to the 20.109 lab!

Orientation (M0D0):

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

Lab-Specific Biosafety Training for 20.109

Why do we start with safety?

- This lab space contains a number of chemical and biological **hazards**
- Risk of **injury** and infection for anyone work in or visiting the lab space
- Risk of producing and releasing **environmentally dangerous** material
- Improper use and containment of hazards can also **contaminate** lab stock material and ongoing experiments

Hazards are categorized by biosafety level

- Biosafety level always posted at the door of the lab
- A combination of:
  - lab practice / technique
  - safety equipment
  - facility design
- Based on concept of “containment”
- For protection of:
  - personnel
  - lab
  - environment


BL2

What does BL2 mean?

- Suitable for work involving agents that pose **moderate hazards** to personnel and the environment.

- Organisms associated with disease that is rarely serious and often **treatable**

Why are we BL2?

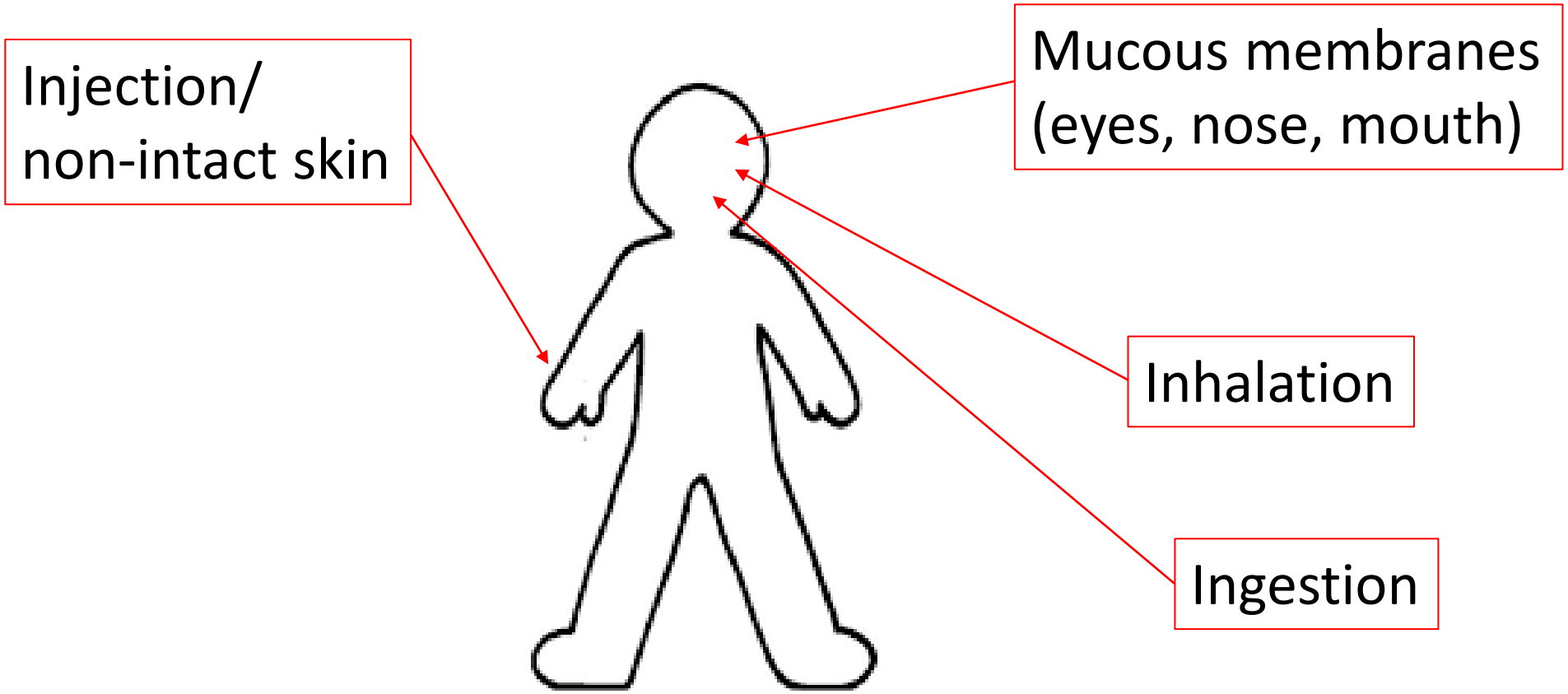
- Work with **human derived material** including established and primary human cell lines/culture.

- **Viral Vectors**: lentiviral vector, Adenoviral vector

What factors determine your risk when working in a BL2 space?

- **Infectivity**
- **Pathogenicity**
- Availability of **prophylaxis**
  - Before exposure (e.g. vaccination)
  - After exposure but before infection (e.g. antibiotics, antivirals)
- Your **health status**
  - Consult with MIT Occupational Heath or your personal physician about your research activities

Routes of exposure and transmissibility



Minimizing exposure
when working with BL2 materials

Standard Microbiological Procedures

- Restrict or limit access to space
- Wear PPE
- Wash your hands!
- Disinfect containers and surfaces

Prohibited activities

- Eating (chewing gum)
- Drinking
- Smoking
- Applying cosmetics, i.e. lip balm
- Handling contact lenses
- Avoid touching face or biting your nails

No food or drink can be stored in the lab

- In bag in cubby is fine
- Not at bench
- Must eat and drink outside the lab door

Personal Protective Equipment (PPE)

DO wear:

- Lab coat
- Gloves

DO NOT wear:

- Skirts/shorts without additional leg coverings
- Open-toed shoes

PPE should remain in the research area

- **Lab coats** should be left in the lab when leaving the room
  - To an auxiliary space to use equipment
  - To go to the TC room

- **Gloves** should not be worn when touching:
  - Phones
  - Door handles
  - Elevator buttons

- Use the “One glove rule” when carrying samples outside the lab

Carry samples in a secondary container

Secondary container

Primary container

Safe disposal
of hazardous materials in the lab

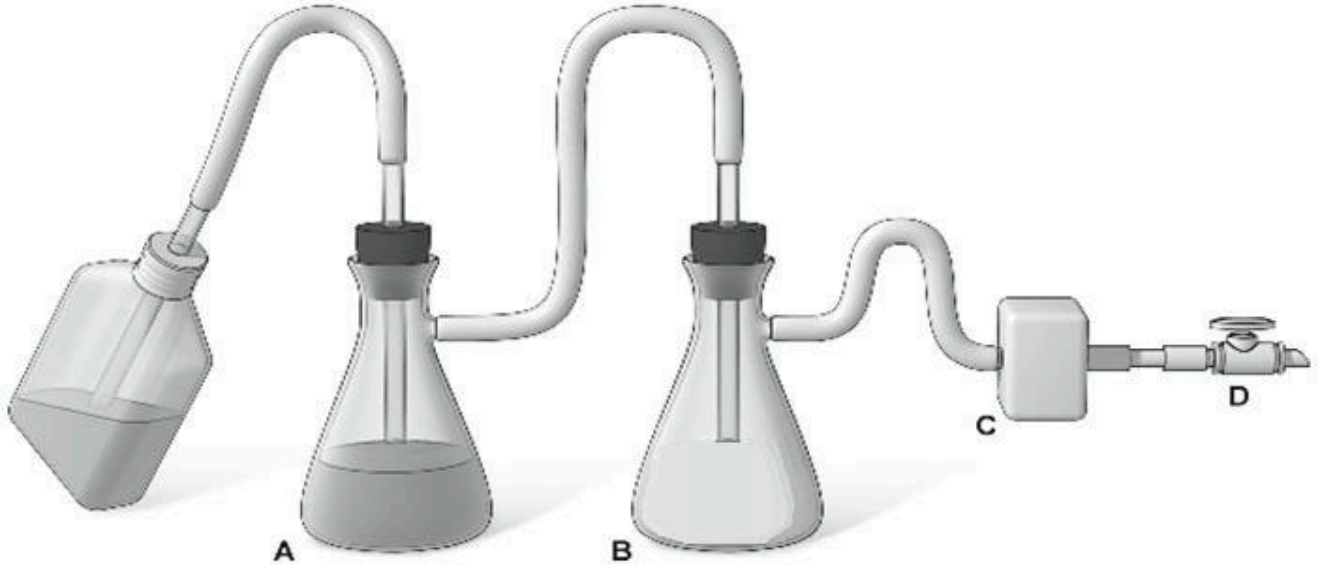
Disposing of biohazardous waste

- Researcher has responsibility for management of research material from “cradle to grave”

- Types of biological waste:
  - Liquids
  - Solids
  - Sharps

Liquid biological waste collection

- Liquid biological waste (cell media) can be aspirated into a collection flask using a vacuum pump
- These are for biological waste only
- Chemical waste is collected in jugs and disposed of separately



A = primary collection flask with disinfectant
B = overflow flask with disinfectant
C = hydrophobic or HEPA filter
D = to vacuum pump

Neutralizing liquid biological waste

- Instructors perform this task– notify us if the waste level is high

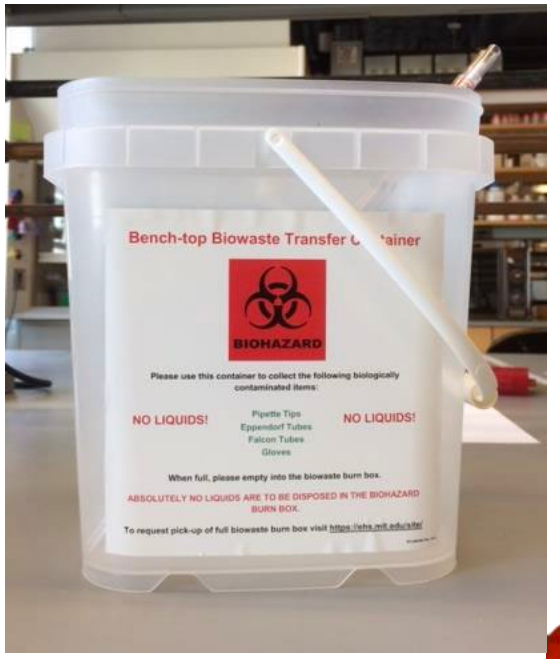
- Use chemical disinfectant
  - Clorox bleach (1:10 final volume)
  - Let sit for at least twenty minutes
  - Pour down the drain and flush with water

- Because aspirator waste is mixed with a **reactive chemical** and **disposed down the drain**, it is important not to mix in chemical waste

Solid biohazard waste

- Solid biohazard waste should be collected at the bench in biowaste transfer containers

Biowaste Transfer Container



- This includes:
  - Tubes (conical and microcentrifuge)
  - Serological pipets
  - Pipet tips
  - ALL GLOVES

- At the end of lab, transfer the contents of the transfer container to the burn box at the front of the room

“Burn Box”

Sharps disposal

- Anything that can puncture or cut the skin
  - Pasteur pipettes
  - Glass vials, slides
  - Glass culture tubes

- Dispose of **biological sharps** in red sharps bins at bench or in hood

- Dispose of **chemical sharps** in clear sharps bins (provided when needed)

- Notify instructors when bins are full

What if something goes wrong?

What if you are exposed to a biological hazard?

- If direct contact to your face or skin or if stuck by a needle or sharp
  - Immediately, wash the area with soap and water for 10-15 minutes
  - If it's in your eyes, nose or mouth, flush with water for 15 minutes
  - Tell the Instructors or TA immediately

- Go to the Medical Department (E23)

- Instructor must submit an incident report

Cleaning up biohazardous spills




- Alert instructors, put on appropriate PPE, gather spill kit and appropriate equipment
  - Remove any broken glass or sharps
  - Cover the spill with paper towels
  - Disinfect the spill: Saturate paper towels with disinfectant, let sit for 20 minutes
  - Clean up the spill and dispose of spill materials in bio box
  - Repeat steps 2-5 as needed

Emergencies

- MIT Alert http://emergency.mit.edu/mitalert/
- **617-253-1212** (fire/ injury/ police 24/7)
- Dial **100** from lab phone
- Use emergency response guide posted in the lab

Massachusetts Institute of Technology

Emergency Response Guide

EMERGENCY NUMBERS

Fire/Medical/Police call MIT Police *100 or 617-253-1212*

Facilities Operations Emergency Service Request *FIXIT 617-253-4948*

EHS After Hrs Emergency *617-253-4948* 8-5 Business Hrs *617-452-3477*

STAY CALM AND FOLLOW INSTRUCTIONS

FIRE

Immediate Action

- PULL FIRE ALARM
- Alert Others
- Evacuate
- Call MIT Police from a safe location.

Additional Information

- Do NOT use elevators.
- Close Doors as you leave.
- Feel Doors with the back of your hand. Do NOT open doors that hot.

Wait for Emergency Personnel at the Department's (Emergency Preparedness Plan) designated Waiting and Meeting Area to provide any useful information:

- Fire Location,
- What happened,
- If there are injuries, and
- Your name, location, and telephone number.

Facilities Operations Emergency

EMERGENCY SERVICE REQUESTS DIAL FIXIT (3-4948) from any campus telephone. Press "1" to speak with someone immediately.

- After Hours HAZMAT incidents
- Gas or Burning Odor
- Burst Pipe
- Elevator Entrapment
- Loss of Utilities, such as:
- Electrical
- Chilled Water
- Any situation that may pose an immediate threat of serious injury to personnel or damage to property.

Medical Emergency

FOR LIFE THREATENING SITUATIONS OR MENTAL HEALTH EMERGENCIES

Call MIT Police

Examples of life threating emergencies:

- Serious injuries or burns
- Poisoning
- Unconsciousness
- Shock

- For non-life threating situations dial MIT Urgent Care: 617-253-4481 - 24 hours/day
- Urgent care walk in service 7a.m. – 11 p.m. E23

HAZMAT Spill

MAJOR SPILL - Major hazardous material and waste spills CALL Police(100 or 617-253-1212) and also report incident to your supervisor.

MINOR SPILL - Minor hazardous materials or waste spills that present no immediate threat to personal safety, health, or the environment. Call EHS (617-252-3477)

Do You Know .....

- emergency exit locations?
- fire alarm locations?
- blue light phone locations?
- assembly area locations?
- emergency and safety shower locations?
- Your DLC's Emergency Preparedness Plan?

SCAN and GO

Active Shooter

Silence Cell Phone

RUN *(Evacuate the area if safe to do so)*

If the sound of gun shots are far away and you can safely access an exit

- GET OUT: Leave immediately and get away from the MIT Campus
- Notify MIT Police
- Get updates from www.emergency.mit.edu

HIDE *(Take immediate refuge)*

If you feel the shooter is close to you and you cannot safely exit the building

- Lock doors, use door stops, bar door with desks, turn off lights.
- Search for objects that can be used as weapons
- Call Police via land line
- MIT Police can trace where you are.

FIGHT *(Attack the shooter)*

If the shooter has entered the room you are in:

- Obtain improvised weapons (scissors, letter opener, fire extinguisher)
- Immediately attack shooter, direct your attack at his/her head/face
- Do not attempt to plead or bargain with the shooter

Threats

The person who receives the call/package/threat should remain in the area to talk to the MIT Police Officers when they arrive.

SUSPICIOUS PACKAGES

- Do not touch or disturb object
- Move to a safe location and contact MIT Police. Use a landline / NO CELL PHONE USE.
- Tell MIT Police what makes it suspicious to you.
- If told to evacuate, look around for anything else suspicious and report.

PHONE THREATS

- Remain calm and try to obtain as much information as possible from caller
- Obtain an accurate description of what the caller said and try to obtain as much information as possible. (Where, When, What, Who, distinctive speech, accent, sex, background noises)
- Record the number indicated in caller ID
- Contact MIT Police

See Something - Say Something

Revision 1, Date: 5/19/2015

This concludes 20.109 lab-specific safety training

In the next lab…

- You will be given a sign in sheet that indicates you have completed this training

- You will provide:
  - Your name
  - Your MIT ID number

Introductions

- What year are you at MIT?
- Do you have any research experience you want to share?
- Do you have any interesting hobbies you'd like to share?

OR

- What is something interesting you did/saw this summer?

Where can you find the instructors?

- Noreen Lyell
  - Office: 16-317
  - Email: nllyell@mit.edu
- Becky Meyer
  - Office: 16-319
  - Email: rcmeyer@mit.edu
- Jamie Zhan
  - Office: 16-469
  - Email: 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!**

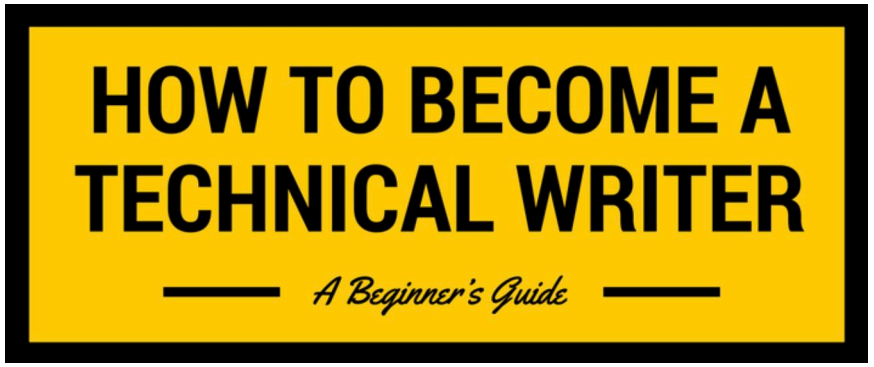
Key deadlines this semester

Assignment	% final grade	Due date
Research talk	5	9/30
Data Summary	15	10/11 (draft), 10/21 (revision)
Journal article presentation	15	10/24 or 10/26
Research article	20	11/20
Research proposal presentation	20	12/7
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!



- A chance to **practice** technical/ scientific writing
  - Technical writing is a very specific style
  - Requires conciseness, clarity, and precision

- Each piece of homework will become a **component of a major assignment**
  - 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 Canvas
  - 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

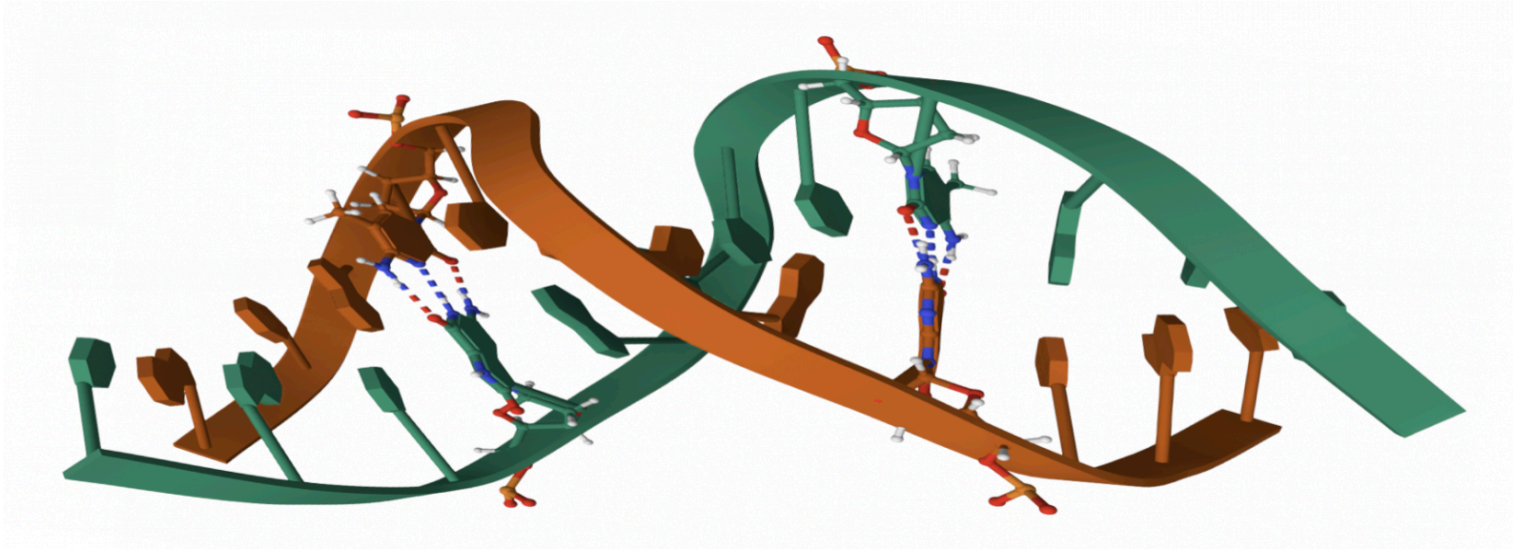
- **Laboratory attendance is mandatory**
  - Excused absences should be discussed with the Instructors as soon as possible.
  - Unexcused absences = 1/3 of a letter grade deduction from the final grade on the major assignment for the module (for example, a B+ would become a B).
    - If absent, you may 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(F23):Fall_2023_schedule

20.109(F23): Laboratory Fundamentals of Biological Engineering



Fall 2023 schedule FYI Assignments Homework Class data Communication Accessibility

M1: Genomic instability M2: Drug discovery 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
	R/F Sep 7/8	NLL Lecture slides	Orientation and laboratory tour	
M1D1	T/W Sep 12/13	BPE	Learn best practices for mammalian cell culture	**Orientation quiz** Homework due
M1D2	R/F Sep 14/15	BPE	Prepare and treat cells for γH2AX experiment	Homework due
M1D3	T/W Sep 19/20	BPE	Use immunoflourescence staining to assess γH2AX experiment	Homework due
	R/F Sep 21/22	BE Comm Lab	**Career Day holiday**	
M1D4	T/W Sep 26/27	BPE	Complete data analysis for γH2AX experiment	**Laboratory quiz** Homework due
M1D5	R/F Sep 28/29	BPE	Treat cells for CometChip assay	Homework due **Research talk due** Sat, Sep 30 at 10 pm
M1D6	T/W Oct 3/4	BPE	Image and analyze data for CometChip assay	Homework due
M1D7	R/F Oct 5/6	BPE	Examine experimental data using statistical methods	**Laboratory quiz** Homework due
	T/W Oct 10/11		**Indigenous Peoples' Day holiday**	**Data Summary draft due** Wed, Oct 11 at 10 pm [Blog post due] Thu, Oct 12 at 10 pm

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 Canvas by 1:05pm

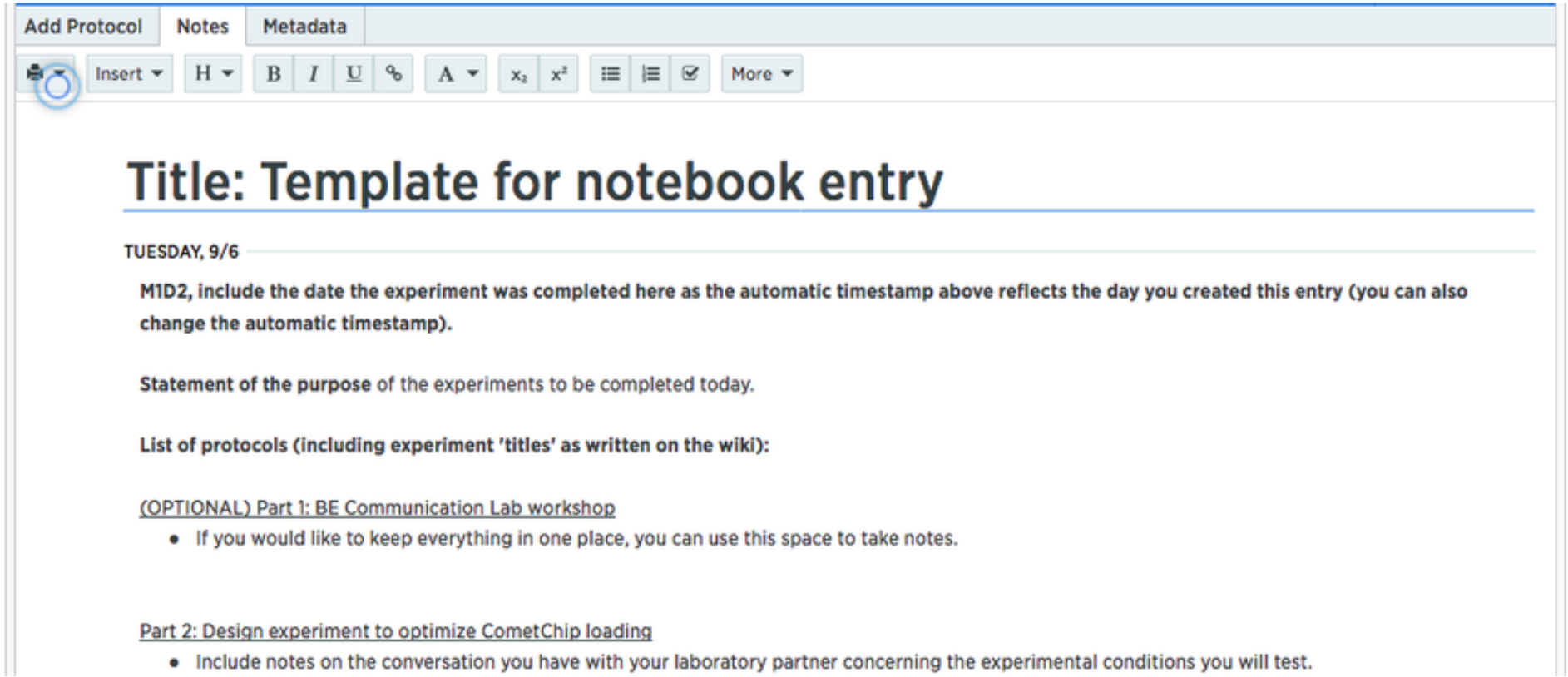
- **Participate** in interactive prelab discussion
  - Typically 15-45 minutes with focus on experimental details

- 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(F23)_YourName”
  - Make each module a new folder
  - Make each day a new entry within the appropriate module folder
- Share with your Instructor and TA

Jamie (zhanj@mit.edu) and
Bishal Thapa (bishalt@mit.edu)



Remember your personal protective equipment (PPE)

Item	Worn (BE guidelines)
Gloves 	- When working with chemical or biological materials ➢ Change when entering tissue culture room!
Lab coat 	- When working with chemical or biological materials ➢ Change when entering tissue culture room!
Goggles 	- When handling large quantities of powder or liquid due to chance of splash - When pipetting toxic chemicals (mutagens) - When using ethanol burners - In conjunction with face shield at UV transilluminator

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(F23):Laboratory_tour

- Orientation quiz on M1D1!

For M1D1:

- Prepare for orientation quiz

- Complete homework assignments (see ‘Homework’ tab on wiki)
  http://engineerbiology.org/wiki/20.109(F23):Homework
  – Complete, screen capture EHS training certificate(s) and submit to Canvas
  – Read Mod1 overview page and M1D1 introduction