Biology (BL)

BL 6210. Bioethics. 2 Semester Hours.
This course provides an advanced, critical examination of ethical, legal, and social implications in medical genomics and precision medicine. Students will engage in in-depth analysis of complex issues including genomic data governance, population-level genomics, equity in access to precision medicine, and the ethical integration of genomics into clinical and research settings. The course emphasizes policy analysis, case-based evaluation, and development of evidence-based ethical frameworks.

BL 6311. Bioinformatics Programming with R. 3 Semester Hours.
The objective of this course is to teach students bioinformatics programming techniques using R. The focus of this course will be on development of programs to perform commonly used bioinformatics techniques like pair-wise and multiple sequence alignments. Students will learn computational gene-finding and comparative genomic techniques. They will also learn to create phylogenetic trees and protein-protein interaction graphs. Students will also learn about Hidden Markov models. Spring Semester.

BL 6320. Medical Genetics & Genomics. 3 Semester Hours.
The objective of this course is to investigate and study the role of genetics in human health and disease. This course will investigate not only common Mendelian diseases and their clinical impacts, but also introduce the genetics of cancer, epigenetics, genetic immunity, microbiome, and how this relates to genetic counseling. Additionally, expanding technology in relation to genetic profiling has provided opportunities to utilize genomics for precision medicine; attention will be paid to the translation of the latest technologies being utilized for genomic-based diagnostic tests and clinical therapies for personalized medicine. Spring Semester.

BL 6340. Mechanisms of Disease. 3 Semester Hours.
This course provides an advanced, integrative examination of the molecular, cellular, and systems-level mechanisms underlying human disease, with an emphasis on genomic and precision medicine approaches. Students will explore how genetic and epigenetic variation, dysregulated signaling pathways, and environmental factors contribute to disease initiation, progression, and heterogeneity across major disease categories, including cancer, metabolic disorders, immunological diseases, infectious diseases, cardiovascular disease, and aging. A mechanistic and data-driven framework will be used to connect genomic variation to phenotype and clinical presentation. (Fall Only).

BL 6360. Research Study Design. 3 Semester Hours.
The objective of this course is to introduce students to different types of research studies (ecological, cross-sectional, case-control, cohort, and randomized control trial), when it would be appropriate to use each study, and how to analyze the results. As a culminating project for the course, students will be required to write their own study proposal. Fall Semester.

BL 6410. Biostatistics for Life Science. 4 Semester Hours.
This course provides advanced training in the application and interpretation of statistical methods for analyzing biological data. Emphasis is placed on the selection, implementation, and critical evaluation of statistical methodologies commonly used in the life sciences, with extensive use of the R programming language. Topics include contingency table analysis, linear and generalized linear models, ANOVA, maximum likelihood estimation, hypothesis testing (including t-tests and chi-square tests), and survival analysis. Students will engage in the analysis of complex, real-world biological datasets and will be expected to interpret results in a biological and clinical context. Additional emphasis will be placed on experimental design, reproducibility, and the critical evaluation of statistical approaches in primary scientific literature.

BL 6411. Genes, Genomes, and Genomics. 4 Semester Hours.
This course provides advanced study of the principles and technologies underlying modern molecular genetics and genomics, with emphasis on genome structure, function, and variation. Students will critically examine gene regulation, genome organization, and the molecular basis of biological processes across systems, with applications to human health and disease. The course integrates theoretical concepts with practical analysis of genomic data, including DNA sequencing technologies and computational approaches to sequence analysis. Students will develop proficiency in interpreting genome-scale datasets and evaluating current methodologies in genomics and molecular medicine. Additional emphasis is placed on the critical analysis of primary scientific literature, emerging genomic technologies, and applications in areas such as genetic engineering, precision medicine, and forensic genomics. Students will be expected to synthesize concepts across molecular genetics and genomics and apply them to complex biological and clinical questions. (Fall Only). Additional fee associated with this course. See fee schedule for details at https://www.stmarytx.edu/admission/financial-aid/tuition/.

BL 7200. Medical Genomics Capstone. 2 Semester Hours.
For successful course completion of the MS in Medical Genomics, students are to complete a comprehensive, scholarly research paper that focuses on current technologies and their applications in relation to medical genomics. This capstone project should be an original scholarly paper that the student independently creates. Students may also utilize relevant industry projects and research projects as approved by instructor. Spring and Summer Semesters.

BL 7310. Population Genetics. 3 Semester Hours.
This course explores the mathematical theory of allele and genotype frequency across populations. Through studying the effects of mutation, selection, gene follow, and genetic drift on allelic frequencies, genetic variability and evolution can be analyzed in human populations. Case studies analyzing genetic diseases and linkage within families will also be utilized for studying changes in allelic frequencies across populations. Spring Semester.

BL 7320. Epigenomics. 3 Semester Hours.
This course focuses on epigenetic modification of the DNA that alters gene expression without changes to the genetic code. Students will learn the basics of epigenetic modification and the molecular mechanisms by which it occurs. Knowledge will also include the different behavioral and environmental factors that can influence epigenetics and disease status and predisposition. Epigenetic modification can be inherited across generations which in turn can affect clinical disease diagnostics, prognostics, and treatments. Summer Semester.

BL 7340. Pharmacogenomics. 3 Semester Hours.
The objective of this course will be to investigate the current and upcoming technologies regarding clinical therapeutic areas through pharmacogenomics. Studentswill learn how genomic differences can translate into specific pharmaceutical treatments and outcomes for patients. Special attention will be paid to cancer diagnostics, prognostics, and treatment due to genomic changes in both germline and somatic cells. Fall Semester.

BL 7350. Genetic Epidemiology. 3 Semester Hours.
Genetic epidemiology investigates the intersection of genes and environmental factors that influence and predispose individuals to disease states. Students in this course will be able to analyze different sources of heritability including environment and epigenetics to address etiology, distribution, and control of disease within the population. Basic epidemiological topics will be taught in the course. Topics including gene identification and risk estimation for disease will be emphasized through the lens of epidemiological studies. Spring Semester.

BL 7370. Special Topics in Genomics. 3 Semester Hours.
Course topics will delve into current topics in genomics to include, but not limited to nutrigenomics, sport genomics, metabolomics, proteomics, microbiomics, etc. Topics will be rotated each semester and students can repeat the course one time for a total of 6 credits. Summer Semester.