VETERINARY AND BIOMEDICAL SCIENCES (VBSC)

VBSC 50: Mechanisms of Disease

3 Credits

Introduction to the study of disease pathogenesis and careers in Animal Health Research and Service. VB SC 050S Mechanisms of Disease (3) Mechanisms of Disease is a first year seminar directed to students with an interest in a career in veterinary medicine or in bio-medical disciplines. Students are introduced to the concepts of epidemiology, cell biology, clinical medicine and toxicology through use of appropriate case material. The importance of basic science courses to the understanding of this material is emphasized. Reading and written assignments are related to the case study material as well as adaptation to the college experience. Grading is based on class participation and written assignments.

First-Year Seminar

VBSC 101: Careers in Veterinary Medicine and the Allied Professions

1 Credits

Exploring career pathways in veterinary medicine and the allied health industry. VB SC 101 Careers in Veterinary Medicine and the Allied Professions (1) The course is intended for first year students with an interest in careers in veterinary medicine or in the allied industries. Upon completion of the course students will have an understanding of the various careers possible in veterinary medicine; including types of specialization by species and/or by discipline. Students will have the opportunity to discuss careers in industries related to animal health and animal health research. Student learning will occur through the use of guest speakers, written assignments and on-line discussion groups. Student evaluation will be based on performance on assignments and on-line discussion groups.

VBSC 130: Understanding Human Disease

3 Credits

An explanation of disease mechanisms, enabling non-scientists to better understand medical journalism and apply basic medical principles to everyday life. VB SC 130 Understanding Human Disease (3) (GHA) All humans are impacted by disease, either personally or through friends or family members who are affected. Understanding Human Disease is an overview of disease processes for individuals not majoring in a scientific field. Students will have the opportunity to study the basic knowledge tools required to understand how different diseases arise, how they progress, how they are treated and in many cases, how they can be prevented. The course material is divided into two segments: the first portion discussing the different ways that diseases develop and includes explanations on normal and abnormal inflammatory processes, different types of infectious diseases, genetic diseases and congenital abnormalities (birth defects), diseases that affect the immune system and metabolic diseases. Diseases that are affecting significant populations such as HIV, diabetes, cancer and heart disease will be discussed. The second segment includes a discussion of the significant diseases affecting different organ systems of the body. Student participation is encouraged through questions. Additional topics of immediate interest as identified by the news media or class interest will be discussed. The course is intended for those who wish to better understand published medical journalism, for individuals who want to be able to discern the caliber of medical information in the popular press, for those students who wish to make healthy choices in their lifestyle and for individuals who may not be destined for a career in a scientific field.

General Education: Health and Wellness (GHW)

VBSC 190: Careers in Veterinary and Biomedical Sciences

1 Credits

Career strategic planning and opportunities for Veterinary and Biomedical Sciences.

VBSC 211: The Immune System and Disease

3 Credits

Introduction to the immune system that emphasizes the immune response to infection and consequences of a defective immune response.

Bachelor of Arts: Natural Sciences

General Education: Natural Sciences (GN)

VBSC 230: The Science of Poisons

3 Credits

An introduction to toxicology using real world examples to highlight the impact of toxicants on environmental, biochemical and physiological processes. VB SC 230 The Science of Poisons (3) Toxicology is the study of poisons (natural and man-made) and how these agents adversely affect living organisms. It involves the prevention of harm and the development of measures to assess risk. As a science it borrows from many disciplines including biochemistry, chemistry, epidemiology, genetics, and physiology. It also has great societal impact with regard to the development and testing of consumer products, exposure to industrial chemicals, and maintaining safe food and water. The course format will be lectures that incorporate real world examples of the effects of toxicant exposure on many levels (cell, organ, whole body, environmental). Students will be evaluated by quizzes, exams, and class participation. Students are required to have a basic understanding of biology and chemistry. The course is offered once per year in the Fall semester.

Prerequisite: CHEM 110, BIOL 110

VBSC 231: Introduction to Cancer Research and Medicine

3 Credits

An understanding of the terminology, basic concepts, techniques, multidisciplinary approaches and challenges in cancer research and medicine. VB SC 231 Introduction to Cancer Research and Medicine (3) Introduction to Cancer Research and medicine is designed for second year undergraduate students preparing for careers in biomedical research. Students will develop an understanding of the theories, scope, approaches and challenges of cancer related biomedical research. The lectures and discussions will emphasize the interdisciplinary character of the discovery process. Students will be introduced to topics on cellular mechanisms responsible for cancer development and
progression; techniques in cancer research involving generation and banking of research materials, and methods for performing molecular, genomic and proteomic analyses; approaches for discovery and validation of diagnostic and prognostic biomarkers as well as systems for high through put screening of targets for rational development of interventional therapeutics. Student evaluation will be based on performance on examinations and class participation.

**Prerequisite:** BIOL 110

**VBSC 280: Current Issues in Veterinary Medicine**

2 Credits

Discussion of the social, ethical and economic aspects of current and emerging issues related to animal ownership and veterinary medicine. V B SC 280 Current Issues in Veterinary Medicine (2)Current Issues in Veterinary Medicine is designed to provide students with the opportunity to research, present and discuss the social, ethical and economic issues important in Veterinary Medicine. Students will be expected to research the literature on specific topics within the general area of discussion, prepare and deliver an in class presentation and discuss their findings. Students are evaluated on class presentations and on three written position papers during the semester. The course is offered every spring semester.

**VBSC 290: Undergraduate Research Colloquium**

1 Credits

Presentations by appropriate faculty on research opportunities for undergraduates. VB SC 290H Undergraduate Research Colloquium (1) The goal of the course is for students to acquire the skills necessary to obtain an independent research project of the scope and scale required to complete an Honors Thesis. Students will learn to use online tools to approach primary literature in order to familiarize themselves with faculty research topics. Department faculty will present overviews of their research programs, including potential opportunities for undergraduate projects. First year honors students in the Veterinary and Biomedical Sciences, Immunology and Infectious Disease, and Toxicology majors should take this course in their second semester. Other interested students may take the course with department approval.

**Prerequisite:** permission of program

Honors

**VBSC 297: Special Topics**

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.

**VBSC 395: Internship**

1-10 Credits/Maximum of 10

Independent study and supervised field experience related to the student's professional interest. Limited to students in animal agriculture majors.

**Prerequisite:** fifth-semester standing in an animal agriculture major; approval by department of proposed plan before registration

**Full-Time Equivalent Course**

**VBSC 402: Biology of Animal Parasites**

3 Credits/Maximum of 3

An introduction to animal parasitology. Emphasis placed on host/parasite interactions, parasites of zoonotic importance, control programs and taxonomy. VB SC 402W Biology of Animal Parasites (3) This course provides students an opportunity to obtain an introduction to the field of animal parasitology. Material presented emphasizes life cycle patterns of animal parasites, host-parasite interactions and pathology, disease patterns and zoonotic potential of parasites to human disease, economic importance of parasitic diseases, taxonomy and parasite control programs. Information presented in this course will be useful to students interested in pursuing a career in veterinary medicine or careers dealing with animal care and management. Evaluation of student performance is achieved by 6 quizzes, three examinations and 3 writing assignments. The course is offered each spring semester with an enrollment of 15 to 25 students.

**Prerequisite:** BIOL 110

Cross-listed with: ENT 402 Writing Across the Curriculum

**VBSC 403: Principles of Animal Disease Control**

3 Credits

Principles of disease control based on knowledge of the multiple causes of animal disease.

**Prerequisite:** MICRB106 or MICRB201 . Prerequisite or concurrent: AN SC301

**VBSC 403H: Principles of Animal Disease Control**

3 Credits

Principles of disease control based on knowledge of the epidemiology of animal disease. VB SC 403H Principles of Animal Disease Control (3) Animal Health and well being has emerged as a clear concern of society. The general public is concerned about the health and well-being of their companion animals as well as the animals that provide them with portions of their daily diet. The Foot and Mouth Disease outbreak that occurred in Great Britain in the spring of 2001 coming on the heels of increased concern about Bovine Spongiform Encephalopathy and its possible links to the human disease; variant Creutzfeldt Jacob Disease, resulted in an increased awareness for the potential for animal disease to have adverse effects on society. These effects range from availability of wholesome food products to the zoonotic transmission of diseases between humans and animals. The goal of this course is to introduce students to the principles of animal disease prevention. This requires the student recall relevant background knowledge in biology, nutrition, microbiology and animal husbandry and management. Students will develop an understanding of the complex physiological, biochemical and microbiological mechanisms of importance to the maintenance of health and the prevention of disease. Examples of certain diseases are used to illustrate the application of general principles of disease control. Diseases of world wide importance as discussed in addition to the major diseases of importance to Pennsylvania animal owners. Collectively, the course material should provide animal owners, managers and future animal health professionals with the background to improve the decision making process required to maintain animal health and prevent losses from disease. The inherent, environmental and special
factors involved in the maintenance of health and the prevention of disease will be emphasized.

**Prerequisite:** MICRB106 or MICRB201. Prerequisite or concurrent: AN SC301

**VBSC 405: Laboratory Animal Science**

3 Credits

Principles involved in maintaining laboratory animals. Emphasis is on management, preventive medicine, and surgical considerations used in laboratory animal colonies. VB SC 405 Laboratory Animal Science (3)This course in Laboratory Animal Science introduces students to the biology and characteristics of a variety of laboratory animal species, explores the care and use of animals in various research environments and examines ethical/legal issues pertaining to the use of animals in research and teaching. The laboratory section reinforces topics discussed in lecture and provides an opportunity for students to learn basic animal handling techniques in a safe and professionally supervised environment. Students work with live laboratory animals including mice, rats, hamsters, guinea pigs, and rabbits. They learn handling techniques, administration techniques (such as by injection), and sample collection techniques (such as blood collection). They also learn surgical principles and perform a surgical procedure using aseptic technique. The Laboratory Animal Science course appeals to and benefits several general groups of students. Those who plan to pursue careers involving animal research such as in academia or industry receive a broad foundation in the field of laboratory animal science as well as an introduction to techniques commonly employed when handling animals. Those pursuing careers involving veterinary medicine or veterinary technology receive training and the opportunity to develop clinical/technical skills focused on a unique group of species. Students that are undecided in their career choice find that the field of laboratory animal science holds many opportunities for those with animal knowledge, handling skills and an understanding of the societal issues surrounding the use of animals in research.

**Prerequisite:** AN SC201, AN SC301, BIOL 110

**VBSC 407: Dairy Herd Health Programs**

2 Credits

A discussion of health programs for dairy herds to assist in the control of infectious and metabolic diseases of dairy animals. VB SC 407 Dairy Herd Health Programs (2)Dairy Herd Health Programs provides students interested in dairy farm management and/or herd health medicine the opportunity to integrate basic knowledge of dairy cattle diseases into a comprehensive and practical herd health program. Herd health management is discussed as it relates to infectious disease control including mastitis and calf diseases, reproductive management, metabolic disease control and parasite control. A text book is not required. Readings are provided via ANGEL and students are strongly encouraged to read current scientific and lay press literature in the appropriate subject areas.

**Prerequisite:** AN SC301, AN SC310, AN SC427, AN SC431W

**VBSC 409: Wildlife Diseases**

3 Credits

An introduction to wildlife diseases emphasizing their impact on wildlife, domestic animals and humans in today's world.

**Prerequisite:** BIOL 110, W F S209

**VBSC 410: Principles of Immunology**

3 Credits

The MICRB 410 / VBSC 410 Theories of immunity (3cr.) course provides a basic foundation in immunology with a focus on the progression from antigen recognition and innate immune responses to the development of acquired immunity. During the course, students will have the opportunity to learn about key topics that lead to an understanding of the how the human immune system functions. Such topics include the primary cells and anatomical sites of the immune system as well as the activation and processes of innate immunity. In addition, students will learn about the organization and generation of lymphocyte antigen receptors, major histocompatibility complexes, and antigen presentation. Topics will also be presented that allow students to build an understanding of how antigen recognition and presentation leads to the development, selection, and survival of B and T lymphocytes. T-cell mediated immunity, humoral immunity, and the dynamics of the immune response will also be discussed in depth. Topics such as the immunobiology of allergy, transplantation, autoimmunity, immunodeficiency, diseases, vaccines, and/or cancer will also be presented in order to help students build an understanding of the interplay between the immune system and health and disease will be discussed throughout the semester.

**Enforced Prerequisite:** (MICRB 201 OR MICRB 201H) AND (BMB 251 OR MICRB 251 OR BMB 251H OR BIOL 230W OR BIOL 230M)

**VBSC 418: Bacterial Pathogenesis**

2 Credits

Study of molecular interactions between bacterial pathogens and their hosts.

**Prerequisite:** MICRB201, MICRB410

**VBSC 420: General Animal Pathology**

3 Credits

Nature and mechanisms of the disease process including degenerations, growth disturbances, inflammation, host-parasite relationships and neoplasia. VB SC 420 General Animal Pathology (3)The objectives of this course are to help the student develop an understanding of the concepts and general principles of disease processes in vertebrate species, attain skills required to observe and describe tissue changes in animals and develop critical thinking skills required for problem solving. In addition to text materials, photographs and photomicrographs of a variety of tissue lesions will be presented and discussed to emphasize concepts of disease processes as described in the course. Specific subjects that will be presented include cellular injury and necrosis, inflammation, blood coagulation, hemodynamic disorders, diseases of immunity, cell growth and adaptation and neoplasia. This course utilizes knowledge previously attained from courses in physiology, chemistry, immunology and biochemistry.
students are required to have previous courses in biology, biochemistry discussions. With the integrative approach to course content, diagnosis to prevention. Course format will be lectures and case-based appreciation for clinical management of nutritional diseases from unique nutritional disease conditions. Additionally, students will gain anatomy and how this influences essential nutrients required and students will have an understanding of comparative gastrointestinal and physiologic processes will be highlighted. In completing the course, in disease susceptibility and recovery mediated through immunologic nutrients will be addressed. In addition, a secondary role of nutrition whole animal basis. Deficiency and toxicity diseases of all essential various principles of disease pathogenesis from a biochemical to disease pathogenesis, recovery and prevention requires an integration of biochemical and physiologic sciences and clinical practice. The intent of this course is to help the student integrate their knowledge from various basic science disciplines to real-world clinical issues related to the role of nutrition in disease pathogenesis, management and prevention across various animal species. Common nutrition and metabolic disease of production and companion animals will be used to demonstrate various principles of disease pathogenesis from a biochemical to whole animal basis. Deficiency and toxicity diseases of all essential nutrients will be addressed. In addition, a secondary role of nutrition in disease susceptibility and recovery mediated through immunologic and physiologic processes will be highlighted. In completing the course, students will have an understanding of comparative gastrointestinal anatomy and how this influences essential nutrients required and unique nutritional disease conditions. Additionally, students will gain appreciation for clinical management of nutritional diseases from diagnosis to prevention. Course format will be lectures and case-based discussions.&nbsp;With the integrative approach to course content, students are required to have previous courses in biology, biochemistry and nutrition. The course can meet requirements for writing across the curriculum and satisfies 400-level course requirements for Animal Bioscience and Animal Science majors. Prerequisites for the course include B M B 211 or B M B 401, and AN SC 301 or equivalent nutrition course.

**Prerequisite:** B M B 211 or B M B 401, AN SC 301 or equivalent nutrition course

**Writing Across the Curriculum**

VBSC 425: Principles of Avian Diseases

3 Credits

Principles of pathogenesis and control of diseases in poultry and other avian populations. Case material used where appropriate. ANSC 425 / VBSC 425 Principles of Avian Diseases (3) This course discusses the major diseases of domestic poultry, with etiology, prevention, and treatment reviewed on each disease. Since many of these diseases also affect wild birds and pet birds these are also reviewed. Lastly, avian disease with zoonotic (human public health) potential are also discussed in the course. This course is required by those seeking a poultry minor. Previous coursework in pathogenic microbiology is beneficial.

**Prerequisite:** MICRB 106 and MICRB 107 or MICRB 201 and MICRB 202 CONCURRENT: AN SC 211, AN SC 311 Cross-listed with: ANSC 425

VBSC 430: Principles of Toxicology

3 Credits

Introduction to the biomedical aspects of toxicology with emphasis on the mechanisms and fate of chemical interaction with biological systems.

**Prerequisite:** BIOL 110, BIOL 240W, B M B 211 or B M B 401

VBSC 431: Environmental Toxicology

3 Credits

Effects of pollutants on animal health at the chemical, physical, and cellular level.

**Prerequisite:** BIOL 110, CHEM 110, CHEM 112

Cross-listed with: ERM 431

VBSC 432: Advanced Immunology: Signaling in the Immune System

3 Credits

The study of signaling pathways that regulate the immune response. BMB 432 / MICRB 432 / VBSC 432 Advanced Immunology: Signaling in the Immune System (3) This course will use the immune system as a model in which to study how cells communicate in order to coordinate an immune response. We will focus on signaling mechanisms that regulate such immune responses as T cell activation, Th1/Th2 differentiation, macrophage activation, and migration of immune cells to sites of inflammation. All lectures are based on recent reviews by key investigators in each field, as well as primary articles to present students with the most recent advances, techniques, and approaches used. The goal of the course will be to convey a basic understanding of intracellular signaling mechanisms that will pertain to all areas of biology, an appreciation for current questions and future directions in the
Mucosal tissues are gateways into the body. Because of their direct interaction with the environment, a specialized immune response is needed. Unlike the systemic immune system, which functions in a sterile environment inside the body, mucosal immune responses must be able to discriminate between harmful pathogens and benign stimuli like commensal organisms and food. The emphasis of this course is to understand the unique properties of the mucosal immune system. This course will build on the general understanding of immunology presented in MICRB410 and provide a detailed discussion of the symbiotic relationship between the microbiome and the development and function of the mucosal immune system. The effects of disruptions in the microbiome and the effects on disease will also be a major theme of the course. The course will include lecture and discussion of the topics presented in the textbook. In addition, articles from the primary literature will be presented and discussed. These articles will also provide an experimental framework for understanding the mucosal immune system. The topics presented here will provide a greater understanding of mucosal immunology and its interactions with the microbiome for students majoring in Immunology and Infectious Disease, Veterinary and Biomedical Sciences, Animal Science, Biochemistry and Molecular Biology, Biology, Microbiology, Food Science and Nutrition. The course would also be appropriate for Graduate students seeking more information about mucosal immune responses.

Prerequisite: MICRB 410

VBSC 444: Epidemiology of Infectious Diseases

3 Credits

An introduction to epidemiology of infectious diseases with emphasis on understanding epidemiologic concepts for identifying, preventing and controlling infectious diseases.

Prerequisite: BIOL 220, STAT 200 or STAT 250

VBSC 445: Molecular Epidemiology of Infectious Diseases

3 Credits

A discussion and practicum of the molecular laboratory techniques used to study molecular epidemiology of infectious diseases.

Prerequisite: BIOL 220, STAT 200 or STAT 250 and VB SC444

VBSC 448: Current Topics in Immunology

3 Credits

Study of current approaches and questions driving research in immunology and infectious diseases.

Writing Across the Curriculum

VBSC 450: Medical Entomology

3 Credits/Maximum of 3

Transmission of human and animal pathogens by insects, mites and ticks, including emergent pathogens, envenomization, and forensic entomology. This course presents principles of transmission of human and animal pathogens by insects, mites and ticks. Non-transmission based aspects of medically important arthropods such as envenomization, zoology and genomics will be discussed also. Basic arthropod biology with special emphasis on diseases caused by arthropods will be presented. We will also consider components of arthropod disease cycles and principles of pathogen transmission groups of arthropod--
borne pathogens and vectors will be discussed. Special topics will include emergent pathogens, vector genetics, traditional and modern disease control strategies and venemous arthropods.

**Prerequisite:** ENT 313, or BIOL 011 and BIOL 012, or BIOL 110 or BIOL 220W

VBSC 451: Immunotoxicology of Drugs and Chemicals

3 Credits

An in depth discussion of the effect of xenobiotics and drugs on host immune mechanisms. VBSC 451 Immunotoxicology of Drugs and Chemicals (3) Maintaining good health is a priority for most of us, and a key element in staying healthy is a properly functioning immune system. However, we are constantly exposed to a barrage of chemicals in the environment both natural and man-made. Some of the key questions asked included: 1) do environmental chemicals affect the generation of immunity?, 2) is our environment to blame for bad health?, and 3) can natural compounds cause immunotoxicity? These questions and more will be addressed in Immunotoxicology. This course will focus primarily on the effects of chemicals in the environment but will also cover the impact of other factors such as therapeutics, recreational drugs, and dietary factors on the immune system. Immunomodulatory mechanisms will be examined at systemic, cellular and molecular levels. Discussions will include theory, principles, and methodology and key issues in immunotoxicity, host immune mechanisms, and tumorigenesis. Key issues in regulatory immunotoxicology will be discussed to make students prepared for jobs in Federal Regulatory Agencies. Grading for undergraduates will include midterm and finals, and class participation; while graduate students will be required to also write a short, immunotoxicologically-related research proposal. Our intent is to provide a bridge between the two sciences and the undergraduate majors of Immunology and Toxicology, with an introduction to the basic mechanisms by which environmental, occupational, and therapeutic agents may interfere with immunologic systems. Immunotoxicology is offered every fall semester and is designed for undergraduate students from toxicology, immunology, and forensic science majors.

**Prerequisite:** MICRB201 or BMB 251

VBSC 494: Honors Thesis

1-6 Credits/Maximum of 6

Independent study directed by a faculty supervisor that culminates in the production of a Veterinary and Biomedical Sciences honors thesis.

**Prerequisite:** junior or senior status in the Schreyer Honors College and permission of the Veterinary and Biomedical Sciences honors advisor

VBSC 496: Independent Studies

1-18 Credits/Maximum of 18

Creative projects, including research and design, which are supervised on an individual basis and which fall outside the scope of formal courses.

VBSC 497: Special Topics

1-9 Credits/Maximum of 9

Formal courses given infrequently to explore, in depth, a comparatively narrow subject that may be topical or of special interest.