EVMS Biotechnology Master’s Program Curriculum

**Fall Semester**

**Cell Structure & Function (BT 700, 4 credits)**
The course provides a foundation in cellular and molecular biology, including cell structure, cell physiology, DNA and RNA structure and function, protein synthesis, and regulation of gene expression.

**Research Techniques (BT701, 2 credits)**
Lectures cover topics in molecular cloning and analysis, detection systems including PCR and real time PCR, working with proteins, basics of cell culture.

**Introduction to the Laboratory (BT702, 2 credits)**
Intensive laboratory course introducing students to basic research techniques, including DNA purification, subcloning, polymerase chain reaction, and cell culture methods.

**Introduction to the Research Literature (BT703, 1 credit)**
Designed to train students in the interpretation of research literature. Students will assess the introduction, methods, results and discussion sections of journal articles.

**Laboratory Management (BT704, 1 credit)**
This course will expose students to important aspects of being a laboratory manager. Students will become familiar with: (1) Good Laboratory Practices and how to keep a laboratory notebook. (2) A general overview of the Institutional Research Board, Institutional Biosafety Committee, Institutional Animal Care and Use Committee, Environmental Health and Safety (Chemical & Radiation Safety) (3) Responsible conduct in research - Conflict of Interest, Research Misconduct, Ethics (4) Intellectual property issues and patents (5) basic overview of Quality Assurance Practices in the Biotechnology sector (6) How to monitor and maintain laboratory-related documentation, equipment, and supplies. (7) Written and Oral Communication Skills.

**Introduction to Animal Biomedical Research (BT705, 2 credits)**
This course will teach students important aspects of working with animals in the biomedical research setting. Student will learn: (1) Ethical and welfare aspects of working with Laboratory animals. (2) State and federal regulations overseeing the laboratory animal field. (3) The general aspects of husbandry and care of laboratory animals, including common diseases and signs of diseases. (4) Common animal models. (5) How to design and develop an animal research protocols. (6) Handling of common laboratory species (rats, mouse and rabbits). (7) Introduction to specific common animal research procedures. (8) Biosecurity and potential zoonotic diseases in the biomedical research setting.

**Spring Semester**

**Advanced Molecular & Cellular Techniques (BT706, 3 credits)**
Methods of gene manipulation and mutagenesis and immunological techniques will be discussed. Topics include deletion and site-directed mutagenesis, chimeras, use of linkers and expression tags, SDS polyacrylamide gel electrophoresis, in vitro transcription and translation, cell culture, transfection and methods of protein analysis.
Microscopy and Imaging Techniques (BT707, 2 credits)
This is a hands-on, technical course that will focus on developing microscopy and imaging skills. The course will provide basic instruction and practice in electron microscopy, confocal and fluorescence microscopy, immunofluorescence, and image analysis.

Microarray Technologies (BT708, 2 credits)
Laboratory course providing hands-on introduction to microarray technology, including experimental design, slide spotting, sample labeling, hybridization and data analysis.

Proteomic Technologies (BT709, 2 credits)
Laboratory course will give students an introduction to basic proteomic techniques, including 2D-gel electrophoresis and mass spectrometry.

Bioinformatics (BT710, 1 credit)
Introduction to basic concepts in bioinformatics. Use of Incogen and Vector NTI software and tools on the NCBI website. Lecture and computer laboratory will cover topics such as DNA analysis tools, PCR primer design, motif analysis, similarity searches, restriction enzyme analysis, multiple sequence alignments, protein sequence identification, phylogenetic tools and public databases.

Flow Cytometry (BT711, 2 credits)
Course covers basic knowledge and main applications of flow cytometry, and contains both lectures/tutorials and laboratory work. The students will learn: (1) Principles of flow cytometry: instrumentation for flow cytometry; probes for flow cytometry; quality control; and instrument maintenance. (2) Basic skills: flow cytometric protocol design; sample preparation; data analysis and presentation. (3) Major applications of flow cytometry in biomedical research and diagnostics.

Research Design (BT712, 1 credit)
This course will introduce the students to the concept of research design and the Scientific Method, relate research design to the NIH grant format and introduce the students to research design focused on various biotechnologies through presentation of a published article by a faculty member who will lead the discussion. A second meeting, in which the students will analyze the research design in the material presented, will follow the faculty presentation.

Techniques Journal Club (BT713, 1 credit)
Seminar presentations by students in various research areas: e.g., tumor biology, infectious diseases, immunology, molecular cell biology, cardiovascular and reproductive physiology, endocrinology and neuroscience. Journal articles emphasizing the latest innovative techniques and instrumentation used for biological and medical research are discussed and critiqued.

Summer Semester

Internship (BT714)
Mentored internship at a biotechnology company or in a research laboratory, with a focus on advanced biotechnical training.

On-Line Journal Club (BT715, 1 credit)
The Biotechnology program is unique in that after an intensive on-campus experience, students then complete a 6-month on-campus or off-campus internship. This on-line journal club is designed to fulfill three primary objectives: (1) maintain student contact with the primary institution and class cohort
while fulfilling their internship requirement; (2) continue the process of life-long learning that is an essential component of scientific research; and (3) enhance their internship experience by discussing journal articles related to their internship research focus.

**Fall Semester**

**Internship (BT716)**
*Mentored internship at a biotechnology company or in a research laboratory, with a focus on advanced biotechnical training.*

**On-Line Biostatistics (BT717, 3 credit)**

**On-Line Journal Club – continued (BT718, 1 credit)**

*Students are required to return to EVMS once their internships are complete and present what they have learned during their internships to the EVMS faculty and graduate students for completion of their Master’s Degree.*