



LB-347 Fall 2012 3 credits
ADVANCES IN APPLIED BIOLOGY
 An Apprenticeship in MSU's CF Research Laboratory

Overview

This course is designed to immerse you in the literature, techniques and critical thinking of a research laboratory. The course will include discussions, debates, oral reports, group projects and reviews of current research literature. The purposes of this class are to enhance your understanding of science and scientific research and delve deeply into a particular research field (cystic fibrosis, CF). You will work individually as well as in research groups that read original and current scientific findings in CF, acquire laboratory skills and design and apply research strategies to answer biological questions.

Learning objectives:

These are our core learning objectives for this course:

1. **THE NATURE OF SCIENCE:** Regardless of your backgrounds, you will end the course with a more sophisticated understanding of the nature of science today.
2. **SCIENTIFIC PROCESS:** You will explore the scientific process, and particularly the “Scientific Method” and acquire various skills in cell and molecular biology.
3. **THE LANGUAGE OF SCIENCE:** You will analyze the language used to communicate science, and how language reflects particular views and goals.
4. **CAUSALITY:** You will examine cause-effect claims in science and compare them to your own cause-effect claims about your research findings.

General Course info:

Instructors

Douglas Luckie, Lyman Briggs School and Physiology (luckie@msu.edu)
 Holmes Hall office: 353-4606, Biomedical Sciences (BPS) lab: 884-5011
 Vincent Cracolici, CHM Graduate Teaching Assistant (cracoli1@msu.edu)

Meeting times:

Journal Club Meeting: Wednesdays 3:00-4:15pm, Room 2235 BPS
 Laboratory Meeting: W/F 4:30-7:30pm & 1:00-4:00pm, Room 2100 BPS

Website: <http://www.msu.edu/course/lb/347/>

Prerequisites: LB145 or equivalent

Office hours: Tu/Th 2:40-3:40pm, W29 Holmes Hall

Text: There is no textbook, yet there will assigned readings from various sources.

What will students do?

1. **INDIVIDUAL WORK:** You will read papers, be quizzed on readings, write essays, keep a lab notebook, pass lab practicals and present your findings to the class. You will participate in discussions, debates and lab meetings. You will learn molecular physiology lab techniques such as: sterile cell culture, ion flux and microphysiometry. Readings from various sources will serve to frame and familiarize you with the body of cystic fibrosis research literature. Your “thesis” project will be to perform original research and ultimately create a final research presentation (poster and seminar) concerning the findings of your group’s independent research project.

2. **GROUP WORK:** You will join a research group that focuses on questions from the CF literature and develops/designs independent research experiments to test your hypotheses. Your research projects will dominate most of the second half of the term. Groups will present their finished research in the form of a poster and oral presentation to the class at the end of the semester. Each group will also submit and present their original research poster at the 2013 University Undergraduate Research and Arts Forum (<http://urca.msu.edu/uuraf/> submit by late February, event in April 2013).

Group Roles:

While each group member will be expected to learn and participate in all “roles”, you will have one as your *primary* job/expertise:

1. **Cell Culture Laboratory Technician:** Your primary responsibility is the master the maintenance of the cell lines tested.
2. **Cytosensor Laboratory Technician:** Your primary responsibility is master the performance of microphysiometry assays.
3. **Ion Flux Laboratory Technician:** Your primary responsibility is master the performance of iodide ion flux assays.

Course assignments:

- **One oral presentation** - Lead a discussion concerning a research paper.
- **Two notebook checks** -Maintain a lab notebook like a professional researcher.
- **One laboratory practical/interview** -Demonstrate your mastery of topics & skills.
- **Group research proposal, poster and presentation** -In class and at the UURAF¹.
- **Quizzes on readings/labs** -There will be 5 quizzes on assigned readings and labs.
- **Peer Review of research proposal** -Critique another groups’ research plan.

Components of final grade: (total is 105%)

Group Research Project (proposal/poster/presentation)= 25%; Lab Notebook checks= 10%, Lab Practical/Interview= 10%, Leading Discussion= 10%, Quizzes=25%, Publication worksheet= 5%, Peer Review=5% Attendance and Participation= 15%.

Honors option: Submit final thesis manuscript and give oral presentation at UURAF.

¹ *University Undergraduate Research and Arts Forum (UURAF)*

Schedule

- **Week 1: Introduction to the MSUCF**

Journal Club Activities: Intro to CF, the MSU CF lab, and its techniques.

Reading assignment [for next class]: Rowe et al *NEJM Cystic Fibrosis paper*

Lab This Week: ORCBS & 2100 Biomedical and Physical Sciences

- **Week 2: CF, Paul Quinton and Michael Welsh**

Journal Club Activities: Quiz & Shotgun Discussion: Discuss CF articles

Reading assignment: “*At The Bench*” and *cell culture readings*

Lab This Week: Lab 1 (Pipetting and Metric System)

- **Week 3: Green thumbs and Sterile Cell Culture**

Journal Club Activities: Quiz & Review of cell culture techniques and discuss cytosensor.

Reading assignment: *Cell- Jeffrey Smith (antimicrobials)*

Lab This Week: **Introduction to Sterile Cell Culture (TC: start cells)**

- **Week 4: CF and the Sterile Lung**

Journal Club Activities: Quiz & Shotgun Discussion: Discuss Smith paper
(**Notebook check due at start of class**)

Reading assignment: *Cell assay readings and cytosensor Science article*

Lab This Week: Lab Rotation A: **Flux/Microphys (TC: passage cells)**

- **Week 5: Cell Culture and Analysis**

Journal Club Activities: Quiz & Review of cell assays and discuss cytosensor.

Reading assignment: *Nature Choi et al and Muallem paper(s)*

Lab This Week: Lab Rotation B: **Microphys/Flux (TC: passage/seed cells)**

- **Week 6: CF and the HCO₃⁻ Revolution**

Journal Club Activities: Quiz & Shotgun Discussion -Choi et al papers

Reading assignment: *Paul Quinton and Jeff Wine reviews of Choi et al.*

Lab This Week: BPV control experiments A: **Microphys/Flux (TC)**

- **Week 7: Research Arguments and Outlines**

Journal Club Activities: Debate: Muallem Articles -is CF about HCO₃⁻?

Reading assignment: *McConnell & Luckie papers on microphysiometry.*

Lab This Week:. BPV control experiments B: **Flux/Microphys (TC)**
(four-page written outline due and you will present your plan to the class)

- **Week 8: Research Designs**

Journal Club Activities: Discuss Cyto. papers and designing your research project

Reading assignment: *Find papers of pH and CF*

(**Notebook check due at start of class**)

Lab This Week: Appointments to discuss experimental plans (DL@CFF 10/16-10/21)

• **Week 9: What's Your Point?**

Journal Club Activities: Discuss papers and designing your research project

Lab This Week: **Independent research**

Reading assignment: *Find papers of pH and CF related to your research*

• **Week 10: Critiques on your projects.**

Journal Club Activities: Peer Review: Assessing your research project (**Proposals due**)

Lab This Week: **Independent research**

Reading assignment: *Find papers of pH and CF related to your research*

• **Week 11: Lab Meeting**

Journal Club Activities: Lab Meeting (show and tell your plans/papers)

Reading assignment: *Find papers of pH and CF related to your research*

Lab This Week: **Independent research**

• **Week 12: Thesis Projects**

Journal Club Activities: Lab Meeting (show and tell your data/papers)

Reading assignment: *Find papers of pH and CF related to your research*

Lab This Week: **Independent research**

• **Week 13: Break**

Journal Club Activities: **Thanksgiving Recess**

Lab This Week: **Thanksgiving Recess**

• **Week 14: Posters and Seminars**

Journal Club Activities: How to do Posters and Presentations

Lab This Week: **Independent research**

• **Week 15: Push and Panic**

Journal Club Activities: Lab Meeting (show and tell your data)

Lab This Week: **Independent research**

(**Notebook check due at start of class**)

• **Finals Week: *Final Presentations*** (during final exam period; Tues, Dec. 11, 3:00-5:00 p.m.)