



# **Welcome** to the **20.109 lab!**

1. EHS laboratory-specific training
2. Introductions
3. Prelab: Laboratory logistics
4. Orientation exercise – your first protocol
5. Preparations for M1D1

# Introductions

- What year are you at MIT?
- Do you have any research experience you want to share?
- Where in the universe would you go if you got the chance?



# Where can you find the instructors?

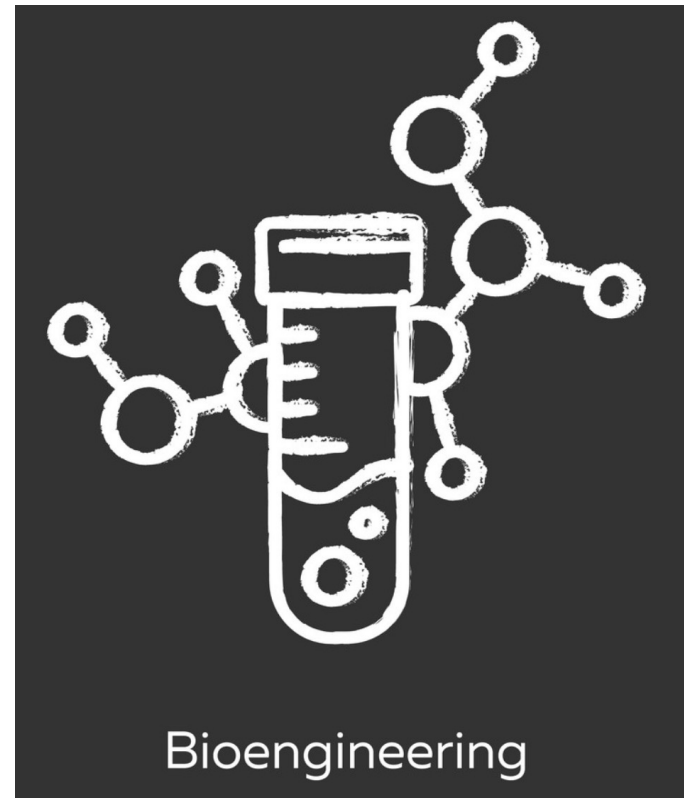
- Noreen Lyell
  - Office: 16-317
  - Email: [nllyell@mit.edu](mailto:nllyell@mit.edu)
- Becky Meyer
  - Office: 16-319
  - Email: [rcmeyer@mit.edu](mailto:rcmeyer@mit.edu)
- Jamie Zhan
  - Office: 16-469
  - Email: [zhanj@mit.edu](mailto:zhanj@mit.edu)



Office hours will be established

# Core missions of 20.109

- Collect **authentic** data
  - Elements of design, unknown outcomes
- Practice **communicating** your science
  - Written & oral, in homework and assignments, a lot of feedback
- Working in **collaboration** with colleagues
  - Experiments completed in teams
  - Assignments are completed individually or in teams (as noted)
  - Class-wide collaboration (for data acquisition and analysis)
  - Integrity (*personal* reflections)
- The faculty are here to help – **come to us with questions!**



# Key deadlines this semester

Assignment	% final grade	Due date
Data summary	15	3/12 (draft), 3/20 (revision)
Research talk	5	2/23
Journal club presentation	15	3/29 & 30 or 3/31 & 4/1
Research article	20	4/23
Research proposal presentation	20	12/7 or 12/8
Lab notebook	5	at the end of each module
Homework	10	daily
Participation	5	daily for notebooks, 4 blog posts
Quizzes	5	2 per module

individual : 65%

team: 35%

# Homework helps!

## HOW TO BECOME A TECHNICAL WRITER

— *A Beginner's Guide* —

- A chance to practice technical/ scientific writing
- Each piece of homework will become a component of a major assignments
  - Allows you to get individualized feedback on first draft of work
- Homework, collectively, is only worth 10% of your final grade
  - Not because it isn't important
  - Gives you a chance to make mistakes without serious damage to your grade
- Homework must be submitted by 1:05pm on the day of lab
  - Submit as .doc or .pdf to Stellar
  - Write your name in the text of the document
  - **Document name: Your name assignment name/identifier**

# Class policies to note (also on wiki!)

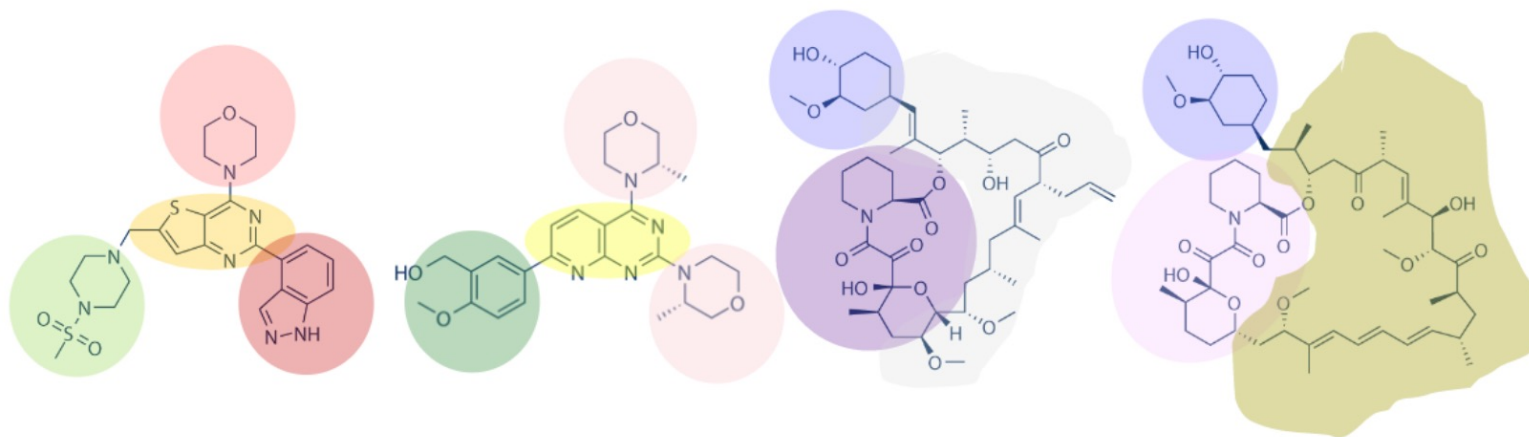
- **Absences from lecture** will impact participation points accumulated throughout the semester.
  - You are responsible for getting lecture material even if you are absent
- **Laboratory attendance is mandatory**
  - Excused absences should be discussed with the Instructors as soon as possible.
  - Unexcused absences = 1/3 of a letter grade deduction from the final grade on the major assignment for the module (for example, a B+ would become a B).
    - If absent, you may be required to attend a different laboratory section to complete experiments.
- **Late policy for homework and major assignments** is very generous!
  - In lieu of extensions
  - Each day late for homework = -0.3pts /10
  - Each day late for major assignment = -3pts /100
  - Work will not be accepted 1 week past the due date



# Welcome to the wiki! The wiki is your lifeline...

[http://engineerbiology.org/wiki/20.109\(S22\):Spring\\_2022\\_schedule](http://engineerbiology.org/wiki/20.109(S22):Spring_2022_schedule)

## 20.109(S22): Laboratory Fundamentals of Biological Engineering



[Spring 2022 schedule](#)

[FYI](#)

[Assignments](#)

[Homework](#)

[Class data](#)

[Communication](#)

[Accessibility](#)

[M1: Drug discovery](#)

[M2: Metabolic engineering](#)

[M3: Project design](#)

Welcome to 20.109! It is our goal to make this class a useful and fun introduction to the experiments and techniques used in biological engineering. Though there is not enough time to show you everything needed to do research, after this class you will feel confident and familiar with some fundamental experimental approaches and laboratory protocols. You will develop good habits at the bench, which will increase the likelihood of success in your work and ensure the health and safety of you and your labmates. By the end of the semester, you will also be well-versed in good scientific practices - through your experience with scientific writing, notebook keeping, and orally presenting data and novel ideas. All of us involved in teaching 20.109 hope you will find it a satisfying challenge and an exciting experience that has lasting value.



# If the wiki is your lifeline, the Schedule page is your best friend

MODULE	DATE	LECTURER	LABORATORY EXPERIMENTS	ASSIGNMENTS
	T/W Feb 1/2	<a href="#">NLL</a> <a href="#">Slides</a>	Orientation and laboratory tour	
M1D1	R/F Feb 3/4	<a href="#">AK</a> <a href="#">Slides</a>	Review small molecule microarray (SMM) technology	<b>Orientation quiz</b> <a href="#">Homework due</a>
M1D2	T/W Feb 8/9	<a href="#">AK</a>	Examine SMM data collected using TDP43 protein	<a href="#">Homework due</a>
M1D3	R/F Feb 10/11	<a href="#">AK</a>	Induce and purify TDP43 protein	<a href="#">Homework due</a>
M1D4	T/W Feb 15/16	<a href="#">AK</a>	Assess purity and concentration of purified TDP43 protein	<b>Laboratory quiz</b> <a href="#">Homework due</a>
M1D5	R/F Feb 17/18	<a href="#">AK</a>	Perform aggregation assay using TDP43 protein and draft data slide for Data summary	<a href="#">Homework due</a>
	T/W Feb 22/23		<b>Presidents' day holiday</b>	<b>Research talk due</b> Wed, Feb 23 at 10 pm
M1D6	R/F Feb 24/25	<a href="#">AK</a>	Learn best practices for mammalian cell culture and seed CAD cells for TDP43-localization experiment	<a href="#">Homework due</a>
M1D7	T/W Mar 1/2	<a href="#">AK</a>	Complete staining for TDP43-localization assay	<a href="#">Homework due</a>
M1D8	R/F Mar 3/4	Comm Lab workshop	Image TDP43-localization experiment and complete data analysis	<b>Laboratory quiz</b> <a href="#">Homework due</a>
M2D1	T/W Mar 8/9	<a href="#">NLL</a>	Complete in-silico cloning of pdCas9 expression plasmid	<a href="#">Homework due</a>

# A laboratory day in the life of a 109er

- Lab starts at 1:05pm
  - **You must alert me in advance if you will be late or are sick**
- Quiz starts immediately at 1:05pm (on lectures and laboratory material)
  - M1D4, M1D7, M2D4, M2D7...as noted on the wiki!
- Submit homework to Stellar by 1:05pm
- Participate in interactive prelab discussion
  - Typically 15-45 minutes with focus on experimental details
- Design and Experiment!
  - Keep notes in electronic laboratory notebook (Benchling)
  - Q & A throughout the afternoon

# Record your science in Benchling

- Set up your account: benchling.com
- Title your project “20.109(S22)\_YourName”
  - Make each module a new folder
  - Make each day a new entry within the appropriate module folder
- Share with your Instructor and TA

T/R: Becky (rcmeyer@mit.edu)  
and Christine (crzheng@mit.edu)

W/F: Jamie (zhanj@mit.edu)  
and Tyler (tylerdao@mit.edu)

Add Protocol Notes Metadata

Insert H B I U % A x<sub>2</sub> x<sup>2</sup> More

**Title: Template for notebook entry**

TUESDAY, 9/6

M1D2, include the date the experiment was completed here as the automatic timestamp above reflects the day you created this entry (you can also change the automatic timestamp).

Statement of the purpose of the experiments to be completed today.

List of protocols (including experiment 'titles' as written on the wiki):




(OPTIONAL) Part 1: BE Communication Lab workshop

- If you would like to keep everything in one place, you can use this space to take notes.

Part 2: Design experiment to optimize CometChip loading

- Include notes on the conversation you have with your laboratory partner concerning the experimental conditions you will test.

# Remember your personal protective equipment (PPE)

Item	Worn (BE guidelines)
<p>Gloves</p> 	<ul style="list-style-type: none"><li>- When working with chemical or biological materials</li><li>➤ Change when entering tissue culture room!</li></ul>
<p>Lab coat</p> 	<ul style="list-style-type: none"><li>- When working with chemical or biological materials</li><li>➤ Change when entering tissue culture room!</li></ul>
<p>Goggles</p> 	<ul style="list-style-type: none"><li>- When handling large quantities of powder or liquid due to chance of splash</li><li>- When pipetting toxic chemicals (mutagens)</li><li>- When using ethanol burners</li><li>- In conjunction with face shield at UV transilluminator</li></ul>

# Correctly dispose of waste



regular trash can



benchtop waste



sharps container



liquid waste vacuum flask

Please empty  
benchtop  
waste every  
lab



biowaste box

# For today:

- Complete lab orientation with a partner
  - Your "forever" lab partner will be assigned prior to the next lab session based on questionnaire responses or by request

[http://engineerbiology.org/wiki/20.109\(S22\):Laboratory\\_tour](http://engineerbiology.org/wiki/20.109(S22):Laboratory_tour)

Orientation quiz on M1D1!

# For M1D1:

- Complete homework assignments (see 'Homework' tab on wiki)

[http://engineerbiology.org/wiki/20.109\(S22\):Homework](http://engineerbiology.org/wiki/20.109(S22):Homework)

Prepare for orientation quiz

- Complete, screen capture EHS training certificate(s)
- Read Mod1 overview page and M1D1 introduction