

Welcome to 20.109

Laboratory Fundamentals of  
Biological Engineering

Orientation Lecture

Fall 2008

# 20.109

## Laboratory Fundamentals of Biol Eng

- Reality is complex
  - Teaching is not the same as learning
  - Studying is not the same as learning
- We see you as men and women, not boys and girls
  - Risk taking is OK
  - Mistakes are OK

# 20.109

## Laboratory Fundamentals of Biol Eng

### 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

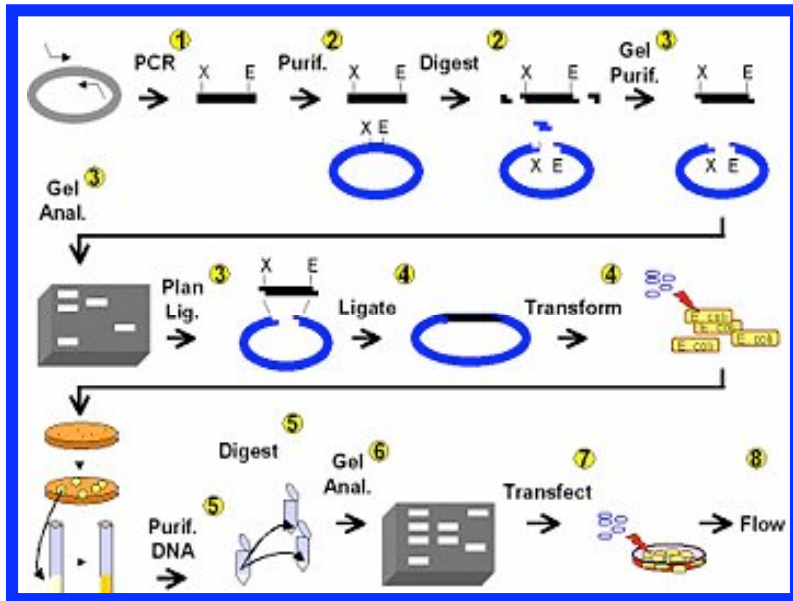
## 20.109(F08): Laboratory Fundamentals of Biological Engineering



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

[openwetware.org/wiki/20.109\(F08\)](https://openwetware.org/wiki/20.109(F08))

# DNA Engineering: GFP recombination vector



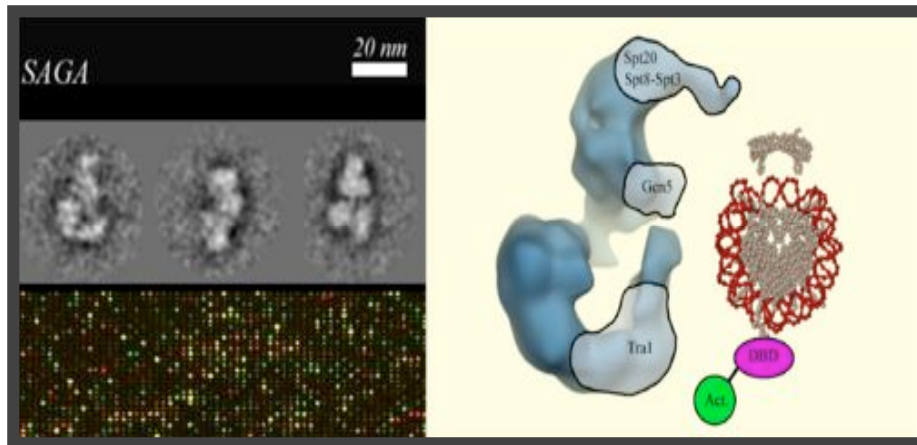
## Experiments

- 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

# Protein Engineering: SAGA TAP-tag



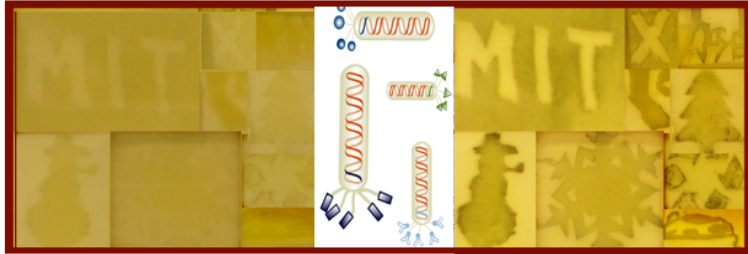
## Experiments

- Affinity tag protein of choice in yeast genome
- Verify modification
- Compare modified and parental genome for unexpected consequences

## Lab Skills

- Transform and select yeast cells
- PCR verification of genomic changes
- Western analysis
- Phenotyping
- Microarray expression analysis

# Biomaterial Engineering: Phage-based ECD



## Experiments

- Grow iridium nanowires on phage surface
- Pattern indium tin oxide slide
- Electrodeposit phage nanowires
- Overlay solid polymer electrolytes

## Lab skills

- Phage material production
- Fabrication of bio-based device
- Design and variation of experimental conditions

# 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



# Course Details

**Lecture** Tuesdays and Thursdays 11-12, 66-168

**Lab** Tuesdays and Thursdays 1-5, 56-322

Wednesdays and Fridays 1-5, 56-322

**There are no “make-up” labs**

**Work must be turned in on time**

reports, homework: at beginning of lab

lab notebook pages: at end of lab

**You will perform experiments in pairs**

**Assignments can be worked on together but submitted individually**

# “Celebrations of learning”

50% Written Work

Modules 1 and 2

30% Oral Presentations

Modules (2 or 3) and 3

10% Homework Assignments

5% Daily Lab Quizzes

5% Lab Notebooks

Module	Topic	Assignment	% of Final Grade
1	<a href="#">DNA Engineering</a>	<a href="#">lab report</a>	20
		<a href="#">"P3"</a>	5
2	<a href="#">Protein Engineering</a>	<a href="#">research article</a>	25
3	<a href="#">Biomaterial engineering</a>	<a href="#">oral presentation of research idea + written text</a>	20
Journal Club	Module <a href="#">2</a> or <a href="#">3</a>	<a href="#">oral presentation</a>	10

# Foundations/Skills

- **Basic Laboratory Skills**

  - following and designing protocols

  - first-hand experience with equipment and procedures

  - how to keep a lab notebook

- **Robust Quantitative Analysis of Data**

  - statistical analysis when appropriate

  - repetition of protocols to assess quality of findings

  - effect of experimental perturbations on outcome

- **Verbal and Written Communication**

  - two oral presentations

  - two written reports

- **Critical Thinking**

  - analysis and discussion of primary scientific literature

“what we learn to do we learn by doing...”