

SCRB 162 - Experimental Regenerative Biology

In this laboratory class, students will have the opportunity to directly conduct experiments with a wide variety of modern regenerative models including planarian worm, zebrafish, salamander, frog, and mouse. Through experimentation, key concepts and modes of regeneration will be illustrated, for example, stem cell-mediated tissue regeneration and whole organ regeneration. Some of the techniques that will be taught include surgical procedures, tissue transplantation, cell culture, gene delivery by electroporation, and drug treatment.

Another important goal of the class is to help develop skills on critical reading of literature and designing experiments. Students will have the opportunity to independently design and conduct experiment in the last module and present results to the class.

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Lectures/Labs: Mondays
2:00-6:00 p.m.
NW B-133
Each class starts with a 30' lecture, followed by student presentation of relevant articles (chalk talk, 10-15' each). The rest of the time will be laboratory work. Students are expected to actively participate in the experiments, data analysis, and discussions.

Course Grading:	Participation	40%
	Lab Notebook	20%
	Paper Presentation	10%
	Final Project	30%

Prerequisites: Life and Physical Sciences A or Life Sciences 1a; Life Sciences 1b; SCRB 10 or MCB 54 or permission of the instructor.

Module #1: Planarian regeneration

- 1 1/23 Planarian head regeneration
We will observe rapid regeneration of planarian worms from small pieces of tissues. We will also use a chemical to induce formation of two-headed worms.

Module #2: Zebrafish regeneration

- 2 1/30 Fin regeneration
We will cut the tail fin of larval fish, treat the larvae with several compounds that affect tissue regeneration, and observe and quantify fin regenerates.

Module #3: Axolotl regeneration

- 3 2/6 Limb regeneration, IACUC training
We will cut the limbs of Axolotl and record their full regeneration over the course of one month.
- 4 2/13 Blastema transplantation
We will transplant limb blastema from GFP positive animals to GFP negative animal.
- 2/20 **Holiday – President’s Day**
- 5 2/27 Gene transfer into blastema by electroporation
We will use electroporation to express genes in the limb blastema that will influence their regeneration.

Module #4: Mammalian regeneration

- 6 3/6 Mouse skin stem cell culture
We will culture skin keratinocyte stem cells and fibroblasts.
- 3/13 – 3/19 Spring Break** (The notebook and questions will be collected for grading after spring break)
- 7 3/20 Skin/hair transplantation in nude mice
We will transplant the cultured skin cells into nude animals for skin/hair regeneration.

8 3/27 3-D culture of intestinal stem cells
We will culture primary intestinal stem cells from mouse in 3-D matrigel and observe their growth and morphogenesis into crypt-villi structures.

Module #5: Frog regeneration

9 4/3 Transplantation frog eye primordia
We will transplant the eye primordia, the cellular precursor of the eye, to different parts of the body of tadpoles and observe/analyze ectopic eye formation.

Module #6: Designing your own experiments

You will write an experimental design (1-2 page), carry out the experiment independently or in collaboration with other students, with the help of the instructor and TAs, and write a report. A presentation of the experimental design and results, if available, will be given in the final class.

10 4/10 Experiment
11 4/17 Experiment
12 4/24 Experiment and presentation

End of term dates:

April 26: last day of class

April 27 – May 3 Reading Period

May 4-13 Exam Period (lab notebook and final report due)