Learning by Doing: A year in the Phage Genomics Laboratory at Oregon State University

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Implementation of the Phage Genomics Laboratory

Our guiding principle motivating the implementation of the Phage Genomics laboratory (PGL) was to have students engage in a primary research experience early in their undergraduate experience.

- The PGL was one of two Honors laboratories associated with a large, year-long Introductory Biology course, Principles of Biology BT 211, 212 and 213.
- Freshman and sophomore Honors and at-risk students applied for the course and fourteen were accepted into the laboratory.

Course timeline

| Collect samples | Isolate, purify phage, extract DNA | 9/30 |
| Colbert genome to JGI | Electron microscopy - phage morphology | 12/03 |
| Final Colbert genome sequence | Final Colbert genome archived | 3/10 |
| Phage projects completed | 3/31 |
| Team projects completed | 6/02 |

Fall term:

- Students were immersed into wet lab from the first day.
- We started each session with short demonstrations and lectures to introduce techniques.
- Students gave oral updates on their weekly experimental progress.
- We provided lists of one-on-one and small group support until students become adept at the techniques and trouble shooting their own problems.

Winter term:

- Introduced research papers for discussion and instruction.
- Provided instruction on molecular biology and computational analysis because these topics were not part of their course sequence.

Spring term:

- Each pair of students annotated segments of the genome.
- The entire class held an annotation ‘jamboree’, modeled after those held for other genomes.
- Following Phanerorute-based gene family analysis, the students conducted a module on molecular evolutionary analysis for gene families in Colbert using Molecular Evolutionary Genetic Analysis (MEGA) and DNA Sequence Polymorphism (DNA SP) programs in order to assess whether natural selection might be acting on particular genes.
- Students selected one of four possible task force teams and completed the projects.

Conclusions:
1. All of the students enrolled in the Fall term were retained through the entire 3-term sequence.
2. A third of the students have entered research laboratories to pursue additional research experience. Two students were awarded competitive summer HHMI Research fellowships.
3. Students performed well on the lecture examinations even though they had a different laboratory experience from other students in the class.
4. Students worked hard, rolled with the punches, had a good sense of humor, were cooperative and collaborative. They were very productive.
5. They communicate with each other outside of the laboratory and classroom setting.