## HHMI CURRICULUM DEVELOPMENT: BIO 292 Tutorial: Evaluating/Developing a Bioinformatics Laboratory Exercise for BIO 101

### Inputs
- Faculty member responsible for initial selection/development of bioinformatics laboratory exercise: J. Caldwell (J.E.C.)
- Undergraduate Student to carry out and evaluate exercises through Bio 292 tutorial: L. Correia (L.C.)
- Potential laboratory exercises selected and modified from publications by the Association for Biology Laboratory Education (ABLE) and commercially available kits.
- Learning goals and existing curriculum in BIO 101 lecture and laboratory. (The new laboratory exercise will complement these.)
- Existing BIO 101 laboratory equipment, including computers, glassware, plant growth lights, and gel electrophoresis equipment.
- Existing departmental laboratory equipment, including thermocycler and protein gel electrophoresis equipment.
- HHMI funding for laboratory supplies to be used in piloting/developing exercises
- HHMI stipend to J. Caldwell for course development
- Other Biology faculty who teach BIO 101 (expert evaluators, who will help us select the final exercise(s) to be used in BIO 101): A. McGrain, J. Kilgore, A. Lee
- CURE survey to evaluate effect of Bio 292 tutorial on student (L.C.) learning

### Strategies
- Develop a rubric for evaluating potential laboratory exercises, including student learning outcomes, student understanding of the nature/process of science, and exposure of students to new techniques.
- Pilot various published exercises/kits and evaluate using the rubric.
- Alter and/or combine various exercises to better fit rubric and learning outcomes.
- Weekly meetings between student (L.C.) and faculty mentor (J.E.C.) to review progress and plan next steps.

### Outputs

#### From Student (L.C.):
- Rubric for use in evaluating lab exercises.
- Completed rubric comparing set of five exercises.
- Modified instructions for laboratory exercises, as needed.
- Poster presenting the rubric and overview of selected exercises.
- One or two “best” exercises recommended for rewriting for laboratory manual.
- Pre- and post-survey responses to CURE survey. Particular attention will be paid to significant changes in student’s responses to “opinions about yourself and science”

#### From Faculty (BIO 101 instructors):
- Evaluation and comments regarding student’s poster presentation and laboratory exercises.

#### From Faculty (J.E.C.):
- Final writeup of exercise for Bio 101 manual.

### Outcomes

#### (Short Term-Learning)
- Student (L.C.) gains understanding of research process (evaluated by comparing CURE pre-/post-survey responses).
- Student gains confidence in ability to work independently and do research.
- Faculty member (J.E.C.) gains experience in mentoring student research.

#### (Medium Term-Action)
- Specific
  - New laboratory exercise(s) written for Biology 101.
  - Student (L.C.) continues in research activities through internships and/or work with W&J faculty.
  - Rubric available for evaluating other laboratory exercises.

#### (Long Term-Conditions)
- Broad
  - Bio 101 students gain understanding of bioinformatics, biotechnology, and the nature of the scientific process.
  - Bio 101 students gain basic competence with computational bioinformatics tools.
  - Increased student interest in biology lab courses.

- Student (L.C.) may pursue further research experience through graduate study.

- Students who complete Bio 101 are able to apply basic techniques in bioinformatics and biotechnology to upper level coursework and research projects.
- Increased level of student interest and enrollment in advanced courses on bioinformatics and molecular biology.
<table>
<thead>
<tr>
<th>Evaluation Questions for OUTCOMES</th>
<th>Possible Indicators/Measures</th>
<th>Possible Data Collection Methods and Information Sources</th>
<th>Rank/Priority (include brief rationale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How effective was the curriculum development activities in (a) Developing/identifying an appropriate laboratory exercise? (b) Enhancing the student’s learning and understanding of the research process?</td>
<td><strong>Short term (Bio 292 tutorial):</strong> One exercise stands out as clearly superior and is implemented in Bio 101. From CURE pre-/post-surveys: Student (L.C.) becomes more confident in her abilities as a researcher. Student expresses gains in her level of understanding of the research process. Faculty comment favorably about student’s poster presentation. Faculty express interest in new laboratory exercise. <strong>Longer term (Bio 101 curriculum):</strong> 1. Students positive about new curriculum 2. Students increased interest in bioinformatics</td>
<td><strong>Short term (Bio 292 tutorial):</strong> Completed rubric for 6 lab exercises Biology faculty comments regarding student’s poster CURE pre-/post-survey responses from student (L.C.) Student’s future research experiences (further Bio 292, independent study, internships) <strong>Longer term (Bio 101 curriculum):</strong> Course evaluations from Academic Affairs for Bio 101. Enrollment in bioinformatics course in 2011-2012 (taught by new hire)</td>
<td>Items are ranked based on how soon they can be captured during and after program activities (strategies) have occurred. Near-term assessment for assessing effectiveness in course and curricular changes can be performed primarily through feedback from students and faculty. Longer-term effects can be assessed by changes adopted by department and institution. Overall impact can be determined by long-term effect within and outside the institution.</td>
</tr>
</tbody>
</table>