

The word "WELCOME" is rendered in large, white, 3D block letters. The letters are surrounded by a dense cloud of small, multi-colored confetti pieces in shades of red, blue, yellow, and pink. The entire graphic is set against a plain white background.

WELCOME

to 20.109!

Laboratory Fundamentals of Biological Engineering

2/6/24

# 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:*

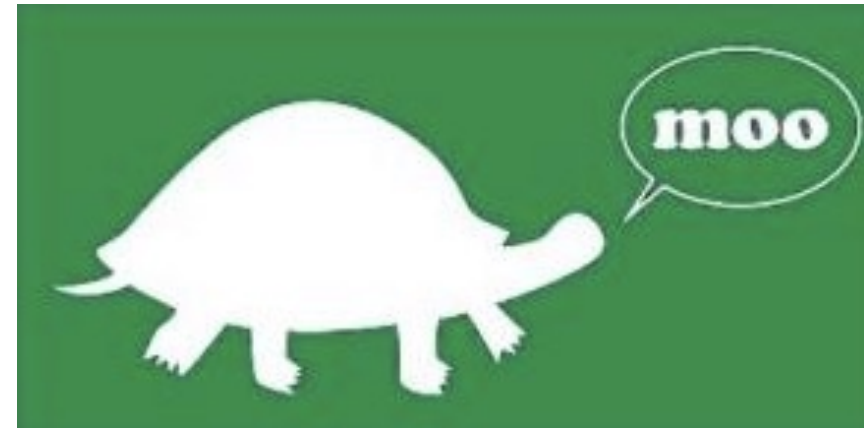
Failure is Beautiful Too

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 Sp24 team
- Experimental overviews
  - Module 1: Drug discovery
  - Module 2: Protein engineering
  - 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 Sp24 teaching team

- Lecture / Laboratory Instructors

- Prof. Angela Koehler (M1)
- Dr. Becky Meyer & Prof. Angela Belcher (M2)
- Dr. Noreen Lyell (T/R)
- Jamie Zhan (W/F)

- Communication Instructor

- Dr. Chiara Ricci-Tam

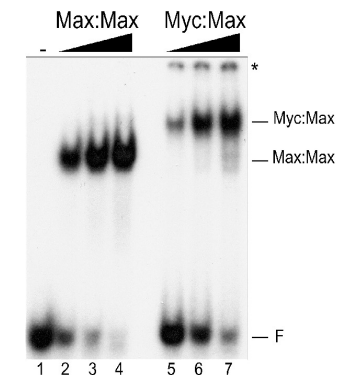
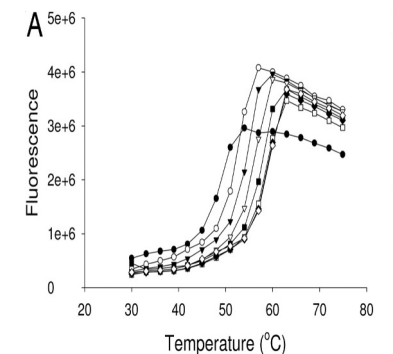
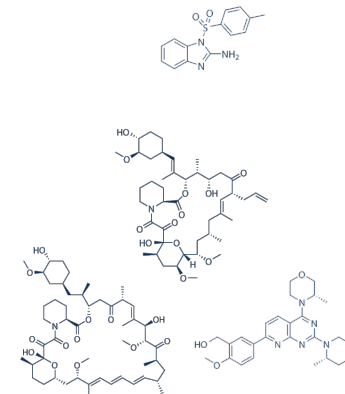
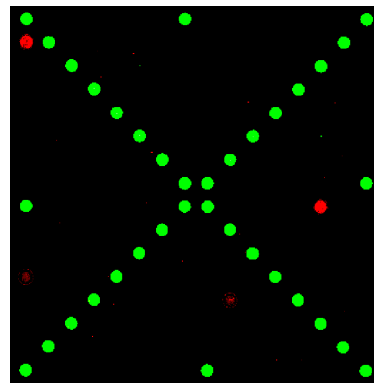
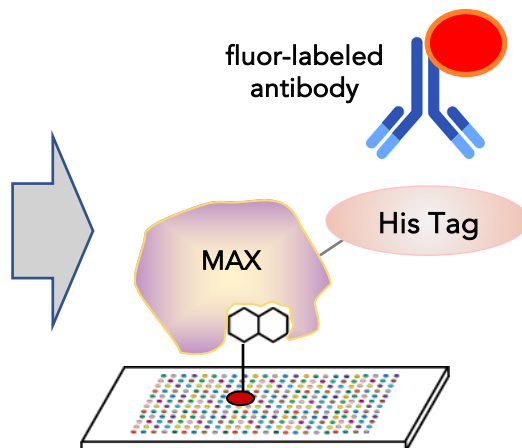
- Teaching assistants

- Daniel Pascal (T/R)
- Yichen Xiang (W/F)



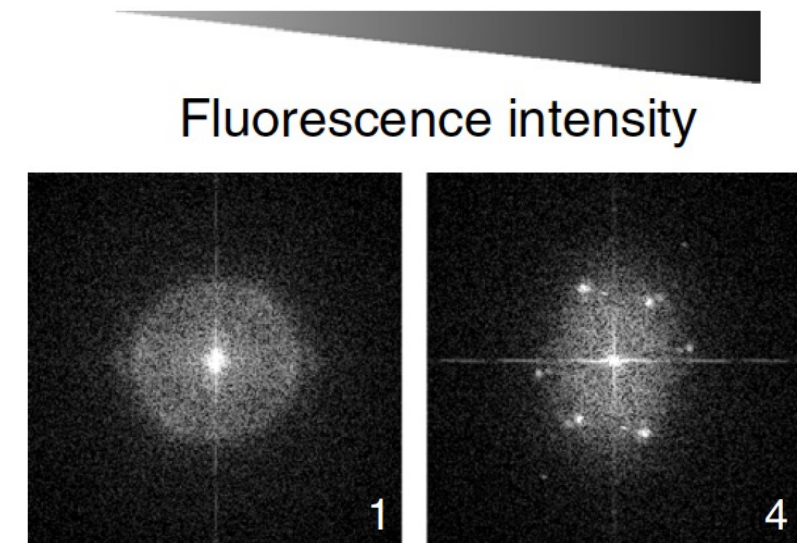
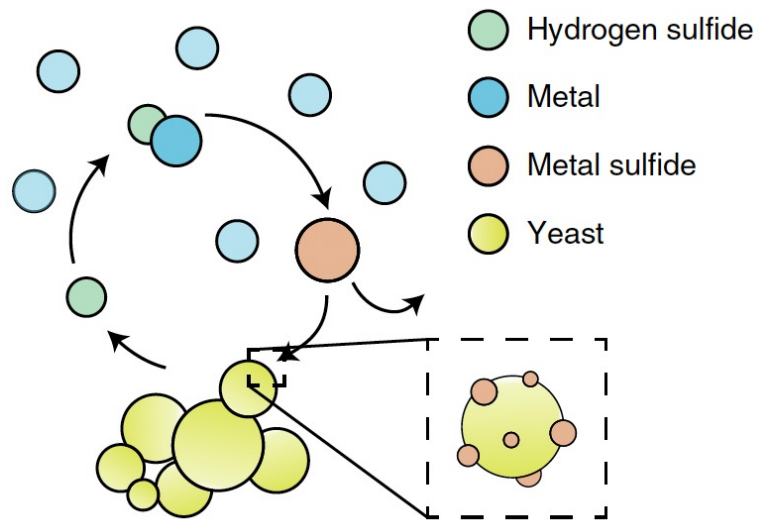
# Mod 1: drug discovery

- Research goal: Purify the Max protein and study candidate small molecule ligands in biophysical and functional assays
- Laboratory skills
  - Recombinant protein expression and purification
  - Quantitative binding studies
  - Data analysis



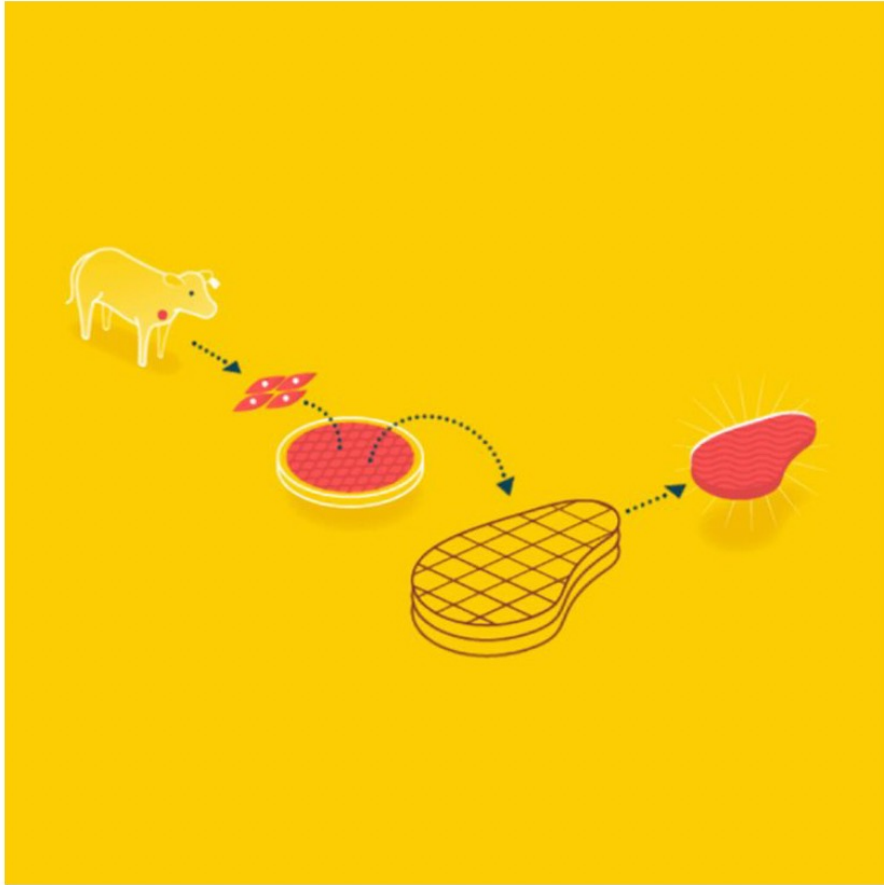
# Mod 2: Protein engineering

- Research goal: Using a yeast model of bioremediation, create a peptide cell surface display capable of sequestering cadmium
- Laboratory skills
  - DNA cloning
  - Cell-surface yeast display
  - Flow cytometry
  - Metal sequestration





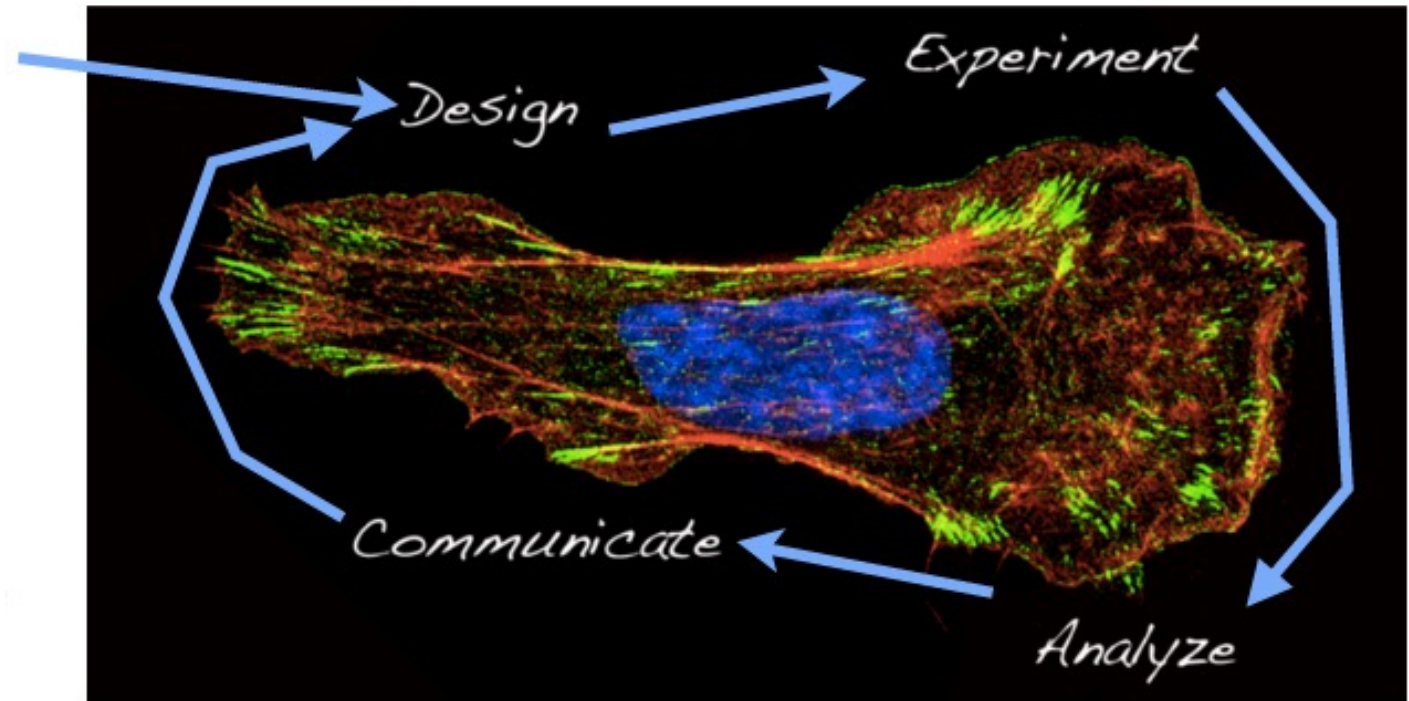
# Mod3: Research design



- **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...

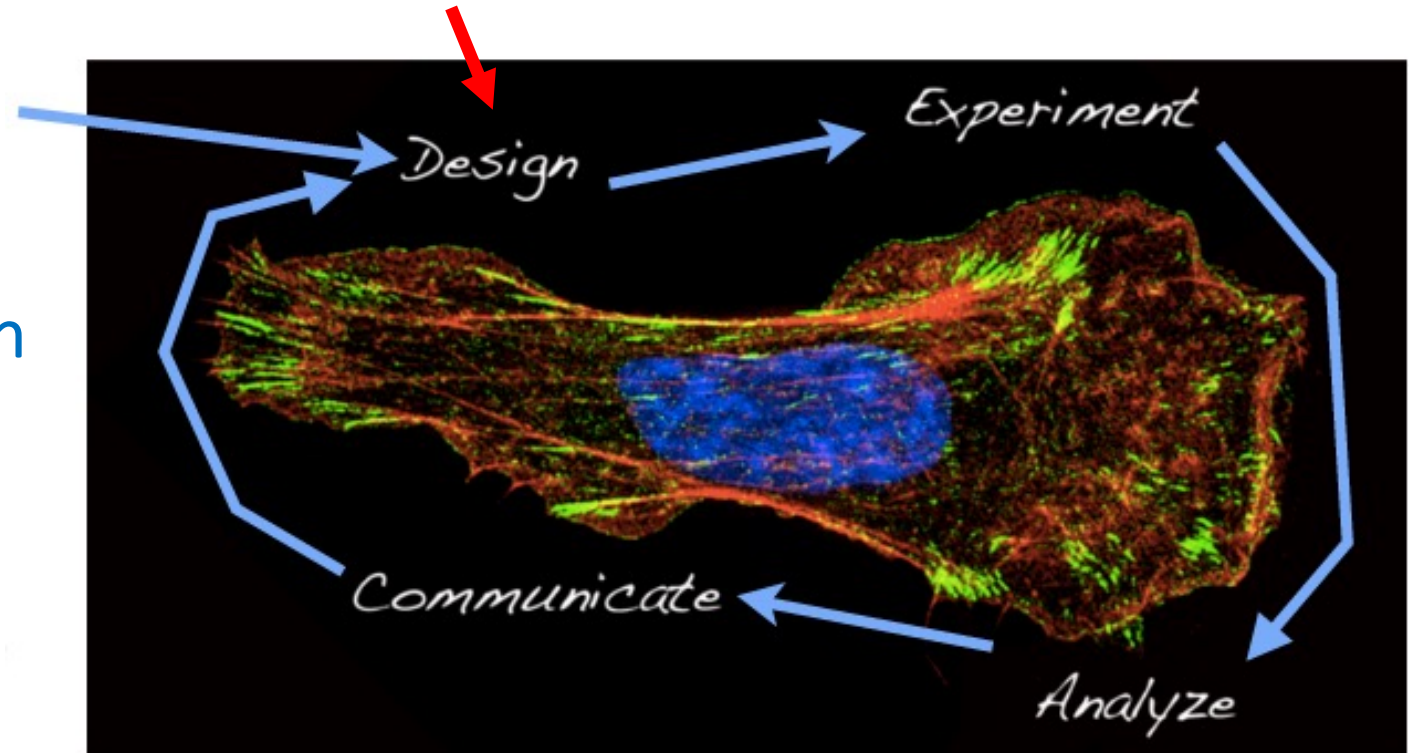


# Workflow in 20.109

## 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



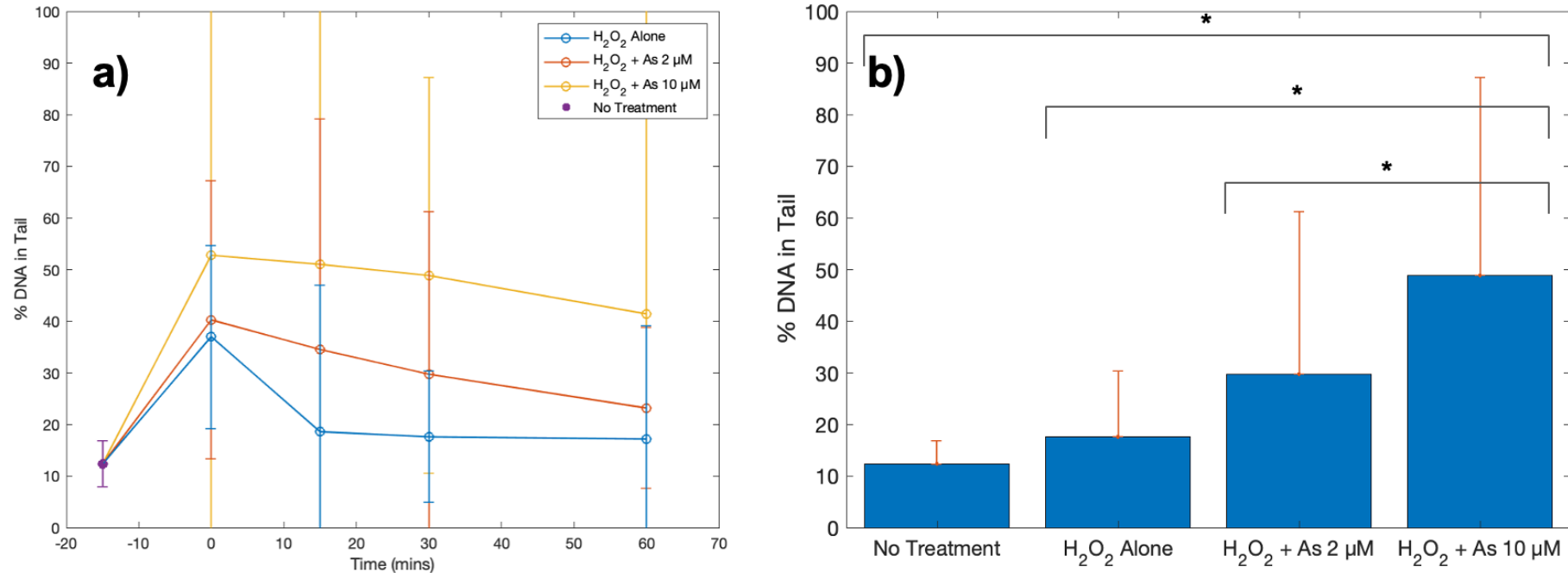
# We follow best practices

We do relevant and cutting-edge research

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



# We analyze and report data



**Figure 5. Cells exposed to combined treatments of H<sub>2</sub>O<sub>2</sub> and high concentrations of As over 60 minutes display significantly more DNA damage compared to controls a) % DNA in tail calculated for each treatment. No treatment was included as a baseline for DNA damage. b) Data from Fig. 5a at T = 30 minutes was plotted. Error bars in both plots represent the 95% confidence interval. Stars (\*) indicate statistical significance (p < 0.05) as determined using a 2-tailed Student's T-test.**

# We develop written and verbal communication skills

MODULE	TOPIC	ASSIGNMENT	WEIGHT
1	Drug discovery	Research talk	5%
		Data summary	15%
2	Protein engineering	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 required, in both lecture and laboratory
- Participation is expected
  - Laboratory exercises are completed with your partner
  - Some homework and assignments are completed with your partner