrate knowledge of fundamental business law and regulations as it pertains to the veterinary practice, pet industry, veterinary pharmaceutical companies and agribusiness (AVMA Practice Act, State and National laws, etc). They will gain knowledge of liens via UCC filings and Deeds of Trust. Students will gain an understanding of the fundamental principles of business ethics and specifics as it applies to veterinary medicine. An understanding of concepts common to both macro and microeconomics will be explained including; aggregate demand and supply, microeconomic supply and demand, monetary and fiscal policy and world trade (tariffs, area of origin labeling, exotic disease designations.) Students will be able to demonstrate how social, environmental and economic sustainability principles of commerce apply to health and health delivery systems locally and globally. Students will learn about the evolution of trade and demonstrate knowledge of the role animals and animal products have played in the past and are playing in today's global trade issues and bioeconomy.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 568B
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 468A.

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 469A: Ethology, Evolution, Ethics, and Animal Handling A** (3 units)
**Description:** In this course students will learn the principles of ethology and evolution as they relate to the development of informed animal handling techniques, the interdependence between humans and animals and the ethics involved in those relationships. Students will learn about the role of animals in the evolution of civilization, religion, and culture and apply that knowledge to relevant issues in a culturally sensitive, ethical, equitable, community-engaged approach. Students will learn about the foundational concepts of normal and abnormal behavioral development in the species studied, and use knowledge learned regarding physiology, anatomy, cognition, nutrition and animal behavior of a variety of species to understand appropriate species-specific handling, husbandry, interpretation of behaviors and medical and behavioral management for optimal outcomes. Students will study the role of zoos, aquaria, wildlife parks and conservation in education, species preservation and entertainment, and learn about the role of shelters and animal control in public health and education. They will study the role animals play in human health and wellbeing (mental, physical and emotional) and the impact on the health and well-being of animals themselves. They will learn about animal loss and its effects on owners in a variety of situations (elderly, children, childless couples, empty nesters, homeless, government-mandated slaughter, natural disasters, disease outbreak) and about quality end-of-life services, euthanasia and hospice care.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 569A
**Course typically offered:**
Main Campus: Fall

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 469B: Ethology, Evolution, Ethics and Animal Handling B** (3 units)
**Description:** In this course students will learn the principles of ethology and evolution as they relate to the development of informed animal handling techniques, the interdependence between humans and animals and the ethics involved in those relationships. Students will learn about the role of animals in the evolution of civilization, religion, and culture and apply that knowledge to relevant issues in a culturally sensitive, ethical, equitable, community-engaged approach. Students will learn about the foundational concepts of normal and abnormal behavioral development in the species studied, and use knowledge learned regarding physiology, anatomy, cognition, nutrition and animal behavior of a variety of species to understand appropriate species-specific handling, husbandry, interpretation of behaviors and medical and behavioral management for optimal outcomes. Students will study the role of zoos, aquaria, wildlife parks and conservation in education, species preservation and entertainment, and learn about the role of shelters and animal control in public health and education. They will study the role animals play in human health and wellbeing (mental, physical and emotional) and the impact on the health and well-being of animals themselves. They will learn about animal loss and its effects on owners in a variety of situations (elderly, children, childless couples, empty nesters, homeless, government-mandated slaughter, natural disasters, disease outbreak) and about quality end-of-life services, euthanasia and hospice care.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 569B
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 469A.

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 470: Interactions of Animals, Humans, and Ecosystems** (3 units)
**Description:** Students will learn about comparative nutrition and its role in health and disease, and the interactions between diet, micro, and macro environments and health. Students will study the basic science of plants, their environment and nutritional value that affect animal, public and ecosystem health and analyze policies and programs promoting plant and animal-based food safety and global food security. Students will learn the principles of One Health and learn the basic principles of epidemiology and apply them to public and animal health disease outbreaks, such as zoonotic, vector-borne, emerging, and food-borne causes. Students will also analyze how government policies and programs impact the delivery of health systems for animals and people and critically analyze the root causes of disease and apply knowledge of biosciences to disease prevention. Lastly, students will learn about the role of animals as they relate to ecosystem health such as environmental resources and the management of those resources (i.e. rangeland, ecosystem restoration, conservation vs. preservation, native lands, etc.).
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 570
**Course typically offered:**
Main Campus: Spring

**ACBS 471: Risk Assessment, Management, and Communication** (3 units)
**Description:** In this course, students will learn how quantitative and qualitative measures are applied to assess risk, with food safety as the primary exemplar, and how risk assessments are used to establish risk management options for national and international policies, regulations and guidelines impacting global food trade. Students will study how to differentiate various risk management processes (regulatory and non-regulatory), and how to analyze scenarios where governments and international bodies use various risk management tools. Students will learn how national and international bodies are influenced by both politics and science. Based on risk assessment and risk management options, students will develop appropriate and effective risk communication messages for various audiences, and understand the importance of risk communication during crisis management. Students will be able to recognize various crisis and non-crisis risk communication tools.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 571
**Course typically offered:**
Main Campus: Spring

**ACBS 472: Advanced Dairy Herd Management** (3 units)
**Description:** Financial records, design of a dairy which includes environmental concerns, employees, calf raising, management of the milking cow.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 572
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** ANS 102.
**Field trip:** 1-2 per term.

**ACBS 475: Equine Enterprises** (3 units)
**Description:** Students will learn about development of equine facilities and operation management for various equine enterprises using sound business principles.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Field trip:** At least two day-long field trips required
**Enrollment requirement:** ANS 270 and ANS 431. Prerequisite or concurrently enrolled in ANS 316.

**ACBS 477: Beef Resource Management** (3 units)
**Description:** Integration of beef production resources into a comprehensive beef production system; including breeding, feeding and marketing strategies.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**Field trip:** Field trip.

**ACBS 480B: Beef Industry Travel Workshop** (1 unit)
**Description:** Intensive travel course presenting an overview of beef production and of the organizations involved in the beef industry. Department supplies transportation. Students must cover hotels and meals.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Repeatable:** Course can be repeated for a maximum of 4 units.
**Course typically offered:**
Main Campus: Summer

**Field trip:** Eight day field trip.

**ACBS 481: Principles of Applied Companion Animal Behavior** (3 units)
**Description:** In this course students will learn the principles of companion animal behavior for the three most common companion animals in the United States (dogs, cats and horses). Basic principles will be emphasized using real world examples of companion animals in an applied setting. Students will learn about species-specific behavior for each of the three companion animals and how to use this information to improve animal welfare. Topics covered will include mechanisms and function of behavior; proximate and ultimate causes of behavior; the relationship between genetics, environment and behavior; role of animal cognition and learning on behavior; the etiology and manifestation of abnormal/maladaptive behaviors; and the effect of the constrained companion animal environment on behavior.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 581
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** ACBS 311

**ACBS 482: Applied Companion Animal Behavior in Practice** (3 units)
**Description:** In this course students will apply the principles of companion animal behavior for the three most common companion animals in the United States (dogs, cats and horses). Students will learn how to effectively improve animal welfare and improve the human-animal relationship. Course topics covered will include individual behavior assessments, captive environment assessments, behavior modification and environmental management. Students will also learn how to effectively present research findings using graphics and text that is visually interesting and accessible.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 582
**Course typically offered:**
Main Campus: Spring

**Field trip:** There will be four field trips to an applied environment (dog, cat, horse) within Southern Arizona, with the specific locations to be determined. One field trip will be on a Saturday to allow for an extended experience and possible extended travel time.
**Enrollment requirement:** ACBS 481
**Student Engagement Activity:** Professional Development
**Student Engagement Competency:** Professionalism

**ACBS 483: Principles of Applied Primate Behavior and Captive Management** (3 units)
**Description:** In this course students will learn about the evolutionary history and adaptations of the major groups of primates as a foundation for understanding primate behavior, and assessing normal vs abnormal behavior in captivity. Specifically, students will learn to use their knowledge of the naturalistic ecology, biology, behavior and psychology of nonhuman primates to understand and evaluate behavior of primates and their use in a variety of captive settings, including zoos, research facilities, and sanctuaries. Students will also become conversant with the history and present-day issues and concerns about primates in captivity, including methods of assessing primate welfare, and legislation governing their housing, handling and welfare. Lastly students will explore the major ethical issues and debates surrounding captive primates. Throughout the course, students will be challenged to use their growing understanding as a basis for recommending improvements in primate captive management practices.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 583
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** 3 units of Ecology (e.g., ECOL 182R) or Biological Anthropology (e.g., ANTH 364) are recommended.

**ACBS 484: Applied Captive Primate Behavior in Practice** (3 units)
**Description:** In this course students will apply the principles of primate behavior and management to problems commonly encountered in captive settings, including zoos, research facilities, sanctuaries, private collections, and entertainment industry. Specifically, students will be challenged to use their knowledge of the naturalistic ecology, biology, behavior and psychology of nonhuman primates and captive management to identify potential solutions to improving the lives of captive primates, so as to be consistent with legal guidelines and to minimize the adverse effects of captive conditions. Students will get the opportunity to directly observe one or more species of captive primates, and learn how to record and assess behavior in the captive setting. As a result, students will have a first-hand understanding of how the conditions of captivity influence behavior and how adverse effects can be minimized.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 584
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ACBS 483/583 Principles of Applied Primate Behavior and Captive Management
**Field trip:** 4 during the semesterThere will be four field trips to a captive primate facility within Southern Arizona, with the specific locations to be determined. One of these field trips will be on a Saturday to allow for an extended experience.

**ACBS 491: Animal and Comparative Biomedical Sciences Preceptorship** (1 - 4 units)
**Description:** A preceptorship involves specialized work on an individual basis, consisting of instruction and practice in service to the Animal Sciences Department for one of its programs; primarily assisting other students in the better understanding of the target course content. Actual duties may vary depending on the enrollment status of the preceptor student in the target course.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated for a maximum of 6 units.
**Equivalent to:** VSC 491
**Course typically offered:**
Main Campus: Fall, Spring

**Recommendations and additional information:** Knowledge and experience in the target course area of study.

**ACBS 492: Directed Research** (1 - 6 units)
**Description:** Individual or small group research under the guidance of faculty.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated for a maximum of 24 units.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 493: Internship** (1 - 6 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 493
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 494: Practicum** (1 - 3 units)
**Description:** The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 494R: Research** (3 units)
**Description:** The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 2 times.
**Equivalent to:** VSC 494R
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**Recommendations and additional information:** ENGL 101, ABE 120 and consent of instructor.

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 495A: Topics In Veterinary Science** (1 unit)
**Description:** The exchange of scholarly information and/or secondary research, usually in a small group setting. Instruction often includes lectures by several different persons. Research projects may or may not be required of course registrants.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Colloquium Required
**Course typically offered:**
Main Campus: Spring

**ACBS 496B: Senior Livestock Judging Team** (2 units)
**Description:** The development and discussion-based exchange of scholarly information, concerning livestock evaluation in relation to contemporary industry standards, in a small group setting.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Seminar Required
**Course typically offered:**
Main Campus: Fall

**Field trip:** One or more
**Enrollment requirement:** ANS 396A.

**ACBS 497A: Race Track** (1 unit)
**Description:** The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Workshop Required
**Repeatable:** Course can be repeated a maximum of 4 times.
**Course typically offered:**
Main Campus: Spring

**ACBS 498: Senior Capstone** (1 - 3 units)
**Description:** A culminating experience for majors involving a substantive project that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline and its methodologies. Senior standing required.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Course typically offered:**
Main Campus: Fall, Spring

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 498A: Senior Capstone: Current issues in the Livestock Industry** (1 unit)
**Description:** A culminating experience for majors involving a substantive project that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline and its methodologies. Senior standing required.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** Senior standing.

**ACBS 498B: Senior Capstone: Current Issues in the Animal Racing Industry** (1 unit)
**Description:** A culminating experience for majors involving a substantive project and presentation that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Co-convened with:** ACBS 598B
**Course typically offered:**
Main Campus: Fall

**Enrollment requirement:** ANS 441 and prerequisite or concurrently enrolled in ANS 442.

**ACBS 498H: Honors Thesis** (3 units)
**Description:** An honors thesis is required of all the students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated for a maximum of 9 units.
**Equivalent to:** VSC 498H
**Course typically offered:**
Main Campus: Fall, Spring

**Enrollment requirement:** Student must be active in the Honors College.
**Honors Course:** Honors Course
**Honors Course:** Honors Course
**Writing Emphasis:** Writing Emphasis Course

**ACBS 499: Independent Study** (1 - 5 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Some sections have special fees. Check with the department.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 499
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 499H: Honors Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work.
**Grading basis:** Regular Grades
**Career:** Undergraduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 499H
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**Enrollment requirement:** Student must be active in the Honors College.
**Honors Course:** Honors Course
**Honors Course:** Honors Course

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 500A: Animal Anatomy and Physiology** (3 units)
**Description:** This is one of two 3-unit lecture/demonstration courses which comprise a 2-semester sequence of animal anatomy and physiology course work which is required for graduation with a major in Veterinary Science. They may be completed in any order. The anatomy portion of these courses is not a traditional type anatomy course which requires that the student name each and every vessel or muscle, etc. and where it originates and terminates. It is more a treatise on "functional anatomy" which will give the learner an appreciation of how the body component is put together (morphology) thus dictating how it may properly function (physiology). Emphasis is placed upon the systemic or whole animal operational levels rather than the precise biochemical and physical intricacies associated with the individual parts or cells which make up that whole. Students will gain an appreciation of how the various domestic species are put together and how they function and the interrelationships of the parts and systems which allow the individuals to thrive in their environment. Some consideration will also be given to what happens to the individual when form or function goes awry to illustrate the importance of the norm. Emphasis will be placed upon the common domestic and pet mammalian species with selected references to wild species, birds and primates where appropriate. Graduate-level requirements include a term paper (100 points) on a preapproved topic in anatomy or physiology and a final comprehensive oral exam (100 points).
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 400A
**Course typically offered:**
Main Campus: Fall

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 500B: Animal Anatomy and Physiology** (3 units)
**Description:** This is one of two 3-unit lecture/demonstration courses which comprise a 2-semester sequence of animal anatomy and physiology course work which is required for graduation with a major in Veterinary Science. They may be completed in any order. The anatomy portion of these courses is not a traditional type anatomy course which requires that the student name each and every vessel or muscle, etc. and where it originates and terminates. It is more a treatise on "functional anatomy" which will give the learner an appreciation of how the body component is put together (morphology) thus dictating how it may properly function (physiology). Emphasis is placed upon the systemic or whole animal operational levels rather than the precise biochemical and physical intricacies associated with the individual parts or cells which make up that whole. Students will gain an appreciation of how the various domestic species are put together and how they function and the interrelationships of the parts and systems which allow the individuals to thrive in their environment. Some consideration will also be given to what happens to the individual when form or function goes awry to illustrate the importance of the norm. Emphasis will be placed upon the common domestic and pet mammalian species with selected references to wild species, birds and primates where appropriate. Graduate-level requirements include the completion of a term paper (100 points) on a preapproved topic in anatomy or physiology and a final comprehensive oral exam (100 points).
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 400B
**Course typically offered:**
Main Campus: Spring

**ACBS 503L: Parasitology Laboratory** (1 unit)
**Description:** Parasite morphology and diagnostic laboratory techniques.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Laboratory Required
**Equivalent to:** ECOL 503L, EIS 503L, ENTO 503L, IMB 503L, INSC 503L, MBIM 503L, MICR 503L, VSC 503L
**Also offered as:** ECOL 503L, EIS 503L, IMB 503L, MIC 503L
**Co-convened with:**
**Course typically offered:**
Main Campus: Fall

**Home department:** Veterinary Science & Microbiology

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 503R: Biology of Animal Parasites** (3 units)
**Description:** Biology of host-parasite relationships with emphasis on parasites of veterinary and human importance. Parasite morphology and physiology, life cycles, epidemiology, pathogenesis and zoonotic potential. Graduate-level requirements include an in-depth research paper on the molecular biology/immune response of a single parasite.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 503R, EIS 503R, ENTO 503R, IMB 503R, INSC 503R, MBIM 503R, MICR 503R, VSC 503R
**Also offered as:** ECOL 503R, EIS 503R, IMB 503R, MIC 503R
**Co-convened with:** VSC 403R
**Course typically offered:**
Main Campus: Fall

**Home department:** Veterinary Science & Microbiology

**ACBS 505: Principles of Livestock Health Management** (3 units)
**Description:** Survey of selected diseases of horses, cattle, sheep, goats and pigs. Includes basic coverage of mechanisms of infectious disease, immunology, infectious agents, diagnostic techniques as well as the relationship of husbandry and management to the occurrence of livestock disease. Disease topics covered will include a wide range of infectious and non-infectious diseases (including nutritional deficiencies and important toxins and toxicants) affecting livestock. A basic course covering the animal industry (e.g. Animal Science 102 or equivalent) is recommended. Graduate-level requirements include a class presentation for which students will review the literature and prepare and present a lecture on a livestock disease topic to the class.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** VSC 405
**Course typically offered:**
Main Campus: Spring

**ACBS 508: Molecular Techniques for Animal Biologists** (3 units)
**Description:** A laboratory-based course designed to introduce basic molecular techniques, such as manipulation of DNA and RNA molecules and analysis of gene and protein expression, and their application in the experimental research laboratory.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Laboratory — May Be Offered
Lecture — Required
**Equivalent to:** N_SC 508
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** An understanding of basic laboratory skills, such as pipetting, is recommended.

**ACBS 509: Environmental Physiology of Domestic Animals** (3 units)
**Description:** Overview of environmental variables that influence thermal environments around domestic animals and their physiological responses to those environments. Evaluation of physiological response will include the sub-cellular, cellular, systemic and whole animal levels. Emphasis will be placed on how biological systems are coordinated to respond to environmental change. Graduate-level requirements include all tests plus a seminar on a topic chosen by mid-term.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture — Required
**Co-convened with:** ANS 409
**Course typically offered:**
Main Campus: Spring

**ACBS 509: Evolution of Infectious Disease** (3 units)
**Description:** Causes and consequences of evolutionary change in pathogens. Evolutionary principles, vertebrate immunity, molecular epidemiology, evolution of virulence, evolution of antimicrobial resistance, predicting epidemics, impacts of infectious disease on host evolution, HIV evolution. Graduate-level requirements include a term paper and an in-class presentation on the same topic.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture — Required
**Equivalent to:** CPH 509, MCB 509, VSC 509
**Also offered as:** ECOL 509, EPID 509
**Co-convened with:**
**Home department:** Ecology & Evolutionary Biology
**Interdisciplinary Interest Area:** MCB - Molecular & Cell Biology

**ACBS 510: Animal Toxicology** (3 units)
**Description:** This course is focused on how animals are affected by toxic substances. The lectures will cover the principles of toxicology, factors affecting response to chemicals, common mechanisms of toxicity, toxicity to key organs, and the toxicity of substances relevant to small and large domestic to animals. In addition to the evaluations above, graduate students will complete three written assignments that will be counted within the exams (60%) component.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 410
**Course typically offered:**
Main Campus: Fall

**ACBS 512A: Biological Electron Microscopy** (5 units)
**Description:** Provides theoretical background and practical experience in transmission and scanning electron microscopy that are necessary for the efficient and effective application of ultra-structural and cytochemical techniques as research tools.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Laboratory May Be Offered
Lecture Required
**Equivalent to:** ANS 512, ANS 512A, BIOC 512, BIOC 512A, CBA 512, CBA 512A, EIS 512A, ENTO 512, ENTO 512A, MBIM 512, MCB 512, PATH 512, PATH 512A, PLP 512, PLP 512A, PSIO 512, PSIO 512A, VSC 512, VSC 512A
**Also offered as:** CMM 512A, EIS 512A, MCB 512A, PATH 512A, PLP 512A, PSIO 512A
**Recommendations and additional information:** One college-level course in each of physics, chemistry, and biology.
**Home department:** Molecular & Cellular Biology
**Interdisciplinary Interest Area:** BIOC - Biochemistry

**ACBS 513: Statistical Genetics for Quantitative Measures** (3 units)
**Description:** This course provide the student with the statistical tools to describe variation in quantitative traits, particularly the decomposition of variation into genetic, environmental, and gene by environment interaction components. Convariance (resemblance) between relatives and heritability will be discussed, along with the topics of epistasis, oligogenic and polygenic traits, complex segregation analysis, methods of mapping quantitative trait loci (QTL), and estimation procedures. Microarrays have multiple uses, each of which will be discussed and the corresponding statistical analyses described.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** EPI 513, EPID 513, GENE 513
**Also offered as:** EPID 513, GENE 513
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** A basic genetic principles course as ANS 213, GENE 433, GENE 533, or GENE 545. A current course on basic statistical principles as GENE 509C or MATH 509C. A course in linear models as MATH 561 and in statistical inference mathematics.

**ACBS 516: Assisted Reproductive Technologies in Horses** (3 units)
**Description:** Course will focus on aspects of equine reproduction, with an emphasis placed on current assisted reproductive technologies. Students will gain experience with artificial insemination practices and develop an understanding of recent, cutting-edge biotechnology. Graduate-level requirements include assisting undergraduate students.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Laboratory May Be Offered
Lecture Required
**Co-convened with:** ANS 416
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ANS 315L, ANS 316. Graduate majors given enrollment preference.

**ACBS 519: General Immunological Concepts** (4 units)
**Description:** Basic concepts of the immune system. Presentation of the roles of antigen, immunoglobulins, complement, lymphokines and role of immune cells play in humoral and cell-mediated immunity.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** IMB 519, MBIM 519, MICR 519, VSC 519
**Also offered as:** IMB 519, MIC 519
**Co-convened with:**
**Course typically offered:**
Main Campus: Fall

**Home department:** Veterinary Science & Microbiology

**ACBS 520: Meat Animal Composition** (3 units)
**Description:** Evaluation of meat animals for carcass merit and economical value using visual, electronic and chemical technologies. Graduate-level requirements include a project at Sunland Beef Co. and additional question(s) on the exams.
**Grading basis:** Regular Grades
**Career:** Graduate
**Flat Fee:** $49
**Course Components:** Laboratory May Be Offered
Lecture Required
**Co-convened with:** ACBS 420
**Course typically offered:**
Main Campus: Spring

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 523: Mechanisms of Disease** (4 units)
**Description:** Comparative general pathology of animal and selected human diseases with emphasis on pathogenesis, pathophysiology, and morphologic and biochemical changes at the macroscopic, microscopic and molecular levels. Recitation will stress general mechanisms of disease common to all mammalian species, with focus on tissue injury and adaptation; inflammation and repair; and disorders of circulation, immunity, and cell growth, including neoplasia. Available for honors credit. Graduate-level requirements will include outside discussion and preparation of a research proposal on a relevant topic emphasizing the molecular pathogenesis of selected infectious diseases and currently applicable biotechniques, and critical analysis of related publications from the current literature.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Also offered as:** IMB 523, PCOL 523
**Co-convened with:** ACBS 423
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** Prerequisites: ACBS 500A and ACBS 500B or concurrent enrollment, or PSIO 201 and PSIO 202 or concurrent enrollment, or ACBS 215 or concurrent enrollment, or consent of instructor.

**ACBS 527R: General Mycology** (3 units)
**Description:** An exploration of the diversity of fungi and fungus like organisms covering general biology and roles as pathogens (of humans and plants), saprobes and symbionts. Fungi as models for eukaryotic molecular research and their uses in industry will be covered. Graduate-level requirements include a term paper 10 pages in length to allow a more in depth exploration of a topic in fungal biology. Also required is a 30 minute oral presentation on a topic of choice for 100 points of grade.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Repeatable:** Course can be repeated a maximum of 2 times.
**Equivalent to:** VSC 527R
**Also offered as:** PLP 527R
**Co-convened with:** PLP 427R
**Course typically offered:**
Main Campus: Fall
Online Campus: Fall
Distance Campus: Fall

**Home department:** Plant Pathology

**ACBS 528: Biotechnology in Animal Sciences** (3 units)
**Description:** Survey of principles of current protein and nucleic acid techniques useful in Animal Sciences research. This course will focus on various techniques, when to use these methods and interpretation of data from these techniques. Included will be in depth discussions on the techniques used, conclusions drawn from the experiments and planning of experiments with appropriate techniques.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** BIOC 460.

**ACBS 528L: Microbial Genetics Laboratory** (2 units)
**Description:** Laboratory associated with lecture course on Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Graduate-level requirements include the DNA sequence of an entire operon from any one of a variety of bacteria and additionally analyze one product from the operon using several GCG protein analysis programs. Also extra exam questions.
**Grading basis:** Regular Grades
**Career:** Graduate
**Flat Fee:** $70
**Course Components:** Laboratory Required
**Equivalent to:** ECOL 528L, MCB 528L, MIC 528L, MICR 528L, PLS 528L, SWES 528L, VSC 528L
**Also offered as:** ECOL 528L, ENVS 528L, MCB 528L, MIC 528L, PLP 528L, PLS 528L
**Co-convened with:** ACBS 428L
**Course typically offered:**
Main Campus: Spring

**Home department:** Plant Pathology

**ACBS 528R: Microbial Genetics** (3 units)
**Description:** Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Graduate-level requirements include a DNA sequence of an entire operon from any one of a variety of bacteria and additionally analyze one product from the operon using several GCG protein analysis programs plus an extensive exam.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 528R, GENE 528, GENE 528R, MCB 528R, MIC 528R, MICR 528R, PLP 528, PLS 528R, SWES 528R, VSC 528R
**Also offered as:** ECOL 528R, ENVS 528R, MCB 528R, MIC 528R, PLP 528R, PLS 528R
**Co-convened with:**
**Course typically offered:**
Main Campus: Spring
Distance Campus: Spring

**Home department:** Plant Pathology

**ACBS 531: Equine Nutrition and Management** (3 units)
**Description:** This course will focus on nutritional requirements of horses for growth, reproduction, lactation and work in addition to maintenance. Graduate-level requirements include extensive literature searches in horse nutrition to design a viable research experiment suitable for submission to a granting agency.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 431
**Course typically offered:**
Main Campus: Fall

**ACBS 532: Comparative Immunology** (3 units)
**Description:** How have vertebrate immune systems evolved from simple origins? We will cover comparative immunology of prokaryotes, protozoans, plants, fungi, invertebrates, and "lower" vertebrates. By studying the origins and evolution of immunity across the history of life, and following the progression of immune system complexity across different lineages, we begin to see patterns that help explain how our immune system developed from those of our ancestors. Such comparative study will highlight the strengths and weaknesses of our immune system, and point to ways in which other organisms have overcome the same pathogenic stresses we currently face. This class will pull together data from many fields, including immunology, molecular and cell biology, ecology, and evolution. Graduate students will prepare and give one oral presentation of a specific topic to the class, which will be graded.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Also offered as:** ECOL 532, EIS 532, IMB 532, MCB 532, MIC 532
**Co-convened with:** ACBS 432
**Course typically offered:**
Main Campus: Fall

**Home department:** Committee on Entomology and Insect Science
**Enrollment requirement:** MCB 181R and MCB 181L, ECOL 182R and ECOL 182L, or instructor consent.

**ACBS 533: Advanced Racing Laws and Enforcement** (3 units)
**Description:** Building on the framework presented in "Racing Laws and Enforcement" course, an in-depth presentation of select components of the regulation of the pari-mutuel industry. The course will also involve presentation and discussion of the current and evolving regulatory issues and challenges facing the industry. Graduate-level requirements includes a research project/paper that fully analyzes an area of the racing regulation. The project will compare various regulatory approaches being used as well as potential approaches not being used which address the regulatory concern.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 433
**Course typically offered:**
Main Campus: Spring

**ACBS 538: Ecology of Infectious Disease** (3 units)
**Description:** Term paper required for graduate credit.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** IMB 538, MBIM 538, MICR 538, VSC 538
**Also offered as:** IMB 538, MIC 538
**Course typically offered:**
Main Campus: Spring

**Home department:** Veterinary Science & Microbiology

**ACBS 541: Racing Organizational Structure and Financial Management** (3 units)
**Description:** Organizational structure and financial management issues involved in the administration of the animal racing facility. Graduate level requirements include an additional analytical and/or research project on a major racing industry topic or a faculty approved project with an industry client.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 441
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** (ANS 142, ANS 301 and ANS 345) and (ACCT 200 or ACCT 250).

**ACBS 542: Racing Business, Strategies and Global Perspectives** (3 units)
**Description:** Strategies and management issues involved in the operations and administration of the animal racing facility. The focus is the strategic management of facilities, other uses for the facilities and the racing business internationally. Graduate-level requirements include a project with an analytical analysis of a topic covered or approved project for an industry client. Faculty-student meetings bi-weekly outside of class required.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 442
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** ANS 441; ANS 533; MATH 509C.

**ACBS 543: Research Animal Methods** (3 units)
**Description:** Regulations, care, diseases and techniques involving common laboratory animals used in research and teaching programs. Graduate-level requirements include an in-depth research paper on one of the lecture topics presented in the course plus research proposal preparation.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** ANS 543, BIOC 543, IMB 543, MBIM 543, MICR 543
**Also offered as:** BIOC 543, IMB 543
**Co-convened with:** VSC 443
**Course typically offered:**
Main Campus: Fall

**ACBS 545: Nutritional Physiology and Metabolic Biochemistry** (3 units)
**Description:** This course is designed to enhance understanding of the principles of animal nutrition and metabolic biochemistry to explain the nutritional requirement, metabolic, and physiological differences between animal species. As such, this course will focus on the most basic molecules of nutrition (carbohydrates, fats, and amino acids) and their digestion, absorption, metabolism, and assimilation into the body. Therefore, a basic understanding of biology and chemistry are expected upon entering this course.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 445
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** CHEM 151/152 and MCB 181R

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 546: Insect Pathogens: Biocontrol Agents & Biological Models** (4 units)
**Description:** Ecology and biology of insect pathogens (viruses, bacteria, protozoa, nematodes). Diagnostics, safety testing of pathogens. Genomics and genetic engineering of entomopathogens. Insect pathogens as biological model organisms. Applications in medical and veterinary research and pharmaceutical bioprospecting. Graduate-level requirements include students to prepare and give one oral presentation of a specific topic that will be coordinated with the instructor at the beginning of the course. Topics considered in the oral presentations will be included in the final exam.
**Grading basis:** Regular Grades
**Career:** Graduate
**Flat Fee:** $75

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|---|---|---|
| **Course Components:** | Discussion | May Be Offered |
| | Laboratory | May Be Offered |
| | Lecture | Required |

**Repeatable:** Course can be repeated a maximum of 2 times.
**Equivalent to:** ENTO 546, INSC 546, MIC 546, PLP 546, VSC 546
**Also offered as:** EIS 546, MIC 546, PLP 546
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** EIS 511, EIS 515L, EIS 515R; or consent of instructor.
**Home department:** Committee on Entomology and Insect Science

**ACBS 549: Diseases of Wildlife** (3 units)
**Description:** Important diseases of wildlife. Immunity, disease mechanisms, infectious agents, diagnostic procedures, and post-mortem techniques as well as a survey of selected but generally well-recognized diseases of wildlife. Graduate-level requirements include a class presentation for which students will review the literature and prepare and present a lecture on a wildlife disease topic to the class.
**Grading basis:** Regular Grades
**Career:** Graduate

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|---|---|---|
| **Course Components:** | Lecture | Required |

**Equivalent to:** ANS 549, WFSC 549
**Also offered as:** WFSC 549
**Co-convened with:** VSC 449
**Course typically offered:**
Main Campus: Fall

**ACBS 553: Statistics for Applied Biological Experiments** (3 units)
**Description:** This course is intended for graduate students in the biological sciences. Topics covered will include parameter estimation, hypothesis testing, regression and ANOVA, graphical exploration of data, Bayesian statistics and resampling methods, and experimental design. Principles of statistical practice will be highlighted and practical experience gained through laboratory homework exercises. The statistical language R will be used for analysis, however other software such as SAS could be used.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** MATH 113, or equivalents. MATH 160, statistics, helpful, but not required.

**ACBS 554: Host-Microbial Interactions** (3 units)
**Description:** Graduate-level requirements include a five-page proposal.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** IMB 554, MBIM 554, VSC 554
**Also offered as:** IMB 554, MIC 554
**Course typically offered:**
Main Campus: Spring

**Home department:** Veterinary Science & Microbiology

**ACBS 556: Aquaculture** (3 units)
**Description:** Overview lectures and assigned readings on the theory and practice of aquaculture. Includes the culture of seaweeds, mollusks, crustaceans, and fin fish. Graduate-level requirements include a topic report.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** WFSC 556
**Also offered as:** WFSC 556
**Co-convened with:** VSC 456
**Course typically offered:**
Main Campus: Spring

**ACBS 557: Medical-Veterinary Entomology** (3 units)
**Description:** An overview of medically important arthropods and the diseases they transmit. Special attention will be paid to newly emerging and locally important vectors and diseases. Basic coursework in biology or entomology is required. Graduate-level requirements include an in-depth review article on a relevant topic of medical entomology. The paper (15 to 20 pages of double-spaced text, including references) should be written in the same form and bibliographic style as articles in the Annual Review of Entomology. Spelling, grammar, sentence and paragraph construction, and overall organization will be considered for the grade.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** ECOL 557, ENTO 557, INSC 557, VSC 557
**Also offered as:** ECOL 557, EIS 557
**Course typically offered:**
Main Campus: Spring

**Home department:** Committee on Entomology and Insect Science

**ACBS 560: Physiology of Lactation** (3 units)
**Description:** This class will be a comprehensive survey of the biology of the mammary gland. Lectures will cover: 1) basic aspects such as anatomy and development of the mammary gland, biochemistry and hormone regulation of milk synthesis and regulation of gene expression in the mammary cells; 2) practical aspects such as the impact of lactation on nutrition, reproduction, and diseases. Lactation in the dairy cow provides the primary context to the course, but examples from other mammals including humans will be used. Graduate-level requirements include a comprehensive paper and presentation of findings to the rest of the class. Answers to all questions are expected to be more comprehensive and detailed for graduate students.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 460
**Course typically offered:**
Main Campus: Spring

**ACBS 564A: Physical Sciences for One Health** (3 units)
**Description:** This course provides students with a working knowledge of the application of the principals of physics and chemistry as they pertain to veterinary sciences. This half of a two-semester class will be animal system based and will cover the mechanics of locomotion, flow dynamics, thermodynamics, optics, electrophysiology and applied radiation in the context of biological systems. It will also provide a foundation on biochemistry and biochemical mechanisms that underlie metabolism, homeostasis, acid base, and common causes of metabolic diseases. By breaking down the class into animal systems students will understand the physical and chemical relationships within and between systems, from the DNA/RNA level with proteins and phenotypes to the basic underlying chemical mechanisms, maintenance of biological fluids. The class will include the application of physics and chemistry to the understanding of basic health, including immunology and vaccines, and how pharmaceutical agents and toxins impact them. Interactions with biochemical pathways and physiological processes will also be covered. Where applicable One Health examples will be incorporated into the class, as will the knowledge of experimental models for research.Graduate students shall prepare a review of a published paper within the topics of this class. A list of topics will be provided to the students by the third week of class. The paper is due by the end of the 13th week of class. Graduate students' grade percentage break down is as follows: Final 20%, Mid-term 30%, Homework 32%, Review of Professional Paper 8%
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 464A
**Course typically offered:**
Main Campus: Fall

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**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 564B: Physical Sciences for One Health** (3 units)
**Description:** Provide students with a working knowledge of the application of the principals of physics and chemistry as they pertain to veterinary sciences. This the second half of a two-semester course that will be based on animal systems. This course will pick up where 464A left off, but will be focused more on the biochemistry and biochemical mechanisms that underlie metabolism, homeostasis, acid base interactions, and common causes of metabolic diseases. Fundamental chemistry topics including but not limited to, reaction kinetics, activation energy, binding affinity, pH, buffers, and oxidation/reduction potential will be covered as they pertain to the animal systems. By breaking down the class into animal systems students will understand the chemical relationships within and between systems, from the DNA/RNA level with proteins and phenotypes to the basic underlying chemical mechanisms, maintenance of biological fluids. The class will include the application of chemistry to the understanding of basic health, including immunology and vaccines, and how they are impacted by pharmaceutical agents and toxins. Interactions with biochemical pathways and physiological processes will also be covered. Where applicable One Health examples will be incorporated into the class, as will the knowledge of experimental models for research.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 464B
**Enrollment requirement:** ACBS 564A

**ACBS 565: Shrimp Pathology** (3 units)
**Description:** Comprehensive lectures and practical laboratory training on the current methods used to diagnose, prevent and treat the principal diseases of cultured penaeid shrimp.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Repeatable:** Course can be repeated a maximum of 2 times.
**Course typically offered:**
Main Campus: Summer

**Recommendations and additional information:** B.S., M.S. and/or D.V.M. in biological and/or medically oriented fields.

**ACBS 566: Principles of Disease** (3 units)
**Description:** Principles of disease will be divided into 6 major sections: Introduction to fundamentals of pathology and pathogenesis of infectious and non- infectious diseases, both acute and chronic; Introduction to types of infectious agents (bacterial, viral, fungal, parasitic, prions; disease vectors) with emphasis on zoonotic agents; general principles of microbial pathogenesis; Introduction to non-infectious causes of disease (genetic disorders, toxins, and injury by physical agents); Introduction to principles of therapeutics and their application to health promotion and disease prevention and treatment; Introduction to genomics in health research and evolution; Introduction to principles of diagnostic testing in clinical cases.Graduate 566 level requirements will include a clear understanding of principles of disease at a depth appropriate for this higher level of education. This will involve required readings from the core textbook and selected current literature references. Graduate level students will also be required to answer additional, more rigorous, in depth exam questions and be held to a higher standard of performance than 466 level undergraduate students.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 466
**Course typically offered:**
Main Campus: Fall

**ACBS 567: Computation in Biomedicine** (3 units)
**Description:** In this course, students will study the basic relationship between biostatistics, experimental design and analysis to critically evaluate and understand the scientific literature. They will learn principles of data management, understand how public biomedical databases are designed and integrated to support knowledge generation and apply principles of statistical and experimental design to critically review scientific articles for their applicability to clinical, real-life scenarios. Students will gain a working knowledge of how data science affects traditional animal sciences, veterinary science and biomedicine.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Also offered as:** BE 567
**Co-convened with:** ACBS 467
**Course typically offered:**
Main Campus: Fall

**ACBS 568A: Bioeconomy, Marketing and Business Principles** (3 units)
**Description:** Students will demonstrate an understanding of small business and corporate structure and be able to understand and explain the differences of sole proprietorship, Limited Liability Corporation, S Corporation and C Corporation. Students will study accounting principles and be able to differentiate between an income statement, balance sheet, and cash flow statement and summarize and interpret what each financial statement represents. Students will learn to prepare budgets and forecasts, and a cash flow statement. Students will discuss the meaning of the basic requirements of a contract while also comparing and contrasting various negotiation tactics. Students will learn to utilize risk management tools and solve problems using basic risk assessment tools. They will learn to demonstrate an understanding of human resource law and indicate the policy implications of those laws (including but not limited to: civil rights, sexual harassment, protected classes, ADA, OSHA, FMLA, etc.) Students will learn to recognize communication skills needed for clients (education, customer service), employees (interviewing, team building, and managing personnel interactions), investors, and media. They will be able to compare and contrast the difference between selling and marketing and describe why both selling and marketing are essential to selling to markets.Students taking this course at the graduate level will be required to complete this project. The student will be expected to develop the following for a start-up small business company (a faculty approved small animal, veterinarian, or agribusiness): - Business structure with supporting reasons for use of this structure and the necessary steps to implement- A start-up budget for the first 3 years of operations including a capital budget with financing- Projected staffing and basic policies that demonstrate company support of the necessary human resource laws covered in the class- A simple value chain model for the businessIn addition the grading scale for graduate-level will be 93-100% A, 83-92% B, 73-82% C, 63-72% D, Below 63% E
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 468A
**Course typically offered:**
Main Campus: Fall

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**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 568B: Bioeconomy, Marketing and Business Principles** (3 units)
**Description:** Students will be able to demonstrate knowledge of fundamental business law and regulations as it pertains to the veterinary practice, pet industry, veterinary pharmaceutical companies and agribusiness (AVMA Practice Act, State and National laws, etc). They will gain knowledge of liens via UCC filings and Deeds of Trust. Students will gain an understanding of the fundamental principles of business ethics and specifics as it applies to veterinary medicine. An understanding of concepts common to both macro and microeconomics will be explained including; aggregate demand and supply, microeconomic supply and demand, monetary and fiscal policy and world trade (tariffs, area of origin labeling, exotic disease designations.) Students will be able to demonstrate how social, environmental and economic sustainability principles of commerce apply to health and health delivery systems locally and globally. Students will learn about the evolution of trade and demonstrate knowledge of the role animals and animal products have played in the past and are playing in today's global trade issues and bioeconomy. In addition to exams, class participation, and quizzes, graduate students will be required to complete the graduate business development/policy project.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 468B
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 568A.

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 569A: Ethology, Evolution, Ethics, and Animal Handling A** (3 units)
**Description:** In this course students will learn the principles of ethology and evolution as they relate to the development of informed animal handling techniques, the interdependence between humans and animals and the ethics involved in those relationships. Students will learn about the role of animals in the evolution of civilization, religion, and culture and apply that knowledge to relevant issues in a culturally sensitive, ethical, equitable, community-engaged approach. Students will learn about the foundational concepts of normal and abnormal behavioral development in the species studied, and use knowledge learned regarding physiology, anatomy, cognition, nutrition and animal behavior of a variety of species to understand appropriate species-specific handling, husbandry, interpretation of behaviors and medical and behavioral management for optimal outcomes. Students will study the role of zoos, aquaria, wildlife parks and conservation in education, species preservation and entertainment, and learn about the role of shelters and animal control in public health and education. They will study the role animals play in human health and wellbeing (mental, physical and emotional) and the impact on the health and well-being of animals themselves They will learn about animal loss and its effects on owners in a variety of situations (elderly, children, childless couples, empty nesters, homeless, government-mandated slaughter, natural disasters, disease outbreak) and about quality end-of-life services, euthanasia and hospice care.Graduate requirements include a literature review and video relating a topic to a current issue or trend in the field.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 469A
**Course typically offered:**
Main Campus: Fall

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 569B: Ethology, Evolution, Ethics and Animal Handling B** (3 units)
**Description:** In this course students will learn the principles of ethology and evolution as they relate to the development of informed animal handling techniques, the interdependence between humans and animals and the ethics involved in those relationships. Students will learn about the role of animals in the evolution of civilization, religion, and culture and apply that knowledge to relevant issues in a culturally sensitive, ethical, equitable, community-engaged approach. Students will learn about the foundational concepts of normal and abnormal behavioral development in the species studied, and use knowledge learned regarding physiology, anatomy, cognition, nutrition and animal behavior of a variety of species to understand appropriate species-specific handling, husbandry, interpretation of behaviors and medical and behavioral management for optimal outcomes. Students will study the role of zoos, aquaria, wildlife parks and conservation in education, species preservation and entertainment, and learn about the role of shelters and animal control in public health and education. They will study the role animals play in human health and wellbeing (mental, physical and emotional) and the impact on the health and well-being of animals themselves. They will learn about animal loss and its effects on owners in a variety of situations (elderly, children, childless couples, empty nesters, homeless, government-mandated slaughter, natural disasters, disease outbreak) and about quality end-of-life services, euthanasia and hospice care. In addition to exams and quizzes graduate students will also need to complete the following: Peer-to-Peer Research Seminar grouped with other graduate students only, and Portfolio Project.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 469B
**Course typically offered:**
Main Campus: Spring

**Enrollment requirement:** ACBS 569A

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 570: Interactions of Animals, Humans, and Ecosystems** (3 units)
**Description:** Students will learn about comparative nutrition and its role in health and disease, and the interactions between diet, micro, and macro environments and health. Students will study the basic science of plants, their environment and nutritional value that affect animal, public and ecosystem health and analyze policies and programs promoting plant and animal-based food safety and global food security. Students will learn the principles of One Health and learn the basic principles of epidemiology and apply them to public and animal health disease outbreaks, such as zoonotic, vector-borne, emerging, and food-borne causes. Students will also analyze how government policies and programs impact the delivery of health systems for animals and people and critically analyze the root causes of disease and apply knowledge of biosciences to disease prevention. Lastly, students will learn about the role of animals as they relate to ecosystem health such as environmental resources and the management of those resources (i.e. rangeland, ecosystem restoration, conservation vs. preservation, native lands, etc.).In addition to exams given after each module, graduate students will be required to complete a case study for each module of the course. The goal of the case studies is to promote a deeper level thinking which includes a detailed analysis and critical evaluation of each assigned case study. Graduate students will complete a case study, demonstrating their ability to apply principles taught during this course. Case studies will be evaluated based upon logical reasoning, demonstrated understanding of the concepts conveyed and knowledge of why these concepts are important in animal and biomedical systems.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 470
**Course typically offered:**
Main Campus: Spring

**-SA** represents a Student Abroad & Student Exchange offering
**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 571: Risk Assessment, Management, and Communication** (3 units)
**Description:** In this course, students will learn how quantitative and qualitative measures are applied to assess risk, with food safety as the primary exemplar, and how risk assessments are used to establish risk management options for national and international policies, regulations and guidelines impacting global food trade. Students will study how to differentiate various risk management processes (regulatory and non-regulatory), and how to analyze scenarios where governments and international bodies use various risk management tools. Students will learn how national and international bodies are influenced by both politics and science. Based on risk assessment and risk management options, students will develop appropriate and effective risk communication messages for various audiences, and understand the importance of risk communication during crisis management. Students will be able to recognize various crisis and non-crisis risk communication tools.In addition to a Module Examination, each graduate student will complete additional case studies, with specific case study topics and due dates posted on D2L during the first week of classes. Case studies are designed to test the application of learning outcomes for each module. During the final learning module, graduate students will develop and present a class tutorial review of their conclusions from these case studies and present it to the class.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 471

**ACBS 572: Advanced Dairy Herd Management** (3 units)
**Description:** Financial records, design of a dairy which includes environmental concerns, employees, calf raising, management of the milking cow. Graduate-level requirements include written project/presentation element required for graduate level credit.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ANS 472
**Course typically offered:**
Main Campus: Fall

**Field trip:** 1-2 per term.

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**-CC** represents a Correspondence Course offering
**May Be Offered** Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

**ACBS 581: Principles of Applied Companion Animal Behavior** (3 units)
**Description:** In this course students will learn the principles of companion animal behavior for the three most common companion animals in the United States (dogs, cats and horses). Basic principles will be emphasized using real world examples of companion animals in an applied setting. Students will learn about species-specific behavior for each of the three companion animals and how to use this information to improve animal welfare. Topics covered will include mechanisms and function of behavior; proximate and ultimate causes of behavior; the relationship between genetics, environment and behavior; role of animal cognition and learning on behavior; the etiology and manifestation of abnormal/maladaptive behaviors; and the effect of the constrained companion animal environment on behavior.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 481
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** ACBS 311

**ACBS 582: Applied Companion Animal Behavior in Practice** (3 units)
**Description:** In this course students will apply the principles of companion animal behavior for the three most common companion animals in the United States (dogs, cats and horses). Students will learn how to effectively improve animal welfare and improve the human-animal relationship. Course topics covered will include individual behavior assessments, captive environment assessments, behavior modification and environmental management. Students will also learn how to effectively present research findings using graphics and text that is visually interesting and accessible.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 482
**Course typically offered:**
Main Campus: Spring

**Field trip:** There will be four field trips to an applied environment (dog, cat, horse) within Southern Arizona, with the specific locations to be determined. One field trip will be on a Saturday to allow for an extended experience and possible extended travel time.
**Enrollment requirement:** ACBS 581

**ACBS 583: Principles of Applied Primate Behavior and Captive Management** (3 units)
**Description:** In this course students will learn about the evolutionary history and adaptations of the major groups of primates as a foundation for understanding primate behavior, and assessing normal vs abnormal behavior in captivity. Specifically, students will learn to use their knowledge of the naturalistic ecology, biology, behavior and psychology of nonhuman primates to understand and evaluate behavior of primates and their use in a variety of captive settings, including zoos, research facilities, and sanctuaries. Students will also become conversant with the history and present-day issues and concerns about primates in captivity, including methods of assessing primate welfare, and legislation governing their housing, handling and welfare. Lastly students will explore the major ethical issues and debates surrounding captive primates. Throughout the course, students will be challenged to use their growing understanding as a basis for recommending improvements in primate captive management practices.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 483
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** 3 units of Ecology (e.g., ECOL 182R) or Biological Anthropology (e.g., ANTH 364).

**ACBS 584: Applied Captive Primate Behavior in Practice** (3 units)
**Description:** In this course students will apply the principles of primate behavior and management to problems commonly encountered in captive settings, including zoos, research facilities, sanctuaries, private collections, and entertainment industry. Specifically, students will be challenged to use their knowledge of the naturalistic ecology, biology, behavior and psychology of nonhuman primates and captive management to identify potential solutions to improving the lives of captive primates, so as to be consistent with legal guidelines and to minimize the adverse effects of captive conditions. Students will get the opportunity to directly observe one or more species of captive primates, and learn how to record and assess behavior in the captive setting. As a result, students will have a first-hand understanding of how the conditions of captivity influence behavior and how adverse effects can be minimized.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Co-convened with:** ACBS 484
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** ACBS 483/583 Principles of Applied Primate Behavior and Captive Management
**Field trip:** 4 during the semesterThere will be four field trips to a captive primate facility within Southern Arizona, with the specific locations to be determined. One of these field trips will be on a Saturday to allow for an extended experience.

**ACBS 587: Molecular Endocrinology** (3 units)
**Description:** Regulation, secretion, and cellular actions of hormones impacting metabolic homeostasis, growth, and reproduction.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Spring

**ACBS 593: Internship** (1 - 6 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 595A: Current Topics in Animal Sciences** (1 unit)
**Description:** The purpose of this course (Journal Club) is to give graduate students experience in critically evaluating scientific papers and to involve graduate students in scientific discussions.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Colloquium Required
**Course typically offered:**
Main Campus: Spring

**ACBS 595B: Current Topics in Metabolic Disease** (1 unit)
**Description:** This colloquium offers an opportunity for graduate students to interact closely with research faculty and fellow graduate students currently engaged in metabolic disease, mainly obesity and diabetes, research. The course is designed to help graduate students to learn how to better read, critique, and analyze primary research articles, present current research within their own specific area of metabolic research, and to appreciate the advancement in knowledge and understanding of overall metabolic disease research. Over the scope of a semester, each student will present at least one primary research article that is closely related to their research, and fellow graduate students will participate in an open discussion about the article, including explaining and analyzing data, and interpreting overall conclusions and objectives of the research.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Colloquium Required
**Repeatable:** Course can be repeated for a maximum of 1 units.
**Course typically offered:**
Main Campus: Fall, Spring

**Field trip:** N/A

**ACBS 596A: Animal Sciences** (1 unit)
**Description:** The development and exchange of scholarly information, usually in a small group setting. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Seminar Required
**Repeatable:** Course can be repeated a maximum of 4 times.
**Course typically offered:**
Main Campus: Fall, Spring

**ACBS 598B: Senior Capstone: Current Issues in the Animal Racing Industry** (1 unit)
**Description:** A culminating experience for majors involving a substantive project and presentation that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline. Graduate-level requirements include a project which includes business recommendations for a select audience based on the project research and analysis.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Independent Study Required
**Co-convened with:** ANS 498B
**Course typically offered:**
Main Campus: Fall

**ACBS 599: Independent Study** (1 - 6 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 599
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 611: Comparative Virology** (3 units)
**Description:** A comprehensive course covering broad-ranging aspects of modern virology with an emphasis on comparisons between representative virus groups, taking into account different host, tissue, cell, and vector tropisms, and modes of transmission. The team of instructors will highlight representative types of viruses across different life forms to encourage and illuminate inter-group comparisons in discussion sessions lead by the graduate students.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** MIC 611, PLS 611, VSC 611
**Also offered as:** MIC 611, PLP 611, PLS 611
**Recommendations and additional information:** PLP 305, BIOC 460, VSC 433.
**Home department:** Plant Pathology

**ACBS 660: Infectious Disease Epidemiology** (3 units)
**Description:** Introduction to epidemiologic methods used in infectious disease investigations. An emphasis will be placed on understanding the relationships between the host, the parasite and the environment as they relate disease causation.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Equivalent to:** CPH 660, EIS 660, ENTO 660, EPI 660, PHL 660, VSC 660
**Also offered as:** EIS 660, EPID 660
**Course typically offered:**
Main Campus: Spring

**Recommendations and additional information:** EPID 573A; prequisite, or concurrent registration, EPID 573B, BIOS/EPID 576A.
**Home department:** Epidemiology and Biostatistics

**ACBS 670: Molecular Aspects of Animal Growth and Development** (3 units)
**Description:** This course will examine the embryonic development and postnatal growth of agriculturally important species with an emphasis on the molecular mechanisms regulating these processes. Current research concerning hormonal and nutritional factors influencing embryo development and juvenile growth will be discussed.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Lecture Required
**Course typically offered:**
Main Campus: Fall

**Recommendations and additional information:** An understanding of mammalian anatomy and physiology is recommended.

**ACBS 693: Internship** (1 - 8 units)
**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 696A: Research Seminar** (1 unit)
**Description:** The development and exchange of scholarly information, usually in a small group setting. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.
**Grading basis:** Regular Grades
**Career:** Graduate
**Course Components:** Seminar Required
**Repeatable:** Course can be repeated a maximum of 4 times.
**Course typically offered:**
Main Campus: Fall, Spring

**ACBS 699: Independent Study** (1 - 3 units)
**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Equivalent to:** VSC 699
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 900: Research** (1 - 8 units)
**Description:** Individual research, not related to thesis or dissertation preparation, by graduate students.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 900
**Course typically offered:**
Main Campus: Fall, Spring, Summer

**ACBS 909: Master's Report** (1 - 8 units)
**Description:** Individual study or special project or formal report thereof submitted in lieu of thesis for certain master's degrees.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Course typically offered:**
Main Campus: Fall, Winter, Spring, Summer

**ACBS 910: Thesis** (1 - 8 units)
**Description:** Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 910
**Course typically offered:**
Main Campus: Fall, Winter, Spring, Summer

**ACBS 920: Dissertation** (1 - 9 units)
**Description:** Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).
**Grading basis:** Alternative Grading: S, P, F
**Career:** Graduate
**Course Components:** Independent Study Required
**Repeatable:** Course can be repeated a maximum of 99 times.
**Equivalent to:** VSC 920
**Course typically offered:**
Main Campus: Fall, Winter, Spring, Summer

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