to 20.109!

Laboratory Fundamentals of Biological Engineering

9/8/22

Insight from previous 109ers

Words of wisdom…

Lesson learned: Label Your Tubes

BE Communications Lab is a great resource!

Don't be afraid to ask your professors and TA's questions:

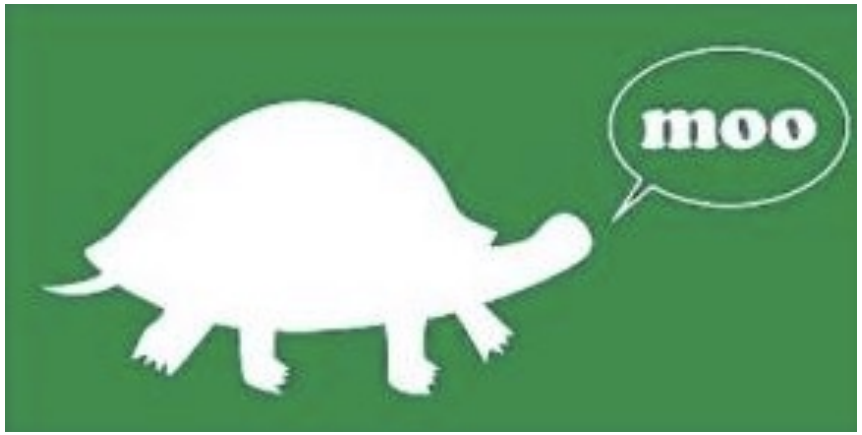
Failure is Beautiful Too

GO TO OFFICE HOURS! You will get useful tips and comments for your presentation.

Best Preparation for Graduate School EVER

Brief introduction to 20.109

- Core mission
  - Building a better bioengineer
- Meet the Fa22 team
- Experimental overviews
  - Module 1: Genomic instability
  - Module 2: Drug discovery
  - Module 3: Research design
- Logistics



Our core mission is building bioengineers

- To prepare students to **be the future** of Biological Engineering
- To teach **cutting edge research skill** and technology through an **authentic research experience**
- To inspire **rigorous data analysis** and its **thoughtful communication**

Scientists should tell more stories

"Story is the number one way we learn from past experiences, to be better people, and share in experiences. Yet as scientists we feel the need to separate ourselves from this proven method of communication…

…encourage the use of narrative in science, but with caution. I would argue that narrative is imperative for science communication. Data already incorporates a narrative; we just need to find ways to bring it to light."

EcoPress is a website highlighting the science and scientists of the Natural Resource Ecology Laboratory at Colorado State University

http://nrelscience.org/2013/09/26/why-scientists-should-tell-more-stories/

Meet the 20.109 Fa22 teaching team

- Lecture / Laboratory Instructors
  - Prof. Bevin Engelward (M1)
  - Prof. Jacquin Niles (M2)
  - Dr. Noreen Lyell
  - Dr. Becky Meyer (T/R)
  - Jamie Zhan (W/F)
- Communication Instructors
  - Dr. Chiara Ricci-Tam
  - Dr. Sean Clarke

- Teaching assistants
  - Chyna Mays (T/R)
  - Alex Hostetler (W/F)

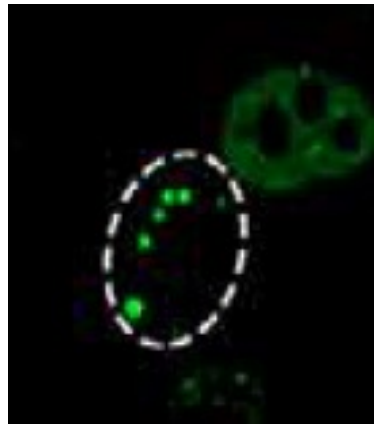
Mod 1: Genomic instability

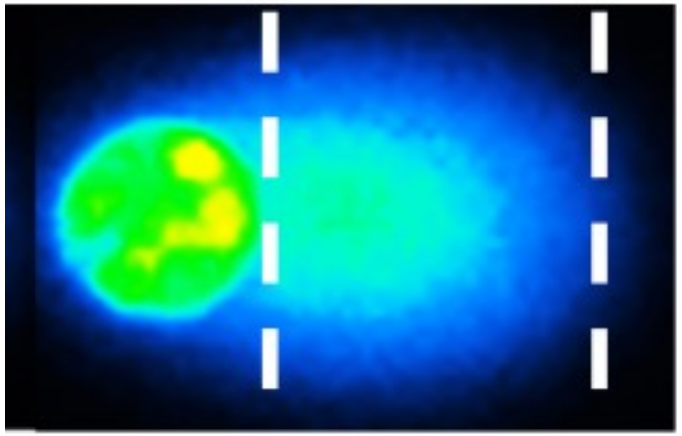
Knowledge and Conceptual Goals:

- Importance of genomic stability in preventing diseases
- How small structural changes have large consequences
- Biochemistry of a multistep DNA repair pathway
- Cost/benefit of DNA repair
- Importance of pathway balance
- Public health importance of studying combined exposures
- Importance of interdisciplinary research for public health
- Responsibility to community stakeholders
- Responsibility as research advocates

General Research Knowledge:

- Mammalian cell culture
- Immunofluorescence
- Quantitative image analysis
- High-throughput assay development and application
- Data presentation and conservative interpretation



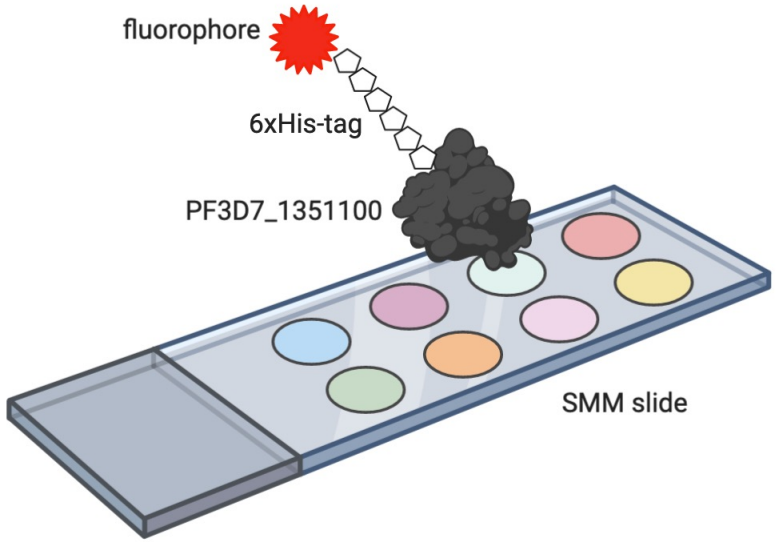


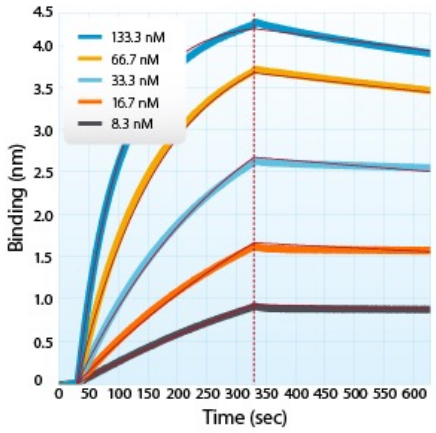
Mod 2: Drug discovery

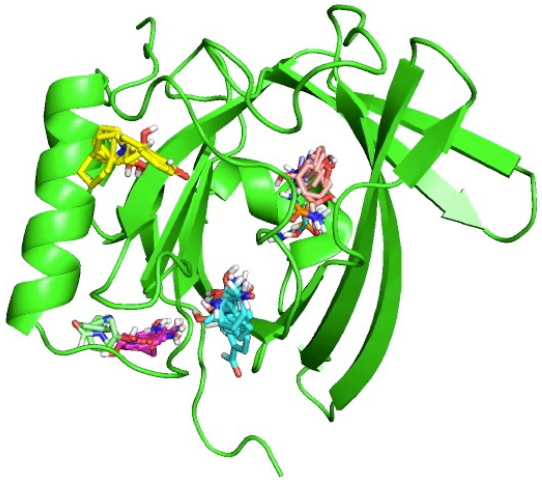
- Research goal: Identify & characterize small molecule binders to a protein drug target
- Laboratory skills
  - Recombinant protein expression and purification
  - High-throughput screening assays to identify small molecule hits
  - *In silico* analysis of hits
  - Validating binding interactions

Discovery

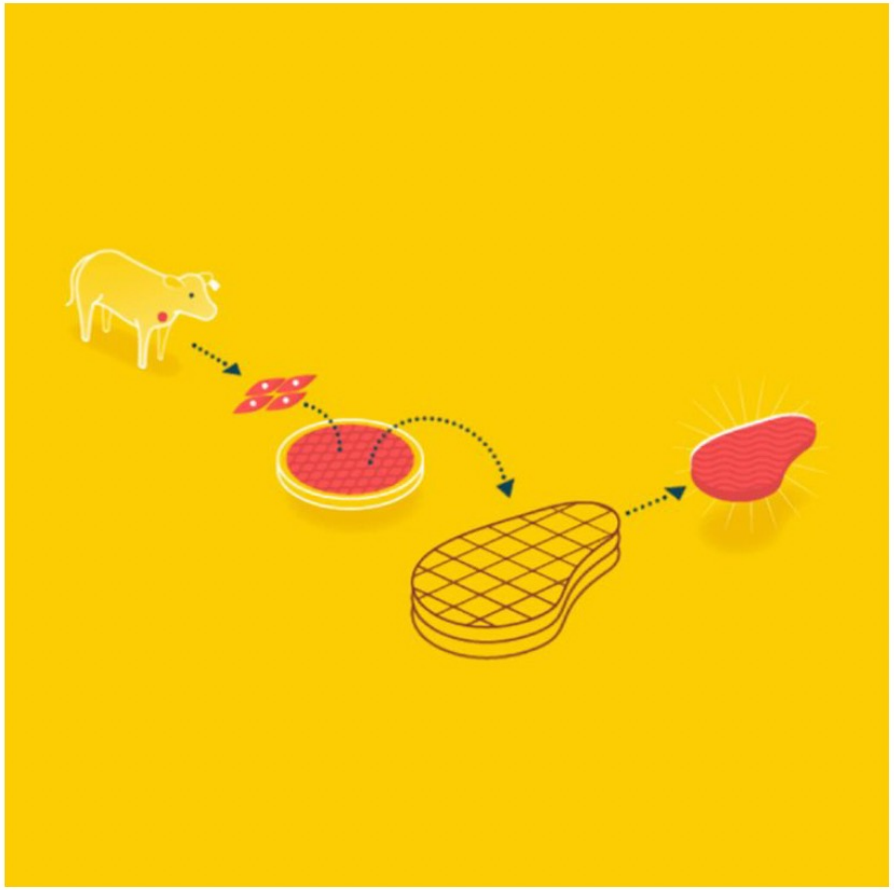
Validation/ Analysis







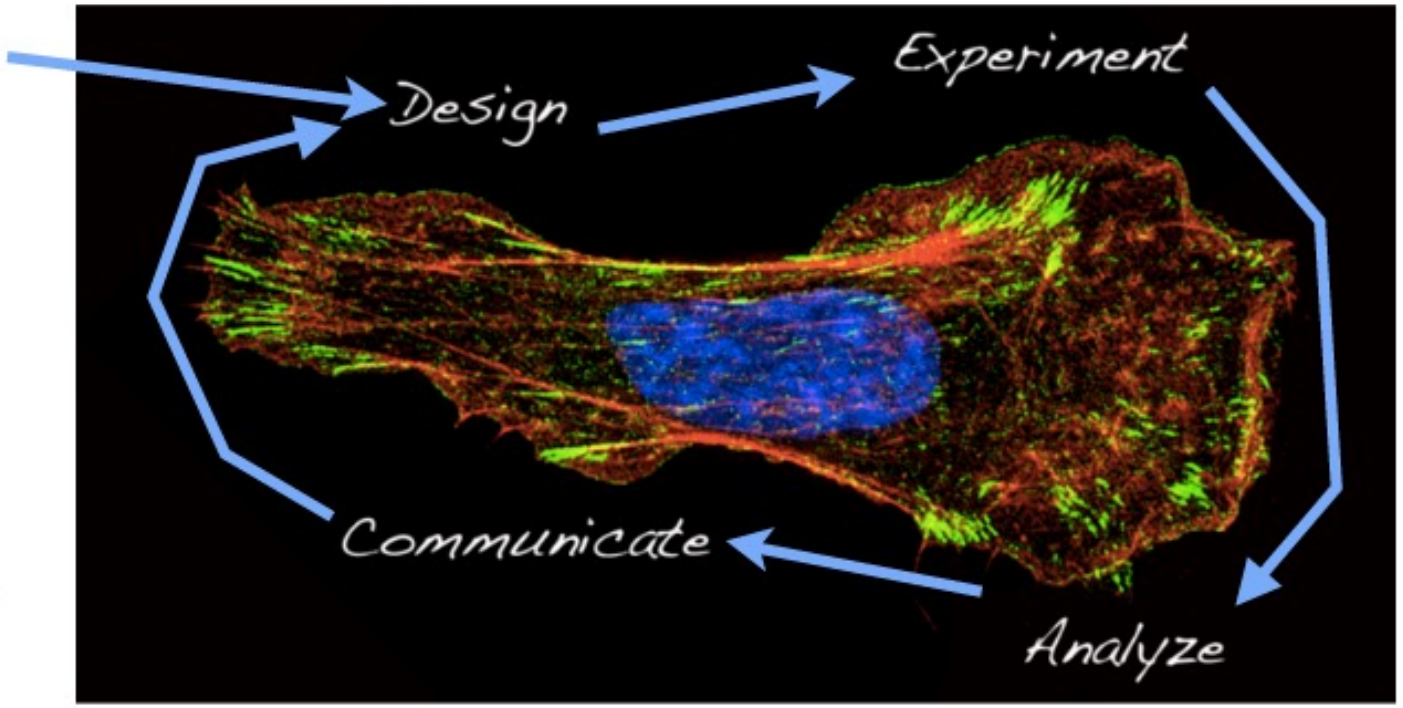
Mod 3: Research design



- **Aim 1:** Identify biological factors needed for cell differentiation and isolate progenitor cells
- **Aim 2:** Identify biocompatible scaffold material that can be functionalized for Wagyu culture
- **Aim 3:** Control localized cell differentiation and architecture by tethering growth and differentiation factors

Workflow in 20.109

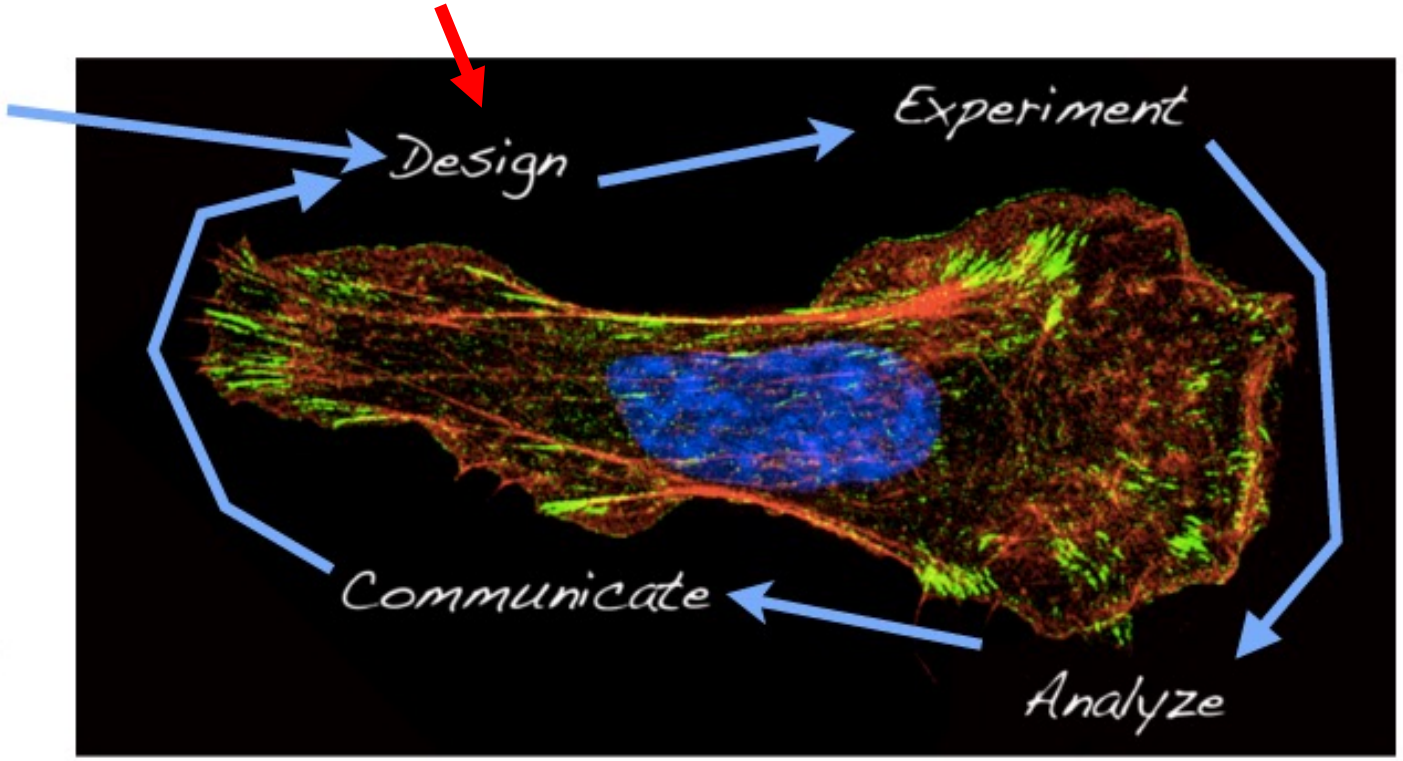
We start here…



Workflow in 20.109

Research!

We start here…



But you can’t design an experiment without reviewing the literature!

We do real science

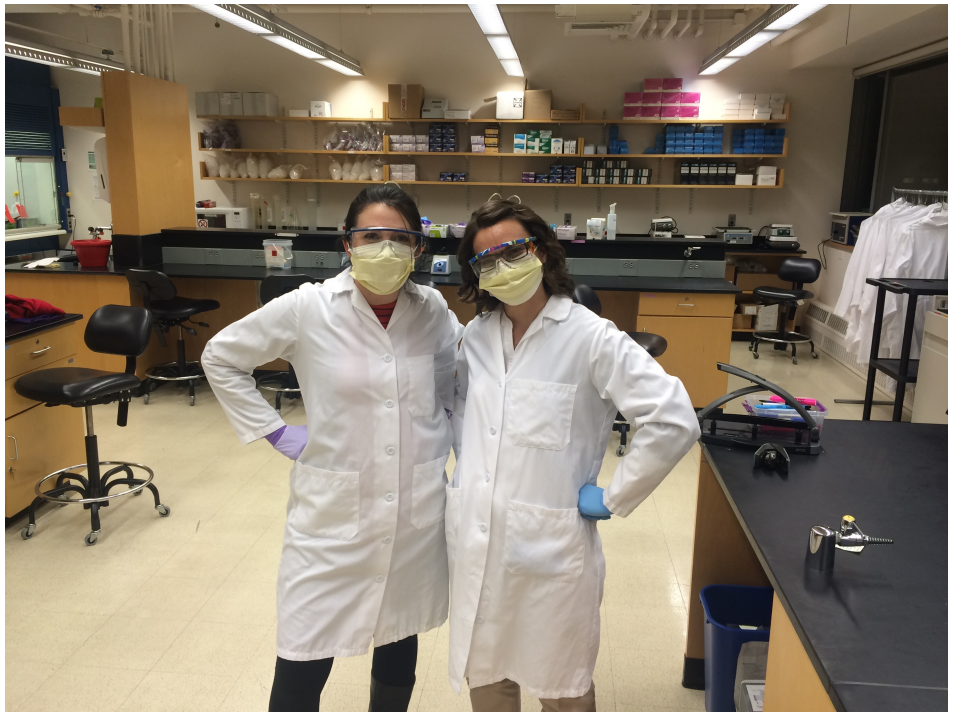
We aim to prevent ‘just follow the protocol’ benchwork

Will discuss not only how experiments are completed, but what each step actually does as part of the experiment

We follow best practices

We do relevant and cutting-edge research

Will discuss best practices for data collection and personal / environmental safety



We analyze and report data

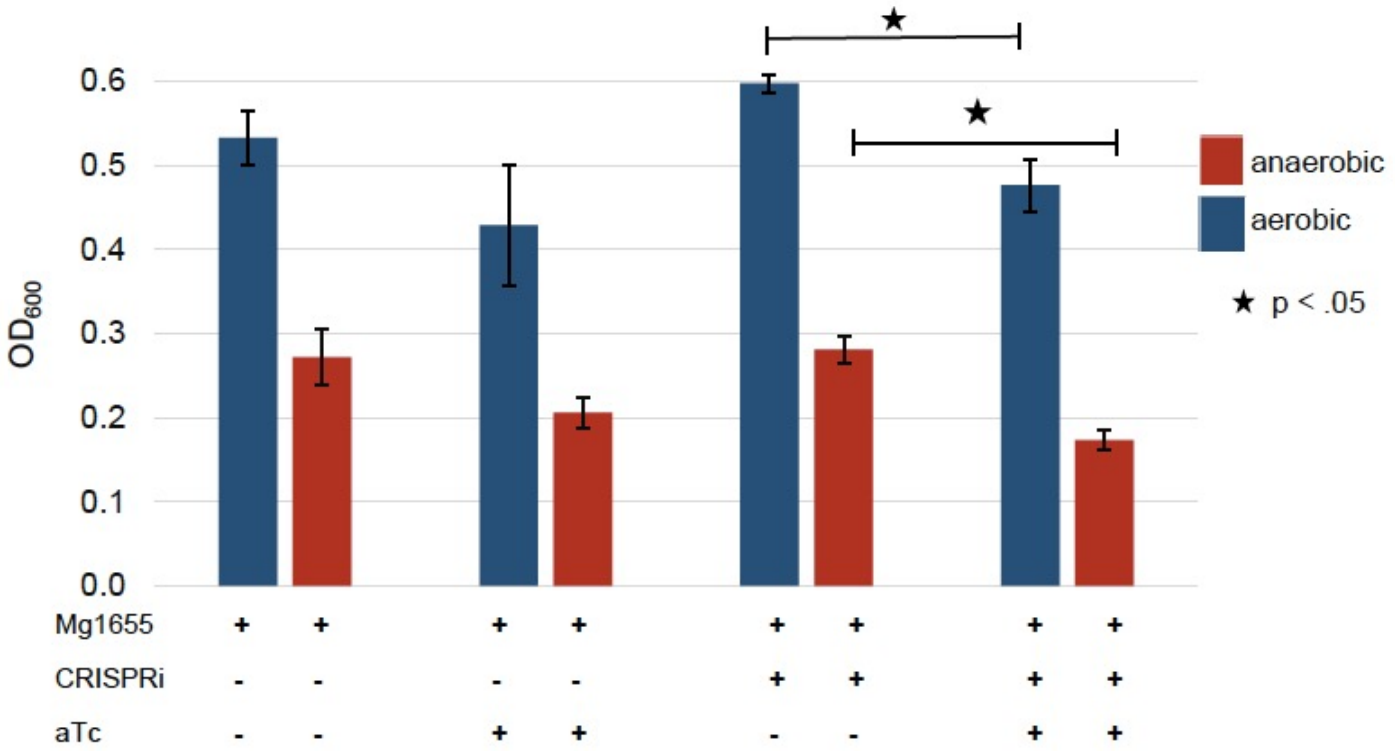


Figure 4. O_2 affects E.coli growth significantly and activated CRISPRi decreases overall cell growth. Conditions similar for CRISPRi and aTc presence were compared in aerobic and anaerobic conditions to check for side-effects on growth rate. Across all four conditions there was a significant difference between aerobic and anaerobic conditions. In addition there was a significant difference between aerobic CRISPRi+O2+aTc and inactivated CRISPRi+O2-aTc. Also, there was a significant difference between anaerobic CRISPRi-O2+aTc and CRISPRi-O2-aTc. ★ = p<.05

We develop written and verbal communication skills

MODULE	TOPIC	ASSIGNMENT	WEIGHT
1	Genomic instability	Research talk	5%
		Data summary	15%
2	Drug discovery	Journal article presentation	15%
		Research article	20%
3	Research design	Research proposal presentation	20%

- Written communication assignments = 35%
- Verbal communication assignments = 40%
- Daily work and participation = 25%

We are here to help!

- 20.109 Teaching Team
  - Faculty
  - Instructors
  - Teaching assistants

- BE Communication Lab
  - Instructors
  - Writing fellows

Our goals for you this semester

- Organize a constructive laboratory notebook
- Implement laboratory protocols and troubleshoot
- Interpret and analyze data
- Recognize the utility of models and assays
- Critically examine scientific literature
- Communicate your science
- Work as a team
- Provide constructive and helpful feedback

Expectations in 20.109…

Your expectations of us:

- We will come to class and laboratory prepared
- We will be clear and reasonable in all assignments
- We will treat every 109er with respect
- We will give everyone equal chance at success

Our expectations of you:

- You will come to class
- You will be prepared for lecture and laboratory
- You will not interfere with each other’s learning
- You will invest the very best of yourself
- You will be honest with your peers and the teaching faculty

Schedule and final notes

- Lectures meet Tuesday and Thursday 11-12p
  - Class divided into two laboratory sections: T/R & W/F 1-5p
- You will work in pairs throughout the semester
  - Collaboration with integrity is key!
- Attendance is expected, in both lecture and laboratory
- Participation is required
  - Laboratory exercises are completed with your partner
  - Some homework and assignments are completed with your partner