Assessing Inquiry Process Skills in the Lab
Using a Fast, Simple, Inexpensive Fermentation Model System

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ncorporating inquiry-based learning in the college-level introductory biology laboratory is challenging because our labs serve the dual purpose of providing a hands-on opportunity to explore content while also emphasizing the development of scientific process skills. Time limitations and variations in student preparedness for college further constrain our ability to offer a discovery-based, student-centered lab experience. At West Chester University, the Introductory Biology course serves both majors and non-majors and has a large enrollment (300/year) with multiple laboratory sections and a steady stream of new instructors. We have learned to balance our goals to teach content while engaging students in the inquiry process through activities called “inquiry-based challenges.” Challenges are performance-based laboratory assessments that allow students to demonstrate problem-solving skills when presented with a problem in context. Here we describe a rapid, inexpensive modification of a traditional fermentation lab that should improve the ability of teachers to incorporate this lab within a limited time frame. More importantly, we introduce a template for inquiry-based challenge activities that can be modified and used to assess problem solving, experimental design, and data analysis abilities of students at many levels.

The yeast fermentation lab is typically used in both high school and college level introductory courses to teach about substrates, products, enzymes, and metabolic pathways. There are numerous variables that can be tested in this model such as the role of pH, temperature, substrate type and concentration, detergents, and metabolic inhibitors (Tatina, 1989; Reinking et al., 1994; Leonard, 2003; Collins & Bell, 2004). The experimental setup is simple and can be performed at a variety of levels without major expense. One limitation to the procedure, however, is the time required for the experiment when large volumes are used. Typically the experiments take up to one hour to complete and students are often spending that time waiting to collect results (Collins & Bell, 2004).

We have developed a yeast fermentation experiment using capillary tubes that minimizes time and increases student participation in the experiment. Numerous variables can be tested yet the time required to set up and test any variable is reduced from hours to minutes using this approach. The major advantage of this rapid method is that it allows time for students to complete and discuss the results of a planned experiment, followed by a performance-based assessment using inquiry process skills. The "inquiry-based challenge" assessments allow students to work cooperatively to solve the problem.

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