

### Suggested BIOT Program Electives

Course Prefix	Course Name	Credit Hours	Semester Offered
ANSC 626	Analysis of Gene Expression	2	fall
ANSC/POSC/GENE 629	Applied Animal Genomics	3	fall
BAEN 631	Bioseparation Processes	3	fall, odd years
BIOL/BICH 650	Genomics	3	fall
BIOT 602	Biotechnology Principles and Techniques II	4	spring
BIOT 685	Directed Studies (can be repeated)	1-4	fall, spring
FSTC/POSC/VTMI 619	Molecular Methods for Microbial Characterization	3	fall
FSTC/POSC 629	Microbiology of Food Irradiation	3	spring
GENE 620	Cytogenetics	3	spring
GENE/MEPS 411	Biotechnology for Crop Improvement	3	spring
MGMT 643	Foundations of Managerial Law	3	fall, spring
MGMT 658	Managing Projects	3	fall, spring
NUTR/FSTC 640	Therapeutic Microbiology	3	fall
POSC/NUTR/VTMI 614	Fermentation and Gastrointestinal Microbiology	3	fall
SCSC/GENE/MEPS 654	Genome Analysis	3	spring
SCSC/GENE/MEPS 655	Analysis of Complex Genomes—Lab	3	spring
STAT 651	Statistics in Research I	3	spring, summer, fall
VIBS 602	Histology	4	fall, spring
VIBS 606	Neuroanatomical Systems—Neurodegenerative Diseases	3	spring even years
VIBS 612	Mammalian Embryology	4	fall
VIBS 617	Cell Biology	1-5	fall
VIBS 657	Issues in Science and Technology Journalism	3	fall
VIBS 658	Research Methods in Science and Technology Journalism	3	spring
VIBS 660	Reporting Science and Technology	3	fall
VIBS 663	Biomedical Reporting	3	spring, summer
VIBS 664	Risk and Crisis Reporting	3	occas., fall 2011
VIBS 685	Directed Studies (can be repeated), science editing	1-3	summer
VIBS 689	Evolutionary Bioinformatics	1	fall
VTMI 615	Immunogenetics & Comparative Immunology	3	spring
VTMI 645	Host-Agent Interaction	3	spring, odd years
VTMI 649	Immunology	3	fall, odd years
VTMI 650	Experimental Immunology	4	fall
VTMI 662	Advanced Immunology Concepts	1-5	fall, odd years
VTMI 689	Physiological Chemistry for Biomedical Sciences I	3	fall
VTPB 409	Introduction to Immunology	3	spring, fall
VTPP 438/638	Analysis of Genomic Signals	3	fall 2011

## Course Descriptions

### **ANSC 626. Analyses of Gene Expression. (1-3). Credit 2.**

Proficiency in handling DNA and RNA gained during exercises used routinely in analyses of gene expression; RNA preparation and analysis on Northern blots; in vitro transcription and polyacrylamide gel analysis of nucleic acids; sub-cloning and mRNA quantitation using polymerase chain reaction. Prerequisites: GENE 450 or approval of instructor; radiation safety training. Cross-listed with GENE 626.

### **ANSC 629. Applied Animal Genomics. (3-0). Credit 3.**

Theory and application of genomics by livestock industries; consideration of genetic markers, gene mapping methods, genome analysis and emerging technologies such as microarrays, transgenesis, cloning and marker assisted selection; exposure to bioinformatic tools for genomics. Prerequisite: GENE 603.

### **BAEN 631. Bioprocesses and Separations in Biotechnology. (3-0). Credit 3.**

Application of engineering principles to recovery and purification of biological compounds derived from cell grown in bioreactors, transgenic animals, and plants. Process development, design, and scale up of downstream processes used in biotechnology and pharmaceutical industry. Emphasis on extraction, sedimentation, membrane filtration, precipitation, and liquid chromatography. Prerequisites: Senior classification in engineering, G7, G8 or approval of instructor.

### **BIOL 650. Genomics. (3-0). Credit 3.**

Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with BICH 650.

### **BIOT 602. Biotechnology Principles and Techniques II. (1-9). Credit 4.**

Application of basic theories and principles of biotechnology to team and individual research problems in a laboratory setting. Prerequisites: BIOT 601; graduate classification.

### **BIOT 685. Directed Studies. (4-0). Credit 1-4**

Provides customized training and experience to students in the Biotechnology Program; topics can include laboratory research, scientific literature reviews, biotechnology market surveys, and training in technology commercialization. Prerequisites: Approval of instructor.

### **GENE 411. Biotechnology for Crop Improvement. (3-0). Credit 3.**

Use of biotechnology to improve agricultural, horticultural and forest crops; techniques and methods used and case studies where biotechnology has been used to alter traits such as pathogen resistance, protein or oil consumption, ripening, fertility and wood properties. Prerequisite: BIOL 111 or equivalent. Cross-listed with MEPS 411.

### **GENE 620. Cytogenetics. (3-0). Credit 3.**

Examination and analysis of variation in chromosome structure, behavior and number; developmental and evolutionary effects of this variation. Prerequisite: GENE 603

### **FSTC 619. Molecular Methods for Microbial Characterization. (2-2). Credit 3.**

Underlying principles of molecular methods for microbial detection and characterization in natural and man-made ecosystems; emphasis on method application and data interpretation; emphasis on microbial pathogens and indicator organisms in foods and environment; laboratory covers select protocols. Prerequisites: FSTC 326; SCSC 405; POSC 429; approval of instructor. Cross-listed with SCSC 619, POSC 619, and VTMI 619.

### **FSTC 629. Microbiology of Food Irradiation. (2-2). Credit 3.**

The course provides a lecture plus laboratory overview of electron beam and x-ray based food irradiation principles. The objective is to provide students with a working knowledge of using electronic

pasteurization as a means of destroying microbial pathogens or retarding microbial spoilage in foods. Cross-listed with POSC 629.

**MGMT 658. Managing Projects. (3-0). Credit 3.**

Application of management processes to complex interdisciplinary organizational environments through the study of program and project management; adoptions of traditional management theories to the project environment; master typical project management microcomputer software for project planning; resource allocation; project budgeting; and control of project cost, schedule and performance. Prerequisite: Graduate classification.

**MGMT 643. Foundations of Managerial Law. (3-0). Credit 3**

Basic legal relationships and issues encountered by managers and organizations; American legal system, administrative law, alternative dispute resolution and selected substantive areas of law (e.g., environmental protection, discrimination, negotiable instruments). Prerequisite: Graduate classification.

**NUTR 640. Therapeutic Microbiology. (3-0). Credit 3.**

This systems biology course surveys the role of gastrointestinal dysbiosis (microbial imbalance) in chronic disease and explores novel interventions that affect disease progression indirectly by resolving dysbiosis or directly by disrupting interkingdom or transgenomic signal exchanges that evoke host response and pathology. Topics include: (i) the role of the "native" intestinal microbiota health and disease; (ii) probiotic & prebiotic nutritional supplements; (iii) recombinant pharmabiotics; (iv) gut-associated lymphoid tissue & mucosal immunity; (v) foodborne pathogens; (vi) fermented products as functional foods; and (vii) bacteriophage (phage) therapy and phage biocontrol.

**POSC 614. Fermentation and Gastrointestinal Microbiology. (3-0). Credit 3.**

Fermentation and gastrointestinal ecosystems in terms of microorganisms present, their activities and requirements and their interactions in a dynamic system. Prerequisite: Beginning microbiology and/or biochemistry or approval of instructor. Cross-listed with NUTR 614 and VTMI 614.

**SCSC 654. Genome Analysis. (3-0). Credit 3.**

Genome structure, organization and function of model organisms and higher eukaryotes; theories, methodologies and applications of different types of DNA markers, digital genotyping, genetic mapping, gene, QTL and eQTL mapping, gene tagging, conventional and megabase-sized recombinant DNA, physical mapping, gene cloning (map-based cloning, RNAi, insertional mutagenesis, TILLING), conventional and next-generation genome sequencing and analysis, gene expression profiling (microarray/ GeneChip, SAGE, digital gene expression profiling, real-time quantitative PCR); emphasis on the theories and methodologies of deciphering and understanding the structure, function and evolution of complex genomes. Prerequisite: GENE 603 or GENE 431. Cross-listed with GENE 654 and MEPS 654.

**SCSC 655. Analysis of Complex Genomes—Lab. (0-7). Credit 3.**

Laboratory methods in molecular genetic techniques for genetic mapping, physical mapping, and map-based cloning of both qualitative and quantitative phenotypes. Prerequisites: Concurrent registration in SCSC 654 and approval of instructor. Cross-listed with GENE 655 and MEPS 655.

**651. Statistics in Research I. (3-0). Credit 3.**

For graduate students in other disciplines; non-calculus exposition of the concepts, methods and usage of statistical data analysis; T-tests, analysis of variance and linear regression. Prerequisite: MATH 102 or equivalent.

**VIBS 602. Histology. (2-6). Credit 4.**

Molecular phenomena placed in context with tissues, organs and organ systems; cell and tissue structures visualized by light microscopy and electron micrographs for functional relationships; clinical correlations reveal relevance of histology in specific disease states; conceptual thinking exercises facilitate problem-solving skills. Prerequisite: Graduate classification.

**VIBS 606. Neuroanatomical Systems. (3-0). Credit 3.**

Course emphasis is on major neural systems that govern identifiable physiological functions, behavior and neurodegenerative disease. Whole-brain anatomy is approached from a "systems" perspective, wherein components of defined functional systems are described in terms of their location, inputs and outputs, and physiological /behavioral significance in health and disease. Prerequisite: Approval of instructor.

**VIBS 612. Mammalian Embryology. (3-3). Credit 4.**

Embryology of domestic mammals; gametogenesis, fertilization, cell proliferation and differentiation, and organogenesis; selected commonly occurring congenital defects of domestic animals used to emphasize embryologic sequences and processes. Prerequisites: VIBS 601 and 602 or approval of instructor. (Offered in 1991 and in alternate years thereafter.)

**VIBS 617. Cell Biology. Credit 1 to 5.**

Series of five 1-hour credit modules focusing on selected aspects of structure, function, and signal transduction in eukaryotic cells through critical analysis of recent literature in the field. Each module listed as separate course section; students may enroll in up to five 1-hour module sections per semester. Prerequisite: Approval of instructor.

**VIBS 657. Issues in Science and Technology Journalism. (3-0). Credit 3.**

Current issues, fundamental concepts in science and technology journalism, communication theory, science and journalism components, philosophy and literature of the field.

**VIBS 658. Research Methods in Science and Technology Journalism. (3-0). Credit 3.**

Research methods including theory, hypothesis formulation, design, data collection, data analysis, measurement and report writing. Qualitative and quantitative methods. Research topics.

**VIBS 660. Reporting Science and Technology. (3-0). Credit 3.**

Gathering, writing and editing complex information, translation techniques, interpretation and analysis, literary and organizational devices and measurement of readability.

**VIBS 663. Biomedical Reporting. (3-0). Credit 3.**

Sources of biomedical information, specialized information-gathering skills, key biomedical vocabulary/concepts, audiences, outlets, translation/interpretation, research, ethical issues.

**VIBS 664. Risk and Crisis Reporting. (3-0). Credit 3.**

Assessment and analysis of environmental and health risk, analytical procedures, interpretation of risk factors, reporting science crisis events.

**VIBS 685. Directed Studies. Credit 1 to 4 each semester.**

Research problem in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses, science and technology journalism).

**VIBS 689. Evolutionary Bioinformatics. (1-0). Credit 1.**

Principles and concepts in molecular evolution, population genetics, and evolutionary genomics; applications of quantitative approaches (computation, statistics, and mathematics) in analyzing large-scale and complex biological data sets; algorithm design and development of scientific software using high-level high-performance computer languages; emerging techniques for integrative data analysis, and the assumptions, advantages, and limitations of these techniques.

**VTMI 615. Immunogenetics and Comparative Immunology. (3-0). Credit 3.**

Genetic mechanisms used to diversify immune receptors; immunoglobulins, T cell receptors, major histocompatibility complex, natural killer cell receptors, toll-like receptors and many others; selected comparative and veterinary examples of different immune recognition systems; evolution of the immune system; theoretical immune surveillance and vaccine development. Prerequisite: Graduate classification; GENE 320 and VTPB 409, or equivalent, or permission of instructor.

**VTMI 645. Host-Agent Interaction. (3-0). Credit 3.**

Basic concepts of infection versus disease; molecular approaches to problems in microbiology; inducible host responses, agent escape mechanisms and movement of potential pathogens in the ecosystem. Prerequisite: GENE 431 or equivalent.

**VTMI 649. Immunology. (3-0). Credit 3.**

Cellular basis of the immune response; relationships between inflammation and acquired immunity, MHC and cell activation; the role of cytokines in immunoregulation and hypersensitivity, vaccines, and the mechanism of immunity to viruses, bacteria and parasites. Prerequisite: VTPB 409 or equivalent. Cross-listed with POSC 649.

**VTMI 650. Experimental Immunology. (3-3). Credit 4.**

Familiarization, development and integration of techniques into experimental design of immunologic investigation; antibody production, protein purification, immunofluorescence, agar-gel diffusion, immunoelectrophoresis and specialized serologic tests. Cross-listed with POSC 660.

**VTMI 689. Physiological Chemistry for Biomedical Sciences I. (3-0). Credit 3.**

This course will provide instruction on the basic structure and function of the key molecular components of the cell and its application to human and animal disease. How these molecules interact and contribute to health will be emphasized. This course is designed for pre-professional students planning to attend veterinary, medical or related professional schools, and graduate students wishing to understand the chemical basis of biological systems.

**VTMI 662. Advanced Immunologic Concepts. Credit 1 to 5.**

Modular course with detailed discussions, workshops and assigned reading/problem solving on advanced topics; structural organization of molecules; genetic regulation; cytokine cascades; pathophysiology of autoimmunity. May be repeated for credit. Prerequisites: VTMI 649; BICH 603 or equivalent; approval of instructor.

**VTPB 409. Introduction to Immunology. (3-0). Credit 3. I, II, S**

Diverse concepts relative to immunologic mechanisms inherent to domestic and laboratory animals. Prerequisite: advanced classification.

**VTPP 438/638. Analysis of Genomic Signals. (2-2). Credit 3.**

Overview of current high throughput technology for data acquisition and analysis of genomic signals (e.g. mRNA or proteins); emphasis on the microarray technology, methods for analyzing microarray data, and approaches to model the underlying phenomena from the systems biology perspective. Prerequisites: junior or senior classification; GENE 320/BIC 320 and BIOL 111/BIOL 112 or BIOL 213 or equivalent; STAT 302 or equivalent.