REGENERATIVE SCIENCES (REGS)

REGS 5200 Fundamentals of Regenerative Sciences (2 Credits)
S. Wyles, R. Hayden, A. Terzic (Winter) – week course (approx. 6-8 hrs. per day) with no pre-requisites for enrolled PhD students, but employees and GREP/PREP/Postbac students must obtain permission to enroll from Dr. Wyles or Dr. Scarisbrick. Medical and graduate students are introduced to the fundamental principles, tools, and platforms of regenerative medicine. PhD students taking the course for credit must participate in all sessions and discussion. Learners will also be required to complete introductory online modules, Good Clinical Practice FDA CITI certification and multiple-choice written exam (70% pass rate with 2 attempts).
Grading: Standard Letter

REGS 5210 Advanced Regenerative Medicine and Surgery (2 Credits)
S. Wyles, R. Hayden, A. Terzic (Spring) – 1 week course (approx. 6-8 hrs. per day) with a prerequisite of REGS 5200 for enrolled PhD students, but employees and GREP/PREP/Postbac students must obtain permission to enroll from Dr. Wyles or Dr. Scarisbrick. Medical and graduate students are introduced to regenerative strategies in clinical and biomedical training. PhD students taking the course for credit must participate in all sessions and discussion. Learners will be required to complete a small interdisciplinary group assignment, simulated patient encounter assignment and organ system-based clinical trial critical review for REGS: Advanced Regenerative Medicine and Surgery.
Prerequisites: REGS 5200
Grading: Standard Letter

REGS 5300 Stem Cells & Development (3 Credits)
N. Kannan (Fall) – This course will introduce stem cell and developmental biology in the context of regenerative sciences. Emphasis is placed on the fundamental concepts that govern development, regeneration and their application to study and treat disease. Topics covered include embryogenesis, organogenesis, pluripotency, differentiation, maturation, transdifferentiation, along with stem cell technologies and tissue engineering.
Grading: Standard Letter

REGS 5500 Topics in Regenerative Sciences and Medicine (1 Credit)
Q. Peterson (Fall, Winter, Spring)– Interdisciplinary course required for RSTP Postbac and PhD students; suitable also for all PhD students and others interested in regenerative science and medicine. Class meets regularly during the Fall/Winter/Spring Quarters. Journal club presentations of recent advances in regenerative sciences, research from one Mayo Clinic lab, and guest speakers on a variety of topics (including but not limited to quality control, quality assurance, regenerative regulatory science, manufacturing, and entrepreneurship). All meetings feature extensive discussion.
Grading: Sat / Unsat

REGS 5800 Developmental Biology (2 Credits)
M. Fernandez-Zapico, J. Doles (Spring) – Tutorials will be arranged on individual basis in selected advanced topics in developmental biology including cellular process of developing organisms, genetic analysis of development, early development: molecular basis of embryo polarity, maternal effect, patterning mechanisms and signal transduction cascades, molecular mechanisms of organogenesis: derivatives of the primary germ layers, molecular model of differential gene expression (e.g., Homeobox model), sex development pathways, teratogenesis and regeneration and aging. Students will determine a study topic with a member of the faculty. Knowledge of the topic will be assessed by oral presentation of the material at the end of the course. (Replaced BMB 5400 Independent Study of Developmental Biology)
Grading: Standard Letter

REGS 6300 Experimental Methods in Regenerative Sciences (1 Credit)
R. Huebert, B. Druliner, H. Guerrero Cazares (Odd: Fall) – This course is designed to teach state-of-the-art basic science technologies that can be applied to regenerative medicine through a series of interactive lectures and lab demonstrations. The focus of the course will be to provide exposure to the breadth and depth of techniques used in regenerative medicine research at Mayo Clinic and nationally. Emphasis will be on application to human disease including development of regenerative diagnostics and therapeutics. Topics will include cell-based therapies, 3D culture/organoids, iPS cells, organ regeneration, and recellularization technology, among others. The course will include a series of 10 lectures and 2 laboratory demo experiences lead by experts in the topics. Lectures will cover current knowledge and approaches across a wide span of regenerative technologies from multiple investigators. To facilitate participation from students at all three sites, the course will include the use of recorded and live-streamed content. Please come to class prepared to take notes and ask questions so that you are prepared to take the weekly quizzes. Students should expect between 1 – 3 hours of work outside of class. A final writing assignment will be due at the end of the course.
Grading: Standard Letter

REGS 6400 Regenerative Tissue Engineering Principles (RTEP) (4 Credits)
L. Griffiths (Fall, Winter) – The regenerative tissue engineering principles course employs a strongly student-centric teaching approach to assist learners to develop their understanding of tissue engineering principles, components and approaches; and apply this knowledge to solve unmet clinical needs. The course employs consists of ~50% student centered (e.g., problem based learning) teaching, allowing time for students to work with and master the course material. No prerequisites.
Grading: Standard Letter

REGS 6500 Introduction to Translational BioProduct Development (2 Credits)
D. Lott (Fall) – This course will cover the fundamentals and concepts needed to understand the development process of complex regenerative bioproducts. Activities will consist of lectures, interactive group discussions, and a pitch presentation. This course is focused on translational capabilities. Students will partner with a Mayo Clinic clinician of their choosing to understand their clinical bioproduct needs. No specific course prerequisites exist.
Grading: Standard Letter

REGS 6700 Genomic and Epigenomic Data Integration (2 Credits)
A. Gaspar Maia (Summer) – This course will provide in-depth exposure to the most important sequencing techniques currently used for analysis of the transcriptomic, epigenomic, and genomic landscape, allowing students to better interpret results in current Regenerative Sciences literature and to venture into utilizing these techniques in their own projects. Focusing on the details of sample preparation (wet lab) and data analysis (dry lab), the course will cover Expression (RNA-seq), Epigenome 1 (ATAC-seq), Epigenome 2 (ChIPseq/CUT&RUN, CUT&TAG), Epigenome 3 (DNA methylation), and single cell analysis (scATAC and scRNA-seq) methodologies. The course will also cover different ways to present the data, since data visualization plays a critical role in genomic analysis. After completing the course, students will be able to identify data sets from each modality, critically evaluate the advantages and disadvantages of each sequencing technique, understand the experimental procedures associated with the preparation for each technique, and run at least one web-based platform for each sequencing modality. In the first quarter, students attend one consecutive week of daily, 2-hour (120 minute) classes for didactic instruction. In quarters two to four, students meet every other week for 1-hour, interactive workshops, during which they discuss and debate the use of the different modalities in scientific literature and perform analysis using their own datasets.
Grading: Sat / Unsat

REGS 6820 Principles to Practice (2 Credits)
S. Wyles, W. Qu (Winter) – This course is designed to introduce students to principles of stem cell biology and provide an appreciation for applications in regenerative medicine and surgery. Presenters will stress fundamental principles. Particular emphasis is placed on state-of-the-art derivation of stem cell population lineages, analysis of respective genomic, proteomic, and metabolomic traits, and applications in therapy in diagnosis. The course will follow a discovery-translation-application curriculum. By course end, students should become proficient in the comprehension of fundamental concepts underlying stem cell platforms as well as obtain insight in new therapeutic/diagnostic opportunities. Proficiency in fundamental cell biology, genomics, and pharmacology is highly recommended. This is a shared course with the Clinical and Translational Sciences track
Grading: Standard Letter