"Real-Life" Biochemistry Projects

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FOR THOSE OF YOU WHO do not teach labs, you may wonder what the goal of a laboratory course is. Believe it or not, this is something that not all scientists agree on! For upper-level labs such as Chem 352 (Biochemistry Laboratory), I believe there should be several goals. I want students to learn lab techniques, obtain reinforcement for concepts from lecture, see some aspects of "real-life" biochemistry, and learn how to interpret data and write better lab reports. Trying to ensure that the laboratory does this sometimes seems like a huge undertaking. How can one perform real-life biochemistry projects (which utilize many different techniques and concepts) without a knowledge and mastery of basic techniques? Yet, students think that just learning the "basics" is boring. We are currently trying to integrate learning of basic laboratory skills with longer projects. It was with this in mind that I applied for Faculty Development grant money. Also, with the conversion to semesters we are planning to have a project-oriented biochemistry laboratory which students may take after completing the required basic lecture/laboratory course.

Many "real-life" biochemistry projects involve working with mammalian cell lines that are transfected with DNA in order to produce the particular protein one wishes to study. Studies with transfected cells may deal with questions of protein function, regulation, drug metabolism, etc. With money from my department and the Faculty Development Award, a carbon dioxide incubator and supplies for projects were purchased. This has allowed us to begin to maintain a mammalian cell culture line in our labs. Currently students doing Directed Study (Chem 400) have learned techniques involved in maintaining cells and using them in experiments. Cell culture techniques are a valuable skill to have if one plans to obtain a job doing biochemical work. This skill is particularly valuable to pharmaceutical companies because they can do many experiments in transfected cells that would have previously required animal research. While I hope to have projects of this type in Chem 352 in the future, I am currently working with two students in Chem 400 on a project utilizing these techniques.

"Directed Study?" you ask. "Doesn't that take a lot of time?" It certainly does, and although faculty receive no teaching credit for supervising students in Directed Study courses, I believe that the projects are invaluable for students. Many scientists have noted that the skills most lacking, but very much needed, in order to begin laboratory research are competency in preparing solutions and in pipeting (a technique used for measuring relatively small volumes of liquid) accurately. These skills are also needed by those who work as a bench chemist or biologist. In a few laboratories students get to do quite a bit of pipeting. However, in most labs there is very little opportunity to prepare solutions, so unless a student works as a laboratory assistant or takes Directed Study, there is very little opportunity to put into practice this important concept covered in lecture. With the time restrictions on our laboratories and the cost of supplies, the option of letting every student in a lab make solutions is really not a feasible one. However, if they take Directed Study they get to perfect their skills in this area!

My students have worked on a project involving the function of glutamate receptors, their regulation by pH, and their role in excitotoxic cell death. An initial goal was to see if it would be possible to use an enzymatic assay for cell death to quantitate the activity of these receptors. If it works scientists will be able to study the regulation and activity of these receptors using a much faster and easier technique than is currently possible. While these students have not been able to meet their goal, they have learned a lot about how science is done. They have seen the joys and frustrations that scientists face first-hand. They are competent at making solutions, utilizing sterile techniques, working with cells, and doing spectrophotometric assays. To paraphrase what one of the students who has worked on this project said, there is simply no better way to get a real-life science education than to participate in a project like this. It serves as an excellent transfer point for applying all of the science you have been spending years learning.

If we don't teach courses like these (Directed Study and specialized project labs), then we are denying our students a chance to develop very practical skills that they will need in life. Part of the skills gained are techniques, but an additional benefit—as my students have commented to me—is that they gain the ability to think for themselves and to solve problems on their own. Even if a student never works as a bench scientist, the latter skills are important.

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