MEDICAL DIAGNOSTIC AND TRANSLATIONAL SCIENCES Courses

**MDTS 400/500. Principles of Molecular Pathology and Clinical Diagnostics. 3 Credits.**
Basic concepts of molecular pathology & clinical diagnostics including nucleic acids, DNA replication, transcription, proteins, mutations and chromosome changes that underlie inherited and acquired/infectious disease, inheritance patterns and genetics as applied to oncology, cardiac disease and organ transplants. Covers emerging molecular/cytologic/histologic methods (amplification, hybridization and microarrays) to detect disease markers, monitor therapy and assess identity; pharmacogenomics and legal/ethical issues of genetic testing. Prerequisites: BIOL 240 or BIOL 250, BIOL 241 or BIOL 251; CHEM 211. CHEM 212 and permission of instructor.

**MDTS 401/501. Molecular Diagnostics Laboratory, 3 Credits.**
Course includes hands-on experience with or discussion of diagnostics instrumentation and assays using nucleic acid and protein extraction, gel electrophoresis, hybridization techniques, standard and real time polymerase chain reaction PCR), reverse transcription, DNA sequencing, autoradiography, flow cytometry, microarrays and proteomics-based methods. Pre- or corequisite: MLRS 400 or permission of the instructor.

**MDTS 500. Principles of Molecular Pathology and Clinical Diagnostics. 3 Credits.**
Basic concepts of molecular pathology and clinical diagnostics including nucleic acids, DNA replication, transcription, proteins, mutations and chromosome changes that underlie inherited and acquired/infectious disease, inheritance patterns and genetics as applied to oncology, cardiac disease and organ transplants. Covers emerging molecular/cytologic/histologic methods (amplification, hybridization and microarrays) to detect disease markers, monitor therapy and assess identity; pharmacogenomics and legal/ethical issues of genetic testing. Prerequisites: permission of instructor.

**MDTS 501. Molecular Diagnostics Laboratory, 3 Credits.**
Course includes hands-on experience with or discussion of diagnostics instrumentation and assays using nucleic acid and protein extraction, gel electrophoresis, hybridization techniques, standard and real time polymerase chain reaction PCR), reverse transcription, DNA sequencing, autoradiography, flow cytometry, microarrays and proteomics-based methods. Pre- or corequisite: MDTS 500 or permission of instructor.

**MDTS 600. Advanced Clinical Applications of Molecular Diagnostics. 3 Credits.**
Course will cover 1) new applications of standard molecular diagnostic techniques and 2) cutting edge technologies, instrumentation and technical advances, both as applied to clinical case studies. Emphasis will be on pharmacogenomics and disease processes including inherited conditions, cancer, hematopathology, infectious diseases, mental retardation and developmental delay. Innovative technologies covered include comparative genomic hybridization, pyrosequencing and bead based assays Prerequisites: MLRS 500, MLRS 501 or permission of instructor.

**MDTS 601. Advanced Molecular Diagnostics Laboratory. 3 Credits.**
Emphasis of this course will be on primer design for PCR, advanced real time PCR, cycle sequencing, capillary electrophoresis (CE) as applied to DNA sequencing, analysis of SNPs (single nucleotide polymorphisms), microsatellite instability, microarray technology and detection of methicillin-resistant bacteria. Prerequisites: MDTS 500. MDTS 501 or permission of instructor. Pre- or corequisites: MDTS 600.

**MDTS 668. Clinical Laboratory Internship. 3 Credits.**
An optional three-week supervised rotation in a hospital-based molecular diagnostic laboratory or a molecular research laboratory. Prerequisites: MDTS 500, MDTS 501, MDTS 600, and MDTS 601 or permission of instructor.

**MDTS 714. Molecular Diagnostics Laboratory. 2,3 Credits.**
Laboratory rotation with a pre-designated faculty member in which the student obtains hands-on experience. Designed for graduate students to sample different types of research models, techniques, and subject matter without the commitment of dissertation level involvement. Prerequisites: Graduate Program Director approval required.

**MDTS 750. Molecular Genetics, Gene Function and Genomics. 3 Credits.**
The goals of this course are a comprehensive understanding of the mechanisms involved in molecular genetics and gene function and in-depth exploration of modern experimental analyses of these processes. Topics include DNA replication, repair, and recombination; transcription; epigenetic regulation of transcription; chromatin structure, histone modifications, transcription factors, and regulatory RNAs; long-range chromatin interactions and gene regulation; post-transcriptional gene regulation and translation; molecular biology based experimental analysis of gene function; and experimental genomic approaches to gene regulation and gene function. Prerequisites: MDTS 600 and MDTS 601 or instructor approval.

**MDTS 805. Fundamentals of Cancer Biology. 3 Credits.**
Course will cover molecular aspects of cancer including DNA damage, tumor viruses, cell cycle regulation, oncogenes and tumor suppressor genes and their respective roles in cancer prevention/development, genes involved in promoting or inhibiting metastasis, angiogenesis, telomeres and telomerase, regulation of both apoptosis and autophagy in normal and cancer cells, cancer stem cells, and diagnostic screening assays for therapeutic responses or resistance in cancer patients. Prerequisites: MDTS 600 and MDTS 601 or equivalents; instructor approval also required.

**MDTS 810. Molecular Basis of Health and Disease. 3 Credits.**
Emphasis is on human genetic syndromes and disorders associated with dysregulation of key signal transduction pathways that control gene expression, cell growth and protein synthesis including the Ras/MAPK pathway, tuberous sclerosis-complex-mammalian target of rapamycin, PI3-kinase and others. Diagnosis, screening and treatment will be covered. Prerequisites: MDTS 600 and MDTS 601.

**MDTS 814. Molecular Laboratory Rotation. 2,3 Credits.**
Laboratory rotation with a pre-designated faculty member in which the student obtains hands-on experience. Designed for graduate students to sample different types of research models, techniques, and subject matter without the commitment of dissertation level involvement. Prerequisites: Graduate Program Director approval required.

**MDTS 850. Molecular Genetics, Gene Function and Genomics. 3 Credits.**
The goals of this course are a comprehensive understanding of the mechanisms involved in molecular genetics and gene function and in-depth exploration of modern experimental analyses of these processes. Topics include DNA replication, repair, and recombination; transcription; epigenetic regulation of transcription; chromatin structure, histone modifications, transcription factors, and regulatory RNAs; long-range chromatin interactions and gene regulation; post-transcriptional gene regulation and translation; molecular biology based experimental analysis of gene function; and experimental genomic approaches to gene regulation and gene function.

**MDTS 895. Topics in Molecular Medicine. 1 Credit.**
Student led presentations of current topics related to molecular medicine. Prerequisites: Instructor approval required.

**MDTS 898. Molecular Biology Research. 3-6 Credits.**
Supervised doctoral research in molecular diagnostcs or biomedical studies. Prerequisites: MLRS 600 or MDTS 600 and MLRS 601 or MDTS 601; instructor approval required.