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

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
Lab Skills
• Transform and select yeast cells
• PCR verification of genomic changes
• Western analysis
• Phenotyping
• Microarray expression analysis

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

Protein Engineering: SAGA TAP-tag
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

<table>
<thead>
<tr>
<th>Module</th>
<th>Topic</th>
<th>Assignment</th>
<th>% of Final Grade</th>
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<tbody>
<tr>
<td>1</td>
<td>DNA Engineering</td>
<td>lab report</td>
<td>20</td>
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<td>&quot;P3&quot;</td>
<td>5</td>
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<td>2</td>
<td>Protein Engineering</td>
<td>research article</td>
<td>25</td>
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<td>3</td>
<td>Biomaterial engineering</td>
<td>oral presentation of research idea + written text</td>
<td>20</td>
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<td>Journal Club</td>
<td>Module 2 or 3</td>
<td>oral presentation</td>
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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…”