REGENERATIVE SCIENCES (REGS)

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) – Cancelled for Fall 2025. Next offering will be Fall 2026. 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)
D.Brownfield, S. P De Lange (993: 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. Student journal club and works in progress presentations of recent advances in regenerative sciences. All meetings feature extensive discussion and engagement.
Grading: Sat / Unsat

REGS 5800 Developmental Biology (2 Credits)
M. Fernandez-Zapico, (Spring) – This course will provide an overview of 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 term layers, molecular model of differential gene expression (e.g., Homeobox model), sex development pathways, stem cell biology, teratogenesis and regeneration and aging. Knowledge of the topic will be assessed by written exam at the end of the course.
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.
Prerequisites: CORE 6150, or MGS 5030 may be taken concurrently
Grading: Standard Letter

REGS 6500 Introduction to Translational BioProduct Development (2 Credits)
D. Lott (Even; 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 (993: Summer, Fall, Winter, Spring) – 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.
Prerequisites: (MGS 5030, or CORE 6150)
Grading: Sat / Unsat, Test-Out/Waivers

REGS 6801 Tutorial in Regenerative Metabolism (2 Credits)
Q. Peterson (Summer) - This course is designed to be a small group discussion (1-3 students) with a faculty member around a series of specific topics. Review of contemporary topics in Metabolism including Aerobic and anaerobic metabolism, metabolic diseases, metabolism in development, and Techniques in metabolic research. Prior approval from Course Director. Enrollment is limited to 3 students.
Grading: Standard Letter

REGS 6820 Principles to Practice (2 Credits)
W. Qu, Q. Peterson (Winter) – This course is designed to introduce students to principles of gene and stem cell biology and provide an appreciation for applications in regenerative medicine and surgery. Presenters will stress fundamental principles. Applied topics will include lectures on core principles of regenerative biotherapeutics with examples of stem cell and extracellular vesicle use in cell replacement therapy, diagnostics, toxicology or as vehicle for gene therapy, prospects for clinical therapy, stem cell banking, tissue engineering, ethical and regulatory affairs, intellectual property rights and patenting issues.
The course will follow a discovery-translation-application curriculum. Attendance and participation in each class is expected. By course end, students should become proficient in the comprehension of fundamental concepts underlying biotherapeutics platforms as well as obtain insight in new therapeutic/diagnostic opportunities.
Grading: Standard Letter, Test-Out/Waivers