

## **“Cookbook to Koch”-- Integrating research design into an immunology lab to stimulate meaningful learning**

Advanced labs in microbiology have a goal of introducing new and sophisticated techniques to students. Often the temptation is to move through these in a cookbook fashion. As part of an HHMI funded endeavor to engage students in meaningful learning of host pathogen interactions, we have transformed the design of an advanced immunology lab course from cookbook to active engagement.

Our design has three specific aims:

1. Learning of standard immunological techniques
2. Understanding the theory and use of the methods
3. Application of the methods to a research problem

Aim 1 is achieved by teaching methodologies as is typically done in a lab course. Aims 2 and 3 are achieved by placing the use in the context of research design – either from published articles or as developed by the students. Throughout the semester students are given introductory sections of three research papers from which they identify the research questions. They propose techniques (from those that they had learned) that would be appropriate to address the questions. After each, students discuss their ideas and then read the complete article assessing the approach taken by the authors. To culminate this experience and further satisfy Aim 3, student groups receive an authentic research problem. Students define a research question and apply their understanding of methods by developing and implementing a research design. Students present projects in a poster session. We will report on our teaching approach, and the assessment of student learning, engagement, and understanding of methodologies in context of host-pathogen interactions and research design.