

Welcome to 20.109


Laboratory Fundamentals of
Biological Engineering

Orientation Lecture
Fall 2012

20.109
Laboratory Fundamentals of Biological
Engineering

“The most important class you’ll take @ MIT”

“Directing attention not only to
what we teach but also to how
we teach as well as to how and
where our students learn”



Expectations

Some of your expectations of us

- that we will come to class and lab prepared
- that our assignments are clear and reasonable
- that we will treat every 109er with respect
- that we will give everyone equal chance at success

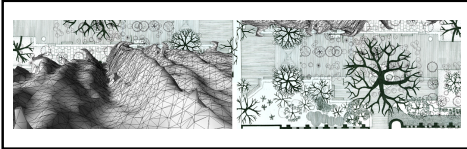
Some of our expectations of you

- that you will come to class and lab prepared
- that you will not interfere with each other’s learning
- that you will invest the very best of yourself
- that you will offer honest and frequent feedback

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Course Mission

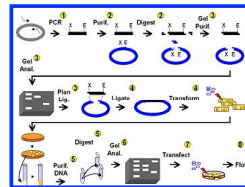
- To prepare students to be the future of Biological Engineering
- To teach cutting edge research skill and technology through an authentic research experience
- To inspire rigorous data analysis and its thoughtful communication



[openwetware.org/wiki/20.109\(F12\)](http://openwetware.org/wiki/20.109(F12))

- Module 1 DNA Engineering
- Module 2 System Engineering
- Module 3 Biomaterials Engineering

DNA Engineering: GFP recombination vector



Experiments

- Design and create vectors for expressing fluorescent protein in mouse embryonic stem cells
- Use fluorescence to analyze recombination of variously damaged DNA substrates

Lab Skills

- Retrieve and manipulate sequences from databases
- Clone PCR-amplified DNA fragments
- Transfect mammalian cells
- Flow Cytometry

System Engineering: Bacterial photography



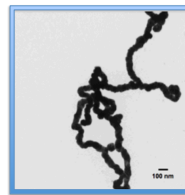
Experiments

- Measure bacterial photography output
- Screen library for mutations that increase dynamic range of system
- Identify amino acid changes and their consequences

Lab Skills

- Optimize a system
- Genetic screen
- Western analysis
- Sequence analysis
- β -gal assay

Biomaterial Engineering: Phage solar cell



Experiments

- Mineralize phage surface
- TEM to visualize
- Assemble solar cell
- Measure performance

Lab skills

- Phage material production
- Fabrication of bio-based device
- Effect of variation: Ratio of SWNTs to phage

Course Details

Lecture Tuesdays and Thursdays 11-12, 16-220

Lab Tuesdays and Thursdays 1-5, 56-322
 Wednesdays and Fridays 1-5, 56-322

There are no "make-up" labs

You will perform experiments in pairs

Assignments can be worked on together but submitted individually

"Celebrations of learning"

Module	Oral communication concentration	Written communication concentration
1		
totals 20% of final grade		
	Lab certifications (10%)	Lab certifications (10%)
	Online cloning lab and defense (5%)	M1 ppt summary and notes (10%)
	FACS data analysis and defense (5%)	
2		
totals 35% of final grade		
	Slides for Journal Club Presentation (10%)	Slides for Journal Club Presentation (10%)
	Journal Club Presentation (10%)	Full Research Article (25%)
	Results and Discussion (15%)	
3		
totals 25% of final grade		
	Written Research Pre-Proposal (10%)	Written Research Pre-Proposal (10%)
	Oral Presentation of Research Proposal (15%)	Written Research Proposal (15%)

5% Daily Lab Quizzes

10% Lab Notebooks

5% Blog and Summary

"what we learn to do we learn by doing..."