Building the foundation of a research-rich curriculum

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We want our graduates to:
- understand the process of scientific inquiry
- be independent learners
- recognize that ‘facts’ are hypotheses well-supported by evidence
- be able to draw appropriate conclusions from evidence
- understand what kinds of issues are amenable to scientific inquiry and what kinds are not
- be able to collaborate effectively

Like many of you, we try to achieve those goals by emphasizing student-designed, inquiry-driven laboratories

BUT how do we assure that student investigations aren’t poorly conceived or executed?

Investigations in Ecology and Environmental Science (Bio 141)
Investigations in Genetics and Evolutionary Biology (Bio 151)
Investigations in Cell and Molecular Biology (Bio 200)

Their labs involve extensive student group-designed projects for which we:

1: Use lecture time to teach experimental design and data analysis
2: Introduce primary literature
3: Provide feedback on projects prior to execution
4: Monitor progress of experiments
5: Assign written reports to be drafted in stages, with revision
6: Assign oral presentations of results, with emphasis on “research lessons learned”

Effect of Boiling on Growth Rate in E. coli

Do Flip-Flops Cause Cancer? An Experimental Study

Investigation: For multi-week projects, students write Introduction and Methods before obtaining Results. Instructor critiques these and students revise them. Student groups outline Introduction, Results, and Discussion sections in lab (with instructor feedback) to assure common understanding, enrich collaborative interpretation, and reduce “you write section A and I’ll write B” discontinuities.

Acknowledgements
I am grateful to:

My biology colleagues at Lewis & Clark for their insight, enthusiasm, and dedication to our students and success in teaching, business, law, etc. where they can use their analytical and learning skills to good effect.

Students feel that the introductory courses prepare them well for more sophisticated research in advanced courses (though there is still room for improvement; e.g., Biology 151 - Genetics and Evolutionary Biology)

For further information
Please contact me: reiness@lclark.edu. More information on the biology program can be obtained at http://www.lclark.edu/college/department/biology

Student Outcomes
- Projects in upper-division courses are sound and sophisticated, often leading to long-term projects and senior theses.
- Interest in opportunities to collaborate on research with faculty has explosively increased. 17 students since 2004 have presented at national meetings of disciplinary societies; one won the best student presentation prize and 3 were runners-up (vs. graduate student competitors)
- Many students have been accepted into top graduate and medical schools; others have chosen non-research careers in teaching, business, law, etc. where they can use their analytical and learning skills to good effect.
- Students feel that the introductory courses prepare them well for more sophisticated research in advanced courses (though there is still room for improvement; e.g., Biology 151 - Genetics and Evolutionary Biology)

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An obligatory “Students at Work” photo

Data from senior biology major exit surveys, in which students are asked to evaluate the efficacy of introductory courses in preparing them for advanced labs and research.

We lay a foundation for research in the first-year core courses...

Effect of Boiling on Growth Rate in E. coli

Do Flip-Flops Cause Cancer? An Experimental Study

Abstract:
We attempted to train C57Bl/6 mice to wear teeny flip flops in order to test our hypothesis that flip-flop wearing would increase the frequency of foot cancer. Unfortunately...