Welcome to 20.109!

Fundamentals of Biological Engineering

Spring 2019

Insight from previous 109ers

Words of wisdom…

Another thing I definitely learned is that if you ever feel unsure about what conclusions can be drawn from any procedures you performed in lab, or if you aren't sure if the information you are about to include in your report is superfluous, never hesitate to **ask the 20.109 faculty for feedback**- these awesome people are actually there to help us!

Ask questions.

Take advantage of office hours.

Tip 211: Get a jump start on the next major assignment

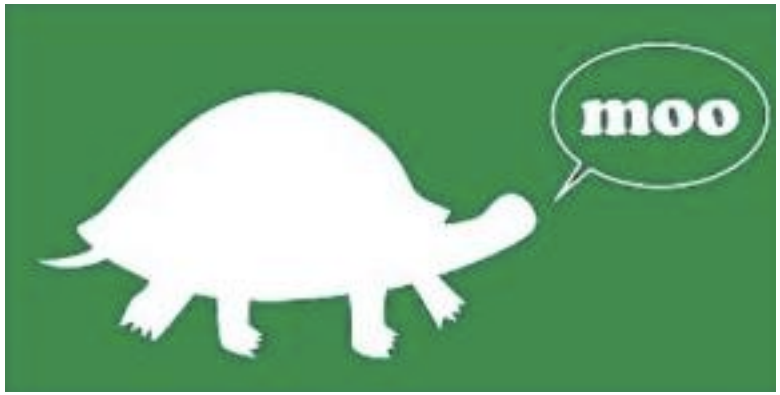
Makes sure to always check the wiki

Don't leave everything to the very last minute.

BE Communication Lab Meetings? 10/10 Would Recommend!

An introduction to 20.109

- Meet the team
- Core mission
  - Building a better bioengineer



- Modular structure
  - Module 1: Assessing ligand binding
  - Module 2: Measuring gene expression
  - Module 3: Engineering biomaterials
- Logistics

Meet the 20.109

- Lecture / laboratory
  - Prof. Angela Koehler (M1)
  - Prof. Prof. Fraenkel and Dr. Noreen Lyell (M2)
  - Prof. Angela Belcher (M3)
  - Dr. Leslie McClain (T/R)
  - Dr. Noreen Lyell (W/F)
- Communications
  - Dr. Sean Clarke
  - Dr. Prerna Bhargava
- Teaching assistant
  - Catherine Henry (T/R)
  - Michaela Gold (W/F)
- Research assistant
  - Dr. Jifa Qi

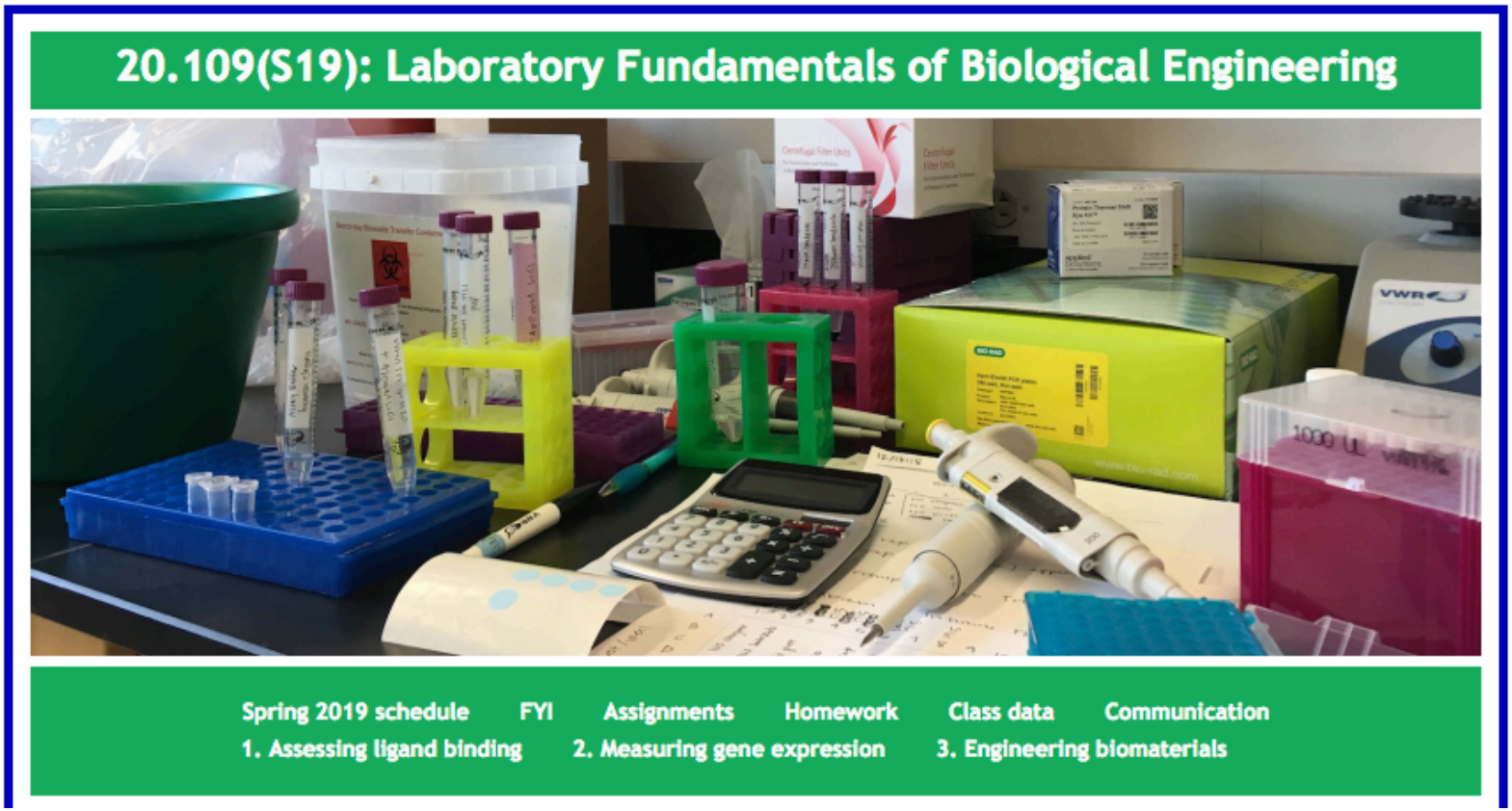
Core mission of 20.109

- 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

Navigating success in 20.109



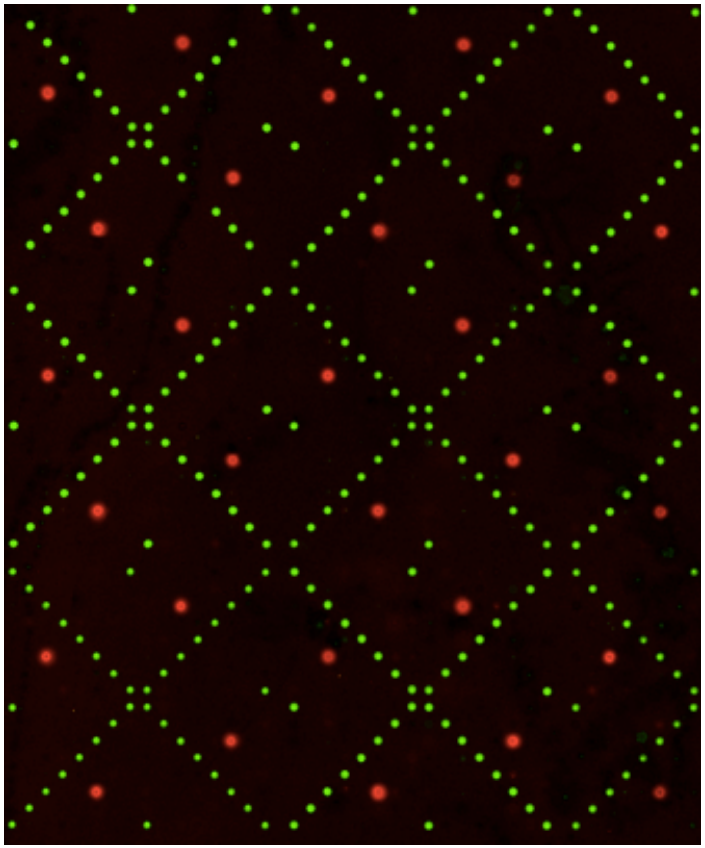
Module 1: Assessing ligand binding (Koehler)

Module 2: Measuring gene expression (Fraenkel/Lyell)

Module 3: Engineering biomaterials (Belcher)

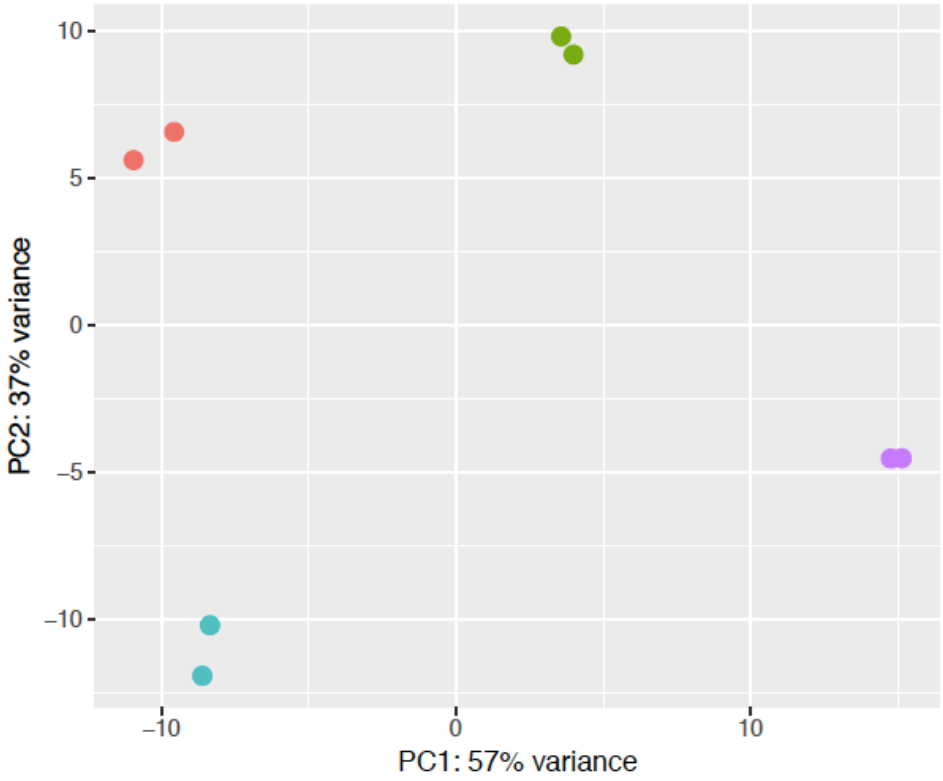
Module 1: Assessing ligand binding

- Experiments
  - Purify protein and assess purity / concentration
  - Screen small-molecule microarray
  - Complete secondary assays
- Lab skills
  - Molecular biology techniques
  - High-throughput screening
  - Data analysis



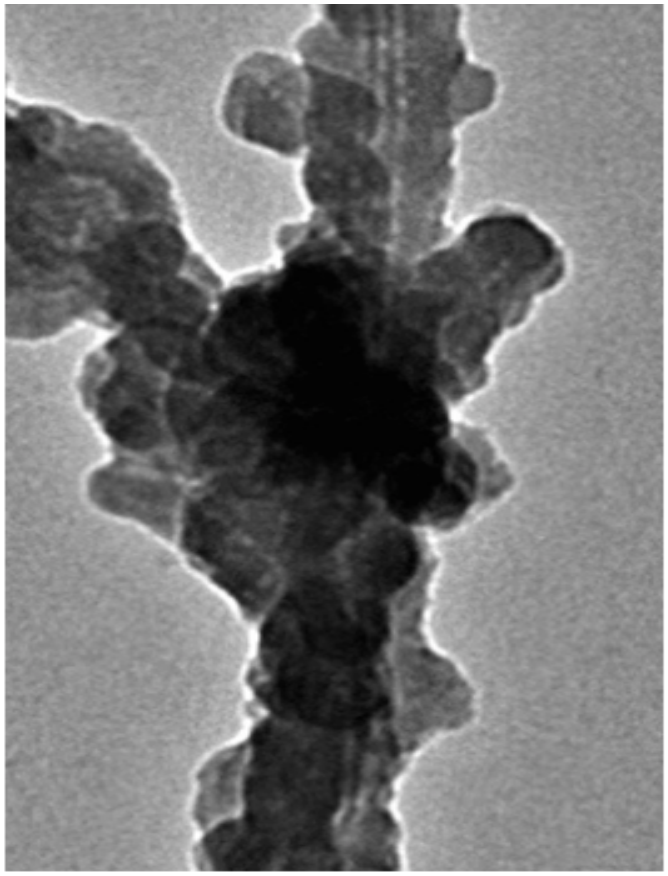
Module 2: Measuring gene expression

- Experiments
  - Measure gene expression using qPCR and RNA-seq
  - Examine cell survival in response to drug treatment
- Lab skills
  - Mammalian tissue culture
  - Molecular biology techniques



Module 3: Engineering biomaterials

- Experiments
  - Mineralize phage with nanoparticles
  - Visualize nanowires with TEM
  - Construct cathode material
- Lab skills
  - Biomaterial production
  - Capacity measurements



Information / details in 20.109

Spring 2019 schedule FYI Assignments Homework Class data Communication
1. Assessing ligand binding 2. Measuring gene expression 3. Engineering biomaterials

SCHEDULE DETAILS:

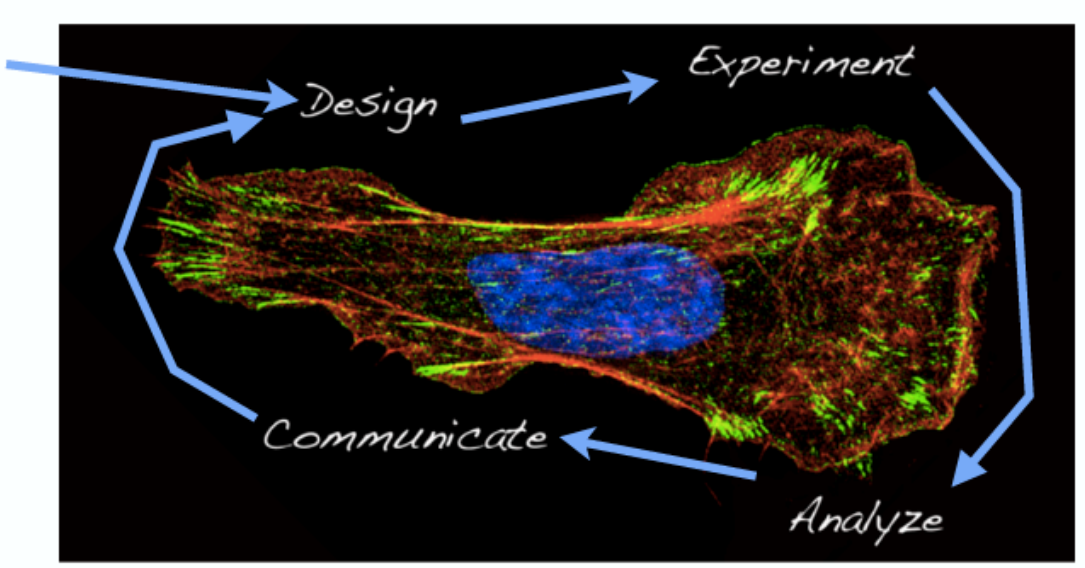
Lecture times: T/R 11 - 12 pm (32-124)

Laboratory section times: T/R 1 - 5 pm or W/F 1 - 5 pm (56-322)

MODULE	DAY	DATE	LECTURER	LABORATORY EXPERIMENTS	ASSIGNMENTS
		T/W Feb 5/6	NLL	Orientation and laboratory tour	
1	1	R/F Feb 7/8	AK	In silico cloning and confirmation digest of protein expression vector	**Orientation quiz** Homework due
1	2	T/W Feb 12/13	AK	Purify protein for secondary assays	Homework due
1	3	R/F Feb 14/15	AK	Analyze small molecule microarray (SMM) data	Homework due
		T/W Feb 20/21		**President's day holiday**	

Workflow in 20.109

- We start here…
- But, you can't design an experiment without analyzing some data!



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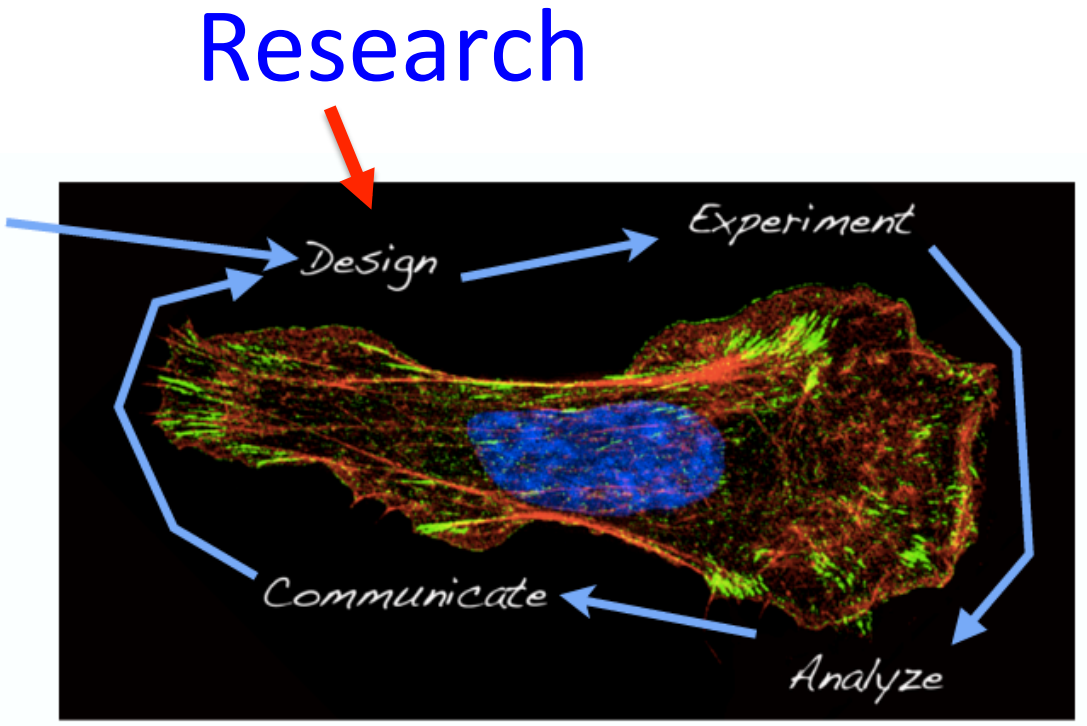
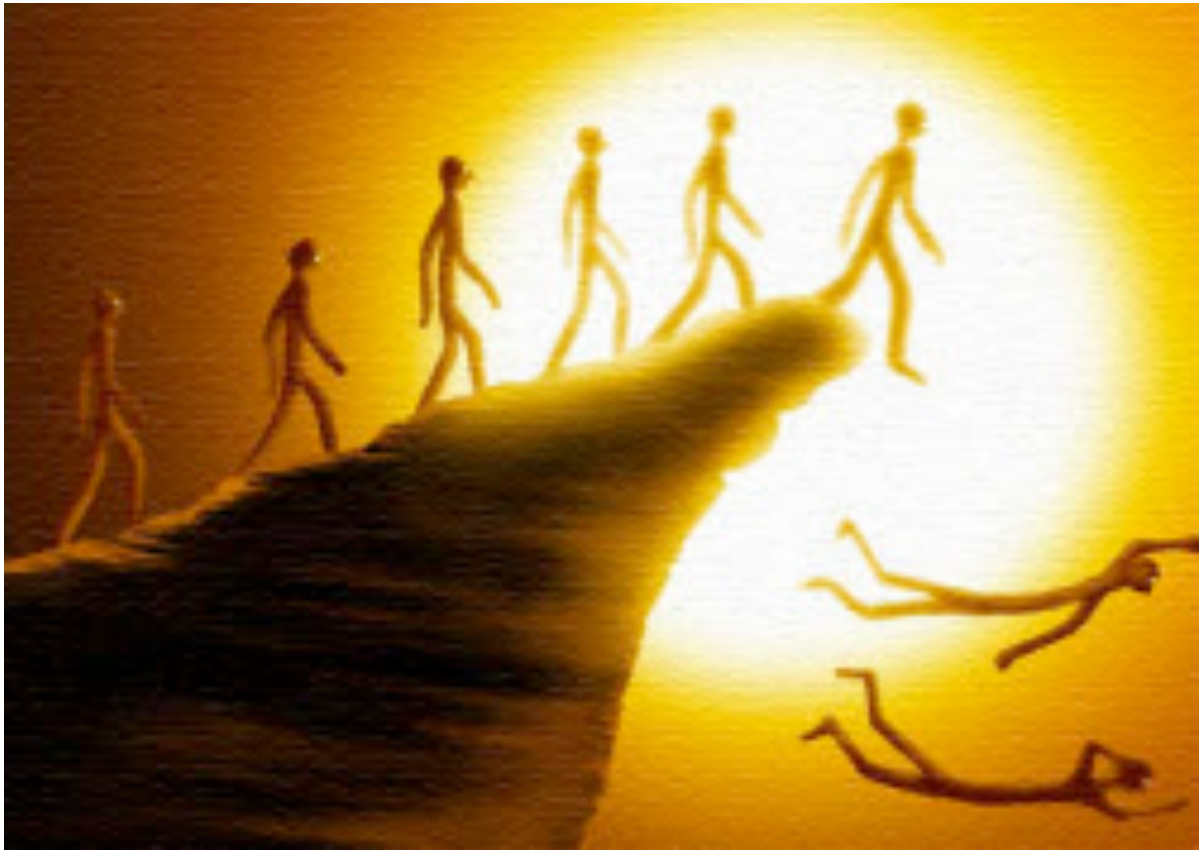


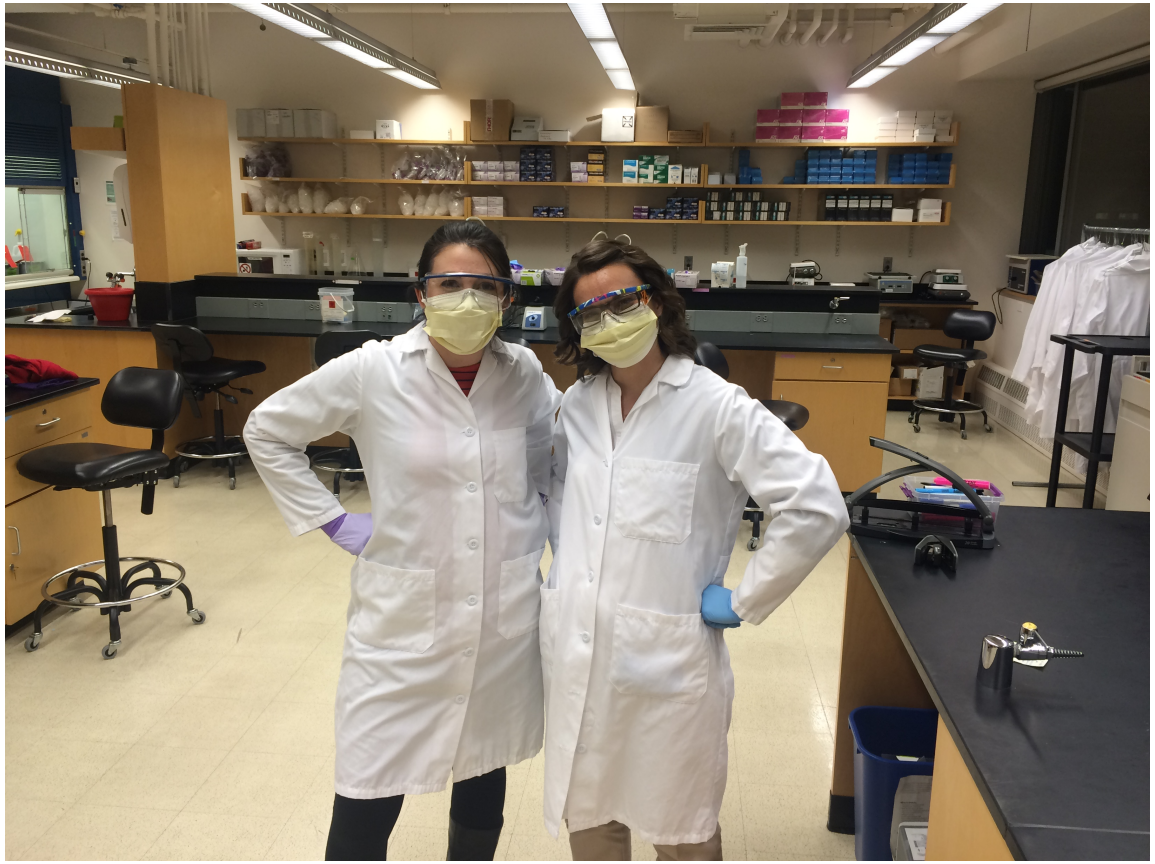
Experiments in 20.109

We aim to prevent ‘just follow the protocol’ syndrome



Best practices in 20.109

We do relevant and cutting edge science…



and we do it safely!!

We analyze real and novel data in 20.109

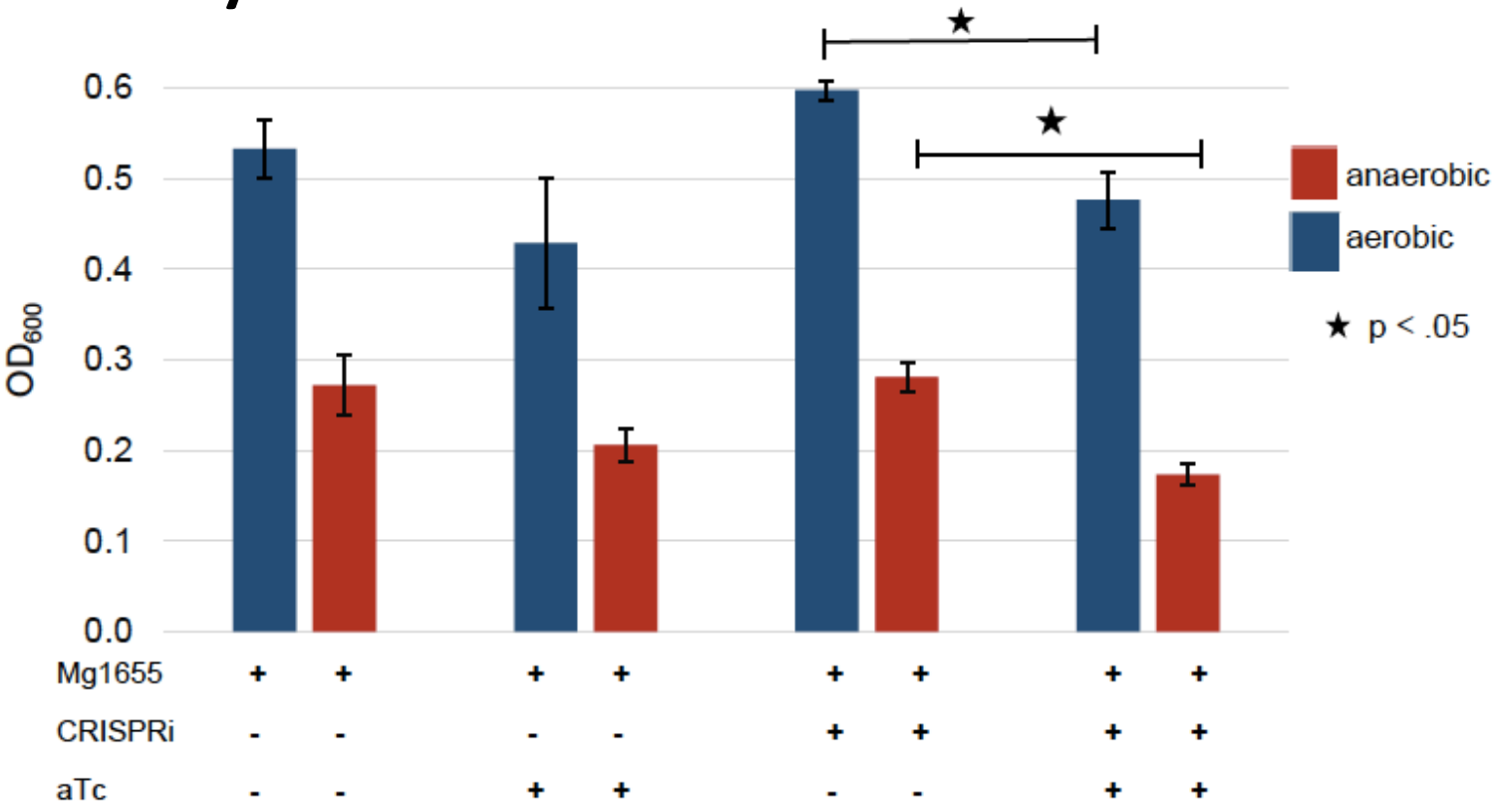


Figure 4. O_2 affects E.coli growth significantly and activated CRISPRi decreases overall cell growth. Conditions similar for CRISPRi and aTc presence were compared in aerobic and anaerobic conditions to check for side-effects on growth rate. Across all four conditions there was a significant difference 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

Written and oral communication

MODULE	TOPIC	ASSIGNMENT	WEIGHT
1	Assessing ligand binding	Data summary	15%
		Mini-presentation	5%
2	Measuring gene expression	Research article	20%
		Journal club presentation	15%
3	Engineering biomaterials	Research proposal presentation	20%
		Mini-report	5%

- Written communication assignments = 40%
- Oral 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

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

why scientists should tell more stories

Credit: jvoves (via Flickr, http://bit.ly/190MCCw)

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."

We are here to help

- 20.109 Teaching faculty
- BE Communication Lab
  - Instructors
    - Dr. Sean Clarke
    - Dr. Prerna Bhargava
  - Writing fellows

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.

NEW!

Check out our blog, created by the BE Communication Fellows: **http://thebench.scripts.mit.edu/home/**.

https://be.mit.edu/communicationlab

Course logistics

- Lectures
  - T/R 11-12p in 32-124
  - Participation partially based on attendance
- Laboratory sections
  - T/R or W/F 1-5p in 56-322
  - Required attendance
- 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 and tomorrow on time
  - EHS laboratory specific training
  - Laboratory orientation and exercise
- Be sure to wear/bring pants and closed toed shoes
  - We will be working in the laboratory