

Comparative Biological Science (CBS)

CBS 461/CBS 561 Principles of Collaboration and Team Science (2 credit hours)

The focus of this course is exploring how to effectively communicate as a member of a cross-disciplinary team. Specifically, this course offers strategies and techniques about engaging in team science to pursue complex research questions, work effectively with team members, identify and address unconscious bias, and assess team performance in order to produce high impact research outcomes. To that end, we will examine aspects of group process and communication related to professional relationship development, teamwork, leadership, and conflict resolution.

Typically offered in Spring only

CBS 463/SLC 463/CBS 563/SLC 563 Leadership in Interdisciplinary Biomedical Sciences (2 credit hours)

This is a two-credit, dual-level undergraduate/graduate course designed for graduate and advanced undergraduate students interested in gaining an understanding of how to lead others effectively through complex situations as it relates to ethical and leadership dilemmas within interdisciplinary biomedical sciences. Students will develop leadership skills and negotiation strategies for working with interdisciplinary teams in biomedicine. Through interaction with professionals in the biomedical field, students will evaluate, apply and propose action plans for how to respond to situations as it relates to theories and practices discussed in the course. This course complements, but does not replace, Responsible Conduct in Research requirements.

P: Graduate Standing

Typically offered in Fall only

CBS 493 Undergraduate Research in Biomedical Sciences (1-3 credit hours)

A learning experience in College of Veterinary Medicine within an academic framework that utilizes campus facilities and resources for supervised undergraduate research. Arrangements must be initiated by the student and be approved by a faculty adviser, the college Undergraduate Research Coordinator, and the Associate Dean of Research Training and Graduate Programs. Students who enroll in this course are required in this course to complete and submit an Agreement for Non-Standard Courses form through Registration and Records.

Requisite: Sophomore Standing or Above

Typically offered in Fall and Spring

CBS 510 Animal Production Topics (1-3 credit hours)

Students will be provided with experience in management of production animals with an emphasis on the veterinary aspects of population health. Experience will come in the form of hands-on experiences and working through relevant literature to specific and relevant population health issues.

Typically offered in Fall and Spring

CBS 550 Population Medicine Forum (1 credit hours)

Population medicine forum is a seminar-based class during which current topics in population health are presented and discussed. Topics covered include: Outbreak investigation, observational epidemiologic research, risk analysis, spatial analysis, the application of unique diagnostic technologies and epidemiologic modeling.

Typically offered in Spring only

CBS 561/CBS 461 Principles of Collaboration and Team Science (2 credit hours)

The focus of this course is exploring how to effectively communicate as a member of a cross-disciplinary team. Specifically, this course offers strategies and techniques about engaging in team science to pursue complex research questions, work effectively with team members, identify and address unconscious bias, and assess team performance in order to produce high impact research outcomes. To that end, we will examine aspects of group process and communication related to professional relationship development, teamwork, leadership, and conflict resolution.

Typically offered in Spring only

CBS 563/SLC 563/CBS 463/SLC 463 Leadership in Interdisciplinary Biomedical Sciences (2 credit hours)

This is a two-credit, dual-level undergraduate/graduate course designed for graduate and advanced undergraduate students interested in gaining an understanding of how to lead others effectively through complex situations as it relates to ethical and leadership dilemmas within interdisciplinary biomedical sciences. Students will develop leadership skills and negotiation strategies for working with interdisciplinary teams in biomedicine. Through interaction with professionals in the biomedical field, students will evaluate, apply and propose action plans for how to respond to situations as it relates to theories and practices discussed in the course. This course complements, but does not replace, Responsible Conduct in Research requirements.

P: Graduate Standing

Typically offered in Fall only

CBS 565 Fundamentals of Biomedical Sciences (3 credit hours)

Introductory course for students interested in gaining a broad understanding of: comparative genomics, comparative immunology, comparative physiology, pharmacokinetics, emerging zoonotic diseases, epidemiology and translational research models and methods. This course also provides an overview of current technologies relevant to comparative biomedical research and a foundation for implementing the scientific method (e.g. experimental design, data analyses, statistics). Priority will be given to first-year students in CBS graduate program; Enrollment of all students requires consent of instructor.

Typically offered in Fall only

CBS 570 Methods in Biomedical Sciences (1 credit hours)

Introductory course for students interested in gaining a broad understanding of various laboratory methods used in molecular, cellular and "omics" based biomedical research.

Typically offered in Fall only

CBS 579 Advanced Specialty Training (1-3 credit hours)

This course is designed to give students clinical experience and training to understand basic health management strategies, handle clinical evaluations, use diagnostic tools to facilitate accurate diagnosis, and develop prevention and/or treatment plans for health management. This course is restricted to Students in the SVM program.

Typically offered in Spring only

CBS 580 Clinical Veterinary Epidemiology (3 credit hours)

To expose students to the concepts and principles of epidemiology from the perspective of assessing health and disease in animal and human populations, and the measures to control disease status. Specifically to study the principles and concepts of veterinary epidemiology, to learn basic epidemiology methodology, critically review major veterinary care studies, and enhance oral and written communication skills.

Prerequisite: ST 511

Typically offered in Fall only

CBS 586/GOH 586 One Health: From Philosophy to Practice (2 credit hours)

Graduate/professional seminar (with team project) addressing intersections of veterinary medicine, human medicine, and environmental health. Co-listed at UNC CH Gillings School of Global Public Health and Duke University School of Medicine. Includes participants from these three institutions, plus related private-sector members, non-governmental organizations, and government professionals. Its purpose is to facilitate understanding of one health as a system of systems, and promote cross-campus and cross-discipline interactions. Weekly evening course held at NC Biotechnology Center, RTP. Requires graduate student standing at NCSU or professional student standing within the College of Veterinary Medicine. Limit: 15 students per university.

R: Graduate Student standing at NCSU or professional student standing within the College of Veterinary Medicine.

Typically offered in Fall only

CBS 595 Special Topics (1-6 credit hours)**CBS 615 Advanced Animal Production Topics** (1-3 credit hours)

Students will be provided with practice and experience in advanced topics related to management of production animals with an emphasis on the veterinary aspects of population health. Actual in-the-field, hands-on practice and investigation of relevant literature will provide the basis for study of advanced animal production topics. Course is restricted to students in the SVM program

Prerequisite: SVM 510

Typically offered in Fall and Spring

CBS 624 Special Problems In Gastrointestinal Physiology (1 credit hours)

1 credit for a 1-hour in depth discussion session of current journal articles presented by students on the subject of gastrointestinal physiology. Journals recommended include the American Journal of Physiology, Gut and Gastroenterology. Each session will focus on one student's selected paper. MS students are expected to present 1 paper, and PhD students are expected to present up to 2 papers each semester. Students should be enrolled in a graduate course of study in a field related to or focused on physiology. Undergraduate students require special permission.

Typically offered in Fall and Spring

CBS 649 Issues in Preventive Medicine and Public Health (1 credit hours)

Issues in Preventive Medicine and Public Health is a literature review course designed to assist students with their preparation for careers in public health, ecosystem health, biosecurity and public policy, disaster management, and application for Board Certification in the American College of Preventive Veterinary Medicine. Permission by course instructor required for enrollment.

Prerequisite: A prior degree in veterinary medicine or public health

CBS 650 Population Medicine Forum (1 credit hours)

Population medicine forum is a seminar-based class during which current topics in population health are presented and discussed. Topics covered include: Outbreak investigation, observational epidemiologic research, risk analysis, spatial analysis, the application of unique diagnostic technologies and epidemiologic modeling.

Typically offered in Spring only

CBS 660 Fundamentals of Comparative Molecular Medicine (3 credit hours)

This is a 3 credit, graduate level course designed for incoming graduate students and advanced undergraduate students interested in gaining a broad understanding of: translational/clinical research, interdisciplinary research related to molecular medicine, basic principles of genetics, cell biology and engineering and how they are applied to the study/treatment of disease. The importance of large animal models to facilitate clinical translation to humans will also be covered. Course instructors include both basic scientists with active research programs as well as clinicians (MD and DVM).

Prerequisite: Graduate Standing or Background in Biology at the Advanced Undergraduate Level

Typically offered in Fall only

CBS 662 Professional Conduct in Biomedical Research (1 credit hours)

Plagiarism, authorship, fraud, safety, sexual harassment, IACUC, consulting agreements, serving as an expert witness, contacting elected officials, working with press, human subjects committee, and related topics.

Typically offered in Spring only

CBS 680 MR Special Topics (1-6 credit hours)

Typically offered in Fall and Spring

CBS 682 Seminar - Poultry Medicine (1-3 credit hours)

Typically offered in Fall only

CBS 685 Master's Supervised Teaching (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Master's student

Typically offered in Summer only

CBS 693 Master's Supervised Research (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Master's student

Typically offered in Fall, Spring, and Summer

CBS 695 Master's Thesis Research (1-9 credit hours)

Thesis research

Prerequisite: Master's student

Typically offered in Fall, Spring, and Summer

CBS 696 Summer Thesis Research (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Master's student

Typically offered in Summer only

CBS 699 Master's Thesis Preparation (1-9 credit hours)

For students who have completed all credit hour requirements and full-time enrollment for the master's degree and are writing and defending their thesis.

Prerequisite: Master's student

Typically offered in Fall, Spring, and Summer

CBS 705/BIO 705 Fundamentals of Neuroscience (3 credit hours)

This is a fundamental course that will provide the student with an up-to-date coverage of molecular, cellular, physiological, and circuit-based aspects of Modern Neurosciences in the Comparative Biomedical Sciences Graduate Program. Being a graduate-level class, the instructors will assume that the students have acquired some background in basic biology and biochemistry. The most important goal of this course is to train PhD students in neuroscience function and disorders, preparing them for neuroscience research. Emphasis will be placed on the systems and skills needed to pursue experimental neuroscience activities.

Important components of the learning process will be presentations from neuroscience experts, class discussions, exams and in class activities.

P: BIO 488 or permission of instructor

Typically offered in Fall only

CBS 711 Applications in Reproductive Physiology (2 credit hours)

Students with advanced interests in Theriogenology will meet weekly to discuss a wide range of current topics surrounding animal reproduction, including comparative physiology and endocrinology, reproductive management, reproductive pharmacologic/technologic advances in Theriogenology. Each student will be expected to present 2-3 topics with typed, referenced notes and an oral presentation. All students will be expected to actively participate in group discussions and briefly present a review of one topic-related article from the past 5 years during each lecture.

Typically offered in Fall only

CBS 712 Reproductive Management and Disease in Domestic Animals (1 credit hours)

Students will meet every other week to review current literature and discuss a wide range of topics surrounding animal reproduction, focused on clinical causes of infertility and their treatments in domestic and non-domestic species. Students will explore 3-5 preassigned questions surrounding a particular topic and prepare an in-depth handout answering those questions prior to arrival. Each student will be expected to actively participate in group discussions

Typically offered in Fall and Spring

CBS 733 Pharmacology I (2 credit hours)

This course focuses on the action of drugs in animals and basic principles of drug disposition and pharmacokinetics. The course will provide presentations on the principles of pharmacology of medications used in animals. Principles of autonomic pharmacology will form a foundation that is important to other drug groups. Important drug groups discussed during the course will be sympathetic and parasympathetic agonists and antagonists, anesthetic, sedative, and tranquilizer drugs. During the chemotherapy portion of the course, anti-infective agent chemotherapy will be discussed, which includes antibacterial, antiparasitic, antifungal, and antiviral drugs. Anticancer agents also will be considered in the chemotherapy portion of the course.

Typically offered in Fall only

CBS 734 Pharmacology II (2 credit hours)

This is a course in veterinary pharmacology. This course focuses on the action of drugs in animals and basic principles of drug disposition and pharmacokinetics. The course will provide presentations on the principles of pharmacology of medications used in animals. Important drug groups discussed during the course will be anti-infective agents used in chemotherapy. These include antibacterial drugs, antifungal drugs, antiviral drugs, and antiparasitic drugs. Anticancer drugs also will be included. Also included in the course are drugs that affect specific body systems such as ophthalmology, gastrointestinal, cardiovascular, and kidneys.

Bachelors Degree in Biological

Typically offered in Spring only

CBS 750 Techniques in Pharmacological Research (2 credit hours)

Theory and applications of modern scientific instrumentation to analysis of tissues, body fluids and drugs in pharmacological research. Discussion of appropriate aspects of the pharmacological use of spectroscopy, microscopy, chromatography, electrophoresis, radioisotope usage and centrifugation.

Prerequisite: BCH 452B or CH 315 or Equivalent and Graduate standing

Typically offered in Spring only

CBS 754 Epidemiology II (3 credit hours)

Study design, data management, and statistical analysis including applications of logistic regression and survival analysis. Main focus on descriptive, analytical and experimental epidemiology pertinent to disease etiology and prevention.

Prerequisite: Graduate standing

Typically offered in Fall and Spring

This course is offered alternate years

CBS 762 Principles of Pharmacology (3 credit hours)

The action of drugs in animals and man including basic principles of drug disposition, pharmacokinetics, drug resistance, and signal transduction. Modification of physiological processes by drugs influencing nervous, renal, cardiovascular, and endocrine systems and the antimicrobial and antineoplastic agents.

Typically offered in Spring only

CBS 764/NTR 764/PHY 764 Advances in Gastrointestinal Pathophysiology (3 credit hours)

This course will focus on advanced gastrointestinal physiology and the pathophysiology of diseases of relevance to scientists involved in animal-related research. In particular, the course will cover the pathophysiology of ulceration, infectious diarrhea, ischemia, motility disorders, and inflammatory diseases of the gut. An in-depth review paper will be required based on recent literature regarding a specific gastrointestinal disease.

Prerequisite: PHY 503, PHY 504

Typically offered in Fall only

This course is offered alternate odd years

CBS 770 Cell Biology (3 credit hours)

Advanced cell and organelle structure and function and recent advances in molecular biology. Emphasis on current literature and application of research procedures.

Prerequisite: BCH 451 and BIO 183 and (CH 223 or CH 227)

Typically offered in Spring only

CBS 775 Designing population-based research (3 credit hours)

The objective of this course is to introduce graduate students to the design of contemporary population-based research, defined broadly as research involving populations including epidemiological, clinical, and outcomes-based studies. Students will be introduced to basic concepts necessary to design and conduct population-based research, as well as, emergent technologies and concepts in the field of population health. Students will gain practice by creating a protocol for a research study addressing a relevant research question in their specific area of interest.

Prerequisite: ST 511

Typically offered in Spring only

CBS 783/IMM 783/MB 783 Advanced Immunology (3 credit hours)

In depth study of the basic cellular and molecular mechanisms of immunity, including antigen processing and presentation, T cell development, initiation of the immune response, effector mechanisms, and immunological memory. The course is designed for advanced graduate students who wish to focus on the current concepts in immunology.

Prerequisite: MB (IMM) 751

Typically offered in Fall only

This course is offered alternate odd years

CBS 787 Pharmacokinetics (3 credit hours)

Mathematical models to describe disposition of drugs and toxic chemicals in the animal body. Areas including classic compartmental and nonlinear models as well as physiological approaches. Discussion of application of these techniques to toxicologic studies.

Prerequisite: CBS 560, working knowledge of calculus

Typically offered in Fall only

This course is offered alternate years

CBS 795 Special Topics in Comparative Biomedical Sciences (1-6 credit hours)

Special Topics in Comparative Biomedical Sciences

Prerequisite: Graduate Students, DVM or equivalent degree

CBS 800 CBS Seminar (1 credit hours)

Presentation and discussions on ongoing research and current topics in biomedical sciences.

Typically offered in Fall only

CBS 803 Seminar in Surgical Pathology (1 credit hours)

Description and interpretation of microscopic changes in tissues from diseased domestic and laboratory animals. Students attend and participate in a one-hour weekly seminar where microscopic lesions described, interpreted and discussed.

Prerequisite: Those holding the DVM or equivalent degree

Typically offered in Spring only

CBS 804 Seminar in Necropsy Pathology (1 credit hours)

Description and interpretation of gross changes in tissues from diseased domestic animals. Students attend daily (M-F) 15-to 30-minute review of necropsy lesions presented by a member of the graduate staff.

Prerequisite: Those holding the DVM or equivalent degree

Typically offered in Spring only

CBS 805/BIO 805 Special Topics in Neuroscience (1 credit hours)

Topics in neuroscience. This course will provide an opportunity for students to integrate and apply knowledge and skills gained from their graduate studies. Emphasis will be placed on primary literature, scientific practice, and on effective, professional communication and presentations. Topics and instructors will vary from semester to semester. Priority will initially be given to graduate students participating in the neuroscience concentration; other students with the necessary prerequisites will be admitted on a space available basis.

R: Grad Standing or Instructor Approval

Typically offered in Spring only

CBS 806 Animal Models in Comparative and Translational Research (2 credit hours)

This course provides an overview of several models of comparative and translational research including the discussion of naturally occurring vs experimental models of disease. We will review 12 animal models and use them as examples to discuss the challenges faced during model development, relevance of the selected models to other animal species and humans, and the advantages/disadvantages of each animal model.

R: Comparative Biomedical Sciences students with an interest in translational animal models.

Typically offered in Spring only

CBS 810 Special Topics (1-6 credit hours)

Designed to present new or special subject matter within the scope of pathology, veterinary microbiology, morphology or pharmacology. The studies may include independent investigations, seminars and/or formal lectures.

Prerequisite: Senior standing or Graduate standing

Typically offered in Fall, Spring, and Summer

CBS 816 Advanced Topics In Immunology (1 credit hours)

Selected topics of current interest in immunology. A different topic will be covered each semester to focus on the most recent developments in the field.

Typically offered in Fall and Spring

CBS 817 Advanced Topics In Zoological Medicine I (2 credit hours)

Selected topics of current interest in clinical zoological medicine focused on marine mammals, fish, reptiles, amphibians, waterfowl, ratites, raptors and medical issues in free-ranging wildlife. Review of current clinical and basic science literature, student-lead discussion sessions and participation in faculty-lead discussions.

Prerequisite: Graduate standing or enrollment in DVM curriculum

Typically offered in Fall only

CBS 818 Advanced Topics in Zoological Medicine (2 credit hours)

This course provides breadth and depth of knowledge in zoological medicine to prepare Zoological Medicine residents to pass American College of Zoological Medicine (ACZM) boards. Veterinary students are exposed to more in depth information related to zoological medicine than covered in their core curriculum. Each Fall (CBS 817) and Spring (CBS 818) semesters, different aspects of zoological medicine are covered. Topics rotate every 3 years so that all major groups of animals within the sub-groups, avian, aquatic, herptile, wildlife, and zoo are addressed.

Prerequisite: Graduate standing or enrollment in DVM curriculum

Typically offered in Spring only

CBS 820 Special Problems (1-6 credit hours)

Selection of a subject by each student on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in CBS.

Typically offered in Fall and Spring

CBS 885 Doctoral Supervised Teaching (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Doctoral student

Typically offered in Summer only

CBS 886 Interdisciplinary Research Team Mentoring (3 credit hours)

This course will be a guided teaching experience within an academic framework that utilizes campus facilities and resources for supervised research. This course requires that you develop a research project with another graduate student and/or postdoctoral fellow and that, once approved, that an undergraduate student is added to the research team. This team then works together to complete the project. In addition, the teams will meet with course directors to ensure that the mentoring and research experience meets the course requirements. The course includes hands-on mentoring in a laboratory setting, as well as participation in group meetings to develop skills associated with organizing and presenting research results both in written and verbal format.

This course is related to the CMI Young Scholars Program that requires a graduate students to mentor an undergraduate in a pre-approved research project. <https://research.ncsu.edu/cmi/young-scholars-program/>
Typically offered in Fall, Spring, and Summer

CBS 893 Doctoral Supervised Research (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer

CBS 895 Doctoral Dissertation Research (1-9 credit hours)

Dissertation research.

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer

CBS 899 Doctoral Dissertation Preparation (1-9 credit hours)

For students who have completed all credit hour, full-time enrollment, preliminary examination, and residency requirements for the doctoral degree, and are writing and defending their dissertations.

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer