

to 20.109!

Laboratory Fundamentals of Biological Engineering 9/5/19

Insight from previous 109ers

WORDS OF WISDOM:

Lesson learned: Label Your Tubes

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.

BE Communications Lab is a great resource!

An introduction to 20.109

- Meet the team
- Core mission
 - Building a better biological engineer
 - Teaching best practices in scientific communication
- Modular structure



- Semester is separated into three research projects
- Each project will include verbal and written communication assignments
- Logistics

Meet the 20.109 teaching team

- Lecture / Laboratory Instructors
 - Prof. Bevin Engelward (M1)
 - Dr. Noreen Lyell (M2)
 - Prof. Angela Koehler (M3)
 - Dr. Leslie McClain (T/R)
 - Dr. Becky Meyer (W/F)

- Communication Instructors
 - Dr. Sean Clarke
 - Dr. Prerna Bhargava



- Teaching assistants
 - Shelbi Parker (T/R)
 - Colin Kim (W/F)
- Post-doc Researcher
 - Dr. Nick Struntz

We are ALL here to help!



Core mission of 20.109

- 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

Modular structure of 20.109



Module 1: Measuring genomic instability (Prof. Engelward) Module 2: Modulating metabolism (Dr. Lyell) Module 3: Testing chemical probes (Prof. Koehler)

Module 1: Measuring genomic stability

• Fundamental Biological Concepts in molecular pathway analysis, genomic stability, and environmental health.



- Fundamental Engineering Concepts in translating a low throughput assay into a high throughput assay.
 Includes learning about the process from going from an idea to a product.
- Laboratory skills: Many fundamental laboratory skills are covered in this module. These include mammalian cell culture, basic statistical tests, image analysis, immunofluorescence, and much more!

Module 2: Modulating metabolism

- Experimental goals:
 - Alter bacterial genetic circuitry using CRISPRi system to increase yield of specific fermentation products
 - Complete colorimetric assay to measure effects of targeted CRISPRi system
- Laboratory skills:
 - Bacterial culturing
 - Molecular biology techniques
 - Data analysis



Module 3: Testing chemical probes

- Experimental goals:
 - Build on work completed by previous 109ers!
 - Complete *in vivo* cell assay to examine protein stability upon addition of chemical probe
- Laboratory skills:
 - Mammalian cell culture
 - Molecular biology techniques
 - Data analysis



Workflow in 20.109

• We start here...



Workflow in 20.109

- We start here...
- But you can't design an experiment without examining the background information & existing data!



Experiments in 20.109

We design laboratory projects that prevent 'just follow the protocol' syndrome by tasking you will asking / designing research questions



Experiments in 20.109

We use relevant and cutting edge scientific techniques / methods from active research laboratories at MIT...

and we do it safely!!!



We generate / analyze real data



Figure 7: DSF assay demonstrates significant thermal shift between compound bound

FKBP12 and free protein. DSF (Differential Scanning Fluorimetry) assay was used to confirm binding of selected compounds to FKBP12. In (a), first derivative data shows a global minimum at around 49°C for FKBP12 + DMSO and a shift to 53.5°C for FKBP12 + compound 1, at both 3 uM and 30 uM. In (b), first derivative data shows a global minimum shift to 53.5°C and 54.5°C for FKBP12 + compound 2 at 3 uM and 30 uM, respectively.

Scientific communication is a priority

MODULE	PROJECT	ASSIGNMENTS	WEIGHT
1	Measuring genomic instability	Data summary	15%
		Mini-presentation	5%
2	Modulating metabolism	Research article	20%
		Journal Club presentation	15%
3	Testing chemical probes	Research Proposal	20%
		presentation	
		Mini-report	5%

- Written communication assignments = 40%
- Verbal communication assignments = 40%
- Daily work and participation = 20%

Why communicate your science?



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

why scientists should tell more stories

RECENT PUBLICATIONS	
ARTICLES	
INTERVIEWS	
OPINIONS	
EDUCATION	
THIS IS HOW I DID IT	
FROM THE FIELD	
ECOPICS	
EVENTS	
NREL NEWS	
LINKS	
CITATION SUBMISSION	
PODCAST	
	Q,



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

Why 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."

BE Communication Lab

BE Communication Lab



Helping you communicate effectively.

Staffed by the BE Communication Fellows, the BE Communication Lab offers writing and speaking support for scientists by scientists.

Course 20 undergraduate students, graduate students and post-docs are invited to bring in any communication-related pieces they are working on – from coursework and posters to resumes and publications.

We encourage students to **book an appointment** at any stage in the writing process – the sooner the better. In addition to offering coaching, the BE Communication Lab runs **workshops** and is building an online tool box to help you find tips and resources quickly to help you communicate more effectively.

mitcommlab.mit.edu/be

Course logistics

- Lectures
 - Tuesday and Thursday 11-12p in 16-220
 - Prof. Engelward → Dr. Lyell → Prof. Koehler
- Laboratory sections
 - Tuesday and Thursday 1-5p in 56-322
 - Wednesday and Friday 1-5p in 56-322
- Details
 - You will work in pairs throughout the semester
 - Collaboration with integrity is key!!

Expectations

- 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

Expectations

- 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

Our goals for you

- 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

Final notes

- Please arrive to laboratory today / tomorrow on time
 - We will begin with EHS 109 laboratory-specific training
- Please wear / bring pants and closed toed shoes
 - We will be working in the laboratory!

