Welcome to 20.109
Laboratory Fundamentals of Biological Engineering

Orientation Lecture
Fall 2010

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

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

openwetware.org/wiki/20.109(F10)

Module 1  DNA Engineering
Module 2  System Engineering
Module 3  Biomaterials Engineering
System Engineering: Bacterial photography

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

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

Biomaterial Engineering: Phage battery

Lab skills
- Phage material production
- Fabrication of bio-based device
- Effect of variation: % Au vs %Ag

Experiments
- Grow gold nanowires on phage surface
- TEM to visualize
- Measure capacity

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, 4-153
Lab       Tuesdays and Thursdays 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”

45% Written Work  Modules 1 and 2
30% Oral Presentations  Modules 2 and 3
10% Homework Assignments
5% Daily Lab Quizzes
5% Lab Notebooks
5% Blog and Summary

45% Written Work

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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
  three written reports

• Critical Thinking
  analysis and discussion of primary scientific literature

<table>
<thead>
<tr>
<th>Module</th>
<th>Topic</th>
<th>Assignment</th>
<th>% of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DNA Engineering</td>
<td>Progress Report</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>System Engineering</td>
<td>Research Article</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Biomaterial Engineering</td>
<td>Oral presentation of research idea &amp; written text</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Journal Club</td>
<td>First Presentation</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Journal Club</td>
<td>Final Presentation</td>
<td>15</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>Blog &amp; Summary</td>
<td>5</td>
</tr>
</tbody>
</table>

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