

Bild 51 - Q-bio Research Project Lab (QPL)

Syllabus Winter 2016

Course synopsis: This lab course covers two important aspects: interdisciplinary and research based education, teaching fundamental experimental and computational skills in quantitative studies of living systems.

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Important: Always include “QPL or BILD51” in the subject line to your emails.

Lab IA: Danielle Hagstrom; EMAIL: dhagstrom@ucsd.edu

Textbook: There is no text book. All instruction materials will be provided or are freely accessible online.

Course hours: 8 hours lab + 1 hour lecture + 3 hours work outside class for data analysis, reading, and writing. Total hours: 12/week. Class hours: Tuesdays 12:30-5:30pm and Thursdays 1:30-5:30pm

Office hours: email either Danielle or myself to set up an appointment

Credit: 4 units (120 hours)

Philosophy: This course is distinctively different from a standard lab course in the sense that you will execute “real” experiments which will lead to novel results in current research. This course will allow you, in an intensive, realistic research setting, to learn how to design and execute experiments, write code in MATLAB for image analysis and data analysis, and present it in oral and written form. Since you will work on projects related to the research of the teaching faculty member, this may also create longer-term research opportunities.

IMPORTANT: This course is an experiment in itself and will grow with you, the students. What this means is that the exact details of the experiments and how far we get will depend on how far *you* are willing to push yourself. There is no fixed script or protocol. Things will not always go smoothly.

You will face roadblocks and learn how to overcome them (or take a different direction if you cannot). You will design and execute experiments just to find out that this was not the right experiment to answer a particular question. And then you will start over again with the “right” kind of experiment.

You will likely have to start over and repeat things several times. Doing research means also learning how to deal with frustration and being able to pick oneself up again after a failed experience. We will not save you from these experiences, because you will learn so much by

having them. The idea of this course is to mimic a realistic research setting, and that means roadblocks, failures and hopefully some successes, too.

My commitment to you, the students, is that I will help you find your way, listen to your ideas and provide feedback, make sure you stay safe and that you will enjoy yourself and learn a lot. My expectations to you, the students, is that you are open to such an unstructured course, willing to explore, learn new things, work hard, and enrich each other's experiences.

To foster a spirit of collaborative research, you will work in pairs and at least 2 pairs will work on the same experiment to enhance research progress and thus student experiences. Each week of laboratory work will be accompanied by a 1 hour lecture, taking place on Tuesdays in the lab. **Lecture is mandatory.** It allows review of broader concepts related to the research projects and discuss general road-blocks and tricks and tips. This discussion will be more of an interactive, peer-education style instead of a classic front-lecture style.

Research topics winter 2016: Students can choose to work on one of the following research topics after an introduction in week 1.

- Nociception, risk assessment and escape behavior in planarians
- Do more eyes mean more effective phototaxis for planarians?
- The role of neuroligins for brain regeneration in planarians
- Effect of inhibition of soluble epoxide hydrolase (sEH) on neuronal regeneration

Experimental system: The free-living freshwater planarians of the species *Dugesia japonica*.

Lab Notebooks: You are required to keep a lab notebook of your data, observations, etc. from your experiments in this course which will count **20% toward your grade**. I cannot over-emphasize the importance of good lab notebook keeping. Any finding you make will be worthless if it was not properly documented in your notebook. A general guiding principle in writing your lab notebook entries should be the ability for a peer to verify your results. **Danielle and I will both check your lab notebooks on a regular basis in class. Of note, the lab notebooks cannot come home with you but need to remain in the lab at all times.**

National brand Laboratory or Computation Notebooks can be purchased from pretty much any bookstore or online. **We expect everyone to have a lab notebook by the second week of lab at the latest. If you do not have a notebook by then, there will be a grade penalty of 5%.**

A nice description of guidelines for keeping a lab notebook can be found here:

<http://www.ruf.rice.edu/~bioslabs/tools/notebook/notebook.html>

We also posted another document on TritonEd. Read both! The lab notebook is a 5th of your final grade!

Evaluation/Grading:

Lab notebook - 20%
3 Team reports - 15%
2 Independent research papers – 40%
Final oral presentation – 25%

Reports and papers are graded using a point system where 20 points is the maximum.

There is no curve. A minimum of 85% is required to obtain an A.

Letter Grade	% Required
A	≥ 85
B	72-85
C	60-72
D	50-60
F	< 50

Plus and minus grades will be given at the instructor's discretion.

Team reports: You will write 4 team reports during the quarter of which 3 will be graded. The goal of these reports is for you to get feedback from the instructors on where things are, what should be changed, and writing practice for the independent research papers. You will hand in 1 report per group.

The first report will be all about experimental design. We want to ensure that you know exactly what kinds of experiments you will be carrying out in the weeks to come. This is best done by writing things up in detail. You will have two shots at this; at the end of the first week, you will hand in a first ungraded draft. We will comment on this to help guide you for the graded version at the end of week 2. From experience, try to make your first draft as polished as possible already; else, you may get surprised when you hand in the second version and find that your grade is not as good as you hoped for. It is difficult to give detailed feedback on immature write-ups.

The second and third write-ups are more like milestones – we will use them again to give you feedback in preparation of your independent work, which will count substantially more toward your grade. You will be allowed to reuse material from your team reports for your independent papers – you cannot “copy&paste” text, however. While you can reutilize ideas from your reports, make sure you reformulate those ideas. Also, the format of the reports and the research papers will be quite different, thus hopefully ensuring that the latter will not read too similar to the reports.

Independent research papers:

You are required to hand in **two independent research papers** about your work. (8 pages max,

not counting the appendix). Even though you will be working in groups, everyone will be expected to hand in a separate research paper. You can discuss with your lab partner and other people in the lab who worked on the same research question as much as you want *before* you start writing. Please include your partner's name or anybody else you strongly collaborated with on your paper. **The report must be your own work and you need to sign it with your name and a statement that this is your independent work.**

Research Paper Criteria: We basically ask you to write a scientific paper. We strongly advise looking at published work in journals such as PNAS for writing guidelines and style. We will post some writing tips on TritonEd. This may also be useful:

<http://www.ruf.rice.edu/~bioslabs/tools/report/reportform.html>

Each paper should include an abstract and a short introduction that gives an overview of the initial goals and set your experiments into the context of the field. Procedures should be stated in detail in the materials and methods section unless you can reference published papers which used the exact same procedures.

Results should be supported by relevant data, calculations & plots. Remember that plots need to be properly labeled and sized for the reader to make sense of it. MATLAB scripts should be included in a separate appendix (the appendix doesn't count toward the total number of pages). A discussion of how your results support or refute your initial goals should also be included. The discussion must include 1-2 sentences about possible sources of experimental errors and a calculation of the error where applicable. Figures or ideas/results that are not your own work must be properly cited.

Papers can be written in Word, Open Office, or LaTeX – whatever you feel most comfortable with. I will post resources for writing in LATEX on TritonEd for those who want to give it a shot. It is not obligatory.

The research paper should generally be structured as follows:

0. Abstract
1. Introduction
2. Materials and Methods
3. Results
4. Discussion (including discussion of results and errors)
5. Conclusion
6. References (if any; most papers will have references)
7. Appendix (if any)

You are welcome to combine the Results and Discussion sections as this is often easier to write. Then you can discuss your results as you present them. You are also welcome to reuse materials from your team reports as long as you properly cite them as such.

How to deal with references:

If you are writing in Microsoft Word or Open Office, then we recommend using freeware to handle your references called **Mendeley**. Mendeley is also a useful tool to share PDFs of the relevant papers for your project with members of your group.

If you are writing in LaTeX, check out **JabRef**. This is what I usually use; Mendeley may also be able to handle Bibtex files, I have not tried that.

1 – The first team reports (submitted by one team member for the team) must be emailed to the PI and the IA no later than Sunday, January 10, NOON, so we can provide you with feedback in Tuesday's lab session.

2- All other team reports and the two independent research papers must be handed in as hard-copy AT THE BEGINNING OF LECTURE on Tuesdays.

Late hand-in penalties: If a report is submitted > 1hr late, 5 points will be deducted for each day late. Thus, if you hand in your report on the due date, but 3.5 h late, we will deduct 5 points (out of 20 possible!). The penalty is high so that you won't get tempted to hand it in late; we want you to learn how to distribute your work well and be able to meet deadlines.

Preliminary syllabus for winter quarter 2016

Week 1: Introduction to the research topic via lecture and discussion. Group brainstorming, formulation of hypotheses, experimental design. Introduction to the experimental system and basic techniques, lab notebooks. Introduction to image and data analysis in MATLAB and to ImageJ, basic statistics and data fitting. Use of MATLAB to analyze provided example data. Learn how to maintain the animals. Discussion of write-ups for team reports and research papers. **Write team experimental plan at end of week 1 (not graded). Submit by January 10, NOON, via email to both PI and IA.**

Week 2: Discuss submitted experimental plans with faculty and IA. Adjust as necessary. Continue design of experiments and necessary controls. Feed and clean worms. Continue introduction to MATLAB and data analysis. Get familiar with the worms and start collecting data on worm behavior. **Write a revised team experimental plan at the end of week 2 (graded).**

Week 3: Hand in revised experimental plan on Tuesday by 12:30PM in class. Start with the experiments. Work on image analysis, gather and analyze data.

Week 4: Discuss potential difficulties with the faculty member and IA. Continue with experiments. Optimize image analysis, gather and analyze data. **Write the first team progress report at the end of the week (graded).**

Week 5: Hand in team progress report on Tuesday by 12:30PM in class. Continue with experiments and data analysis. Start thinking about what you need for your independent research paper.

Week 6: Discuss potential difficulties with the faculty member and IA. Continue with experiments. Write-up first independent research paper. **Write independent research paper #1.**

Week 7: Hand in independent research paper #1 on Tuesday by 12:30PM in class. Repeat experiments as necessary. Design additional experiments based on data obtained so far. Write up a protocol for that.

Week 8: Run the new experiments developed in week 7. **Write a team progress report at the end of the week (graded).**

Week 9: Hand in team progress report on Tuesday by 12:30PM in class. Continue with experiments. Finish data analysis, **write-up 2nd independent research paper.**

Week 10: Hand in 2nd independent research paper in lab on Tuesday of week 10. Discussion of experiences in lab, brainstorming on improvements for future classes. Use remainder of Tuesday lab to prepare oral presentation, which will take place during lab on Thursday.