Implementing Curricular Changes

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How to Best Serve Our Graduate Students?
Our Big Goals

- Focus on teaching process & skills, instead of content & facts
- Instruct and develop student confidence finding & assessing information & content
- Provide foundational introduction to performing rigorous & reproducible experiments before entry into the PhD lab
- Prepare for diverse career paths
Some Guiding Resources

- **Experimental Design for Biologists**
- **Experimental Design for the Life Sciences**
- **Sorting Out the FACS: A Devil in the Details**
- **Data visualization, bar naked: A free tool for creating interactive graphics**
Our New Curriculum

Program Learning Outcomes:

• Critically evaluate experiments, results & interpretations in scientific literature
• Identify key questions, formulate hypotheses & design rigorous experiments to test them
• Appreciate different approaches to tackle scientific problems
• Employ quantitative analysis & appropriate statistical tests
• Communicate effectively & debate respectfully
• Value diversity in classes & on research teams
• Prepare for diverse career paths
Our New Curriculum – Year 1

- BIOL 200A: Critical Analysis of Scientific Literature
  How to read papers
- BIOL 200E: Experimental Design
  How to design experiments
- BIOL 200F: Logic & Approaches to Scientific Discovery
  How to think scientifically
- BIOL 215: Applied Statistics in Biology
  How to analyze data
- BIOL 288: Pedagogy in STEM
  How to teach science
- BIOL 289: Practice of Science (RCR)
  How to be a responsible & ethical scientist
BIOL 200A: Critical Analysis of Scientific Literature

Course Learning Outcomes:

• Critically evaluate experiments, results & interpretations in scientific literature
• Appreciate different approaches (e.g. genetics, biochemistry, bioinformatics) used to tackle scientific problems
• Identify flaws in logic, methodology, and/or analysis
• Communicate effectively & debate respectfully
• Challenge authority
• Become active learners & develop teamwork skills
Course Learning Outcomes:

• Appreciate different systems & approaches used to tackle scientific problems

• Identify key questions, formulate hypotheses & design rigorous experiments to test them

• Understand the importance of controls, numbers & types of replicates, reagent validation, bias, confounding variables, and employing appropriate statistical tests

• Recognize the importance of recording experimental details & data analysis, to enable others to reproduce the study
BIOL 200F: Logic & Approaches to Scientific Discovery

Course Learning Outcomes:

• Identify key unanswered questions in 5 broad areas of biomedical science (e.g. gene expression, genomics, protein structure & function, cell signaling, neurobiology)
• Focus on the logic behind approaches & experiments
• Appreciate the use of multidisciplinary tools & approaches and their strengths & limitations
• Develop problem-solving skills using logic & deduction
• Develop communication & teamwork skills
BIOL 215: Applied Statistics in Biology

Course Learning Outcomes:

• Determine an appropriate sample size for an experiment
• Identify a statistical test appropriate for a given dataset
• Given a statistical test & a dataset, calculate statistical significance
• Interpret the results of statistical tests, including significance & non-significance
• Display & communicate results
• Critique others’ analyses & conclusions
BIOL 288: Pedagogy in STEM

Course Learning Outcomes:

• Appreciate different ways of learning & teaching
• Develop effectiveness as mentors & instructors
• Promote equity & inclusion in the classroom and on research teams
• Develop communication & teamwork skills
• Develop a sample TA-led lesson

Melissa Jurica
BIOL 289: Practice of Science (RCR)

Course Learning Outcomes:

• Consider ethical issues in science
• Learn how to record experiments & results and store data
• Gain insights into writing, publishing & reviewing papers, including authorship & collaborations
• Learn what constitutes academic misconduct (e.g. plagiarism, manipulation of experiments & images, falsification of data) & how to avoid it
• Realize the importance of diversity, equity & inclusion in the scientific enterprise
BIOL 290: Career Planning
Usually in Year 3

Course Learning Outcomes:

• Learn about different career options
• Explore different career paths with visiting experts
• Visit a start-up company
• Learn how to give an “elevator talk”
• Use our Bay Area Biotech database & UCSC MCDB Alumni database for further career exploration

Visit poster #55 at this meeting
Evaluating the Impact of Our Revamped Curriculum

Metrics of success:

• In classes, display skills in critical thinking, problem solving, experimental design & data analysis

• Develop comfort & confidence seeking content, evaluating papers, developing a research project & giving research talks

• Stronger student performances in the Qualifying Exam & 3rd year talk

• Positive feedback from PIs on student research progress: experimental design, independence, rigor, statistical analysis

• Publish more significant-contribution papers

• Shorter time to PhD

• Pursue a satisfying science career after graduation
Thanks to the Curriculum Revamp Team

Joshua Arribere
Needhi Bhalla
Rohinton Kamakaka