

Biotechnology Education

Commentary: A Case for Expanding the Scope of Case Studies in Biotechnology Education

Received for publication, October 31, 2005

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Science education is made more exciting and effective by the use of dynamic examples illustrating the context and relevance of basic scientific principles and discoveries. Recently, this idea has been exploited in textbooks highlighting the medical and scientific relevance of basic science. Contemporary biochemistry and molecular biology texts now routinely use case studies that illustrate how biochemical principles and genetic variation are crucial to understanding disease processes and the development of effective therapeutic strategies. For example, the description of the metabolic dysfunction of diabetes provides an ideal vehicle for teaching carbohydrate metabolism, hormone action, and acid-base balance.

Establishing the relevance of science helps students comprehend and remember basic scientific principles. However, the most important long term benefit, even if students forget the details of the regulation of carbohydrate metabolism, is that they understand that human disease has a rational biochemical and/or genetic basis. Relevance also helps motivate students to pursue scientific careers and is perhaps even more important in assisting non-scientists to attain scientific literacy.

Despite the effectiveness of case studies, today's bioscience curricula often fail to take advantage of one of the most compelling areas of research and scientific activity: that which originates in the *business* of bioscience. Many of today's most exciting discoveries take place within organizational structures set up by the bioscience industry. The scientific method is still employed at the core of these experiences, but the dramatic impact that successful research and product development can have on people's lives can inspire both students and the general public.

A major reason for the scarcity of business cases in our curricula is a lack of accessible, well documented, and concise bioscience business case studies. For example, an appropriate case study could motivate students to learn

about the mechanisms of prokaryotic and eukaryotic gene expression if they understood that this knowledge was instrumental in the genesis of the pioneering biotechnology companies that have made products that result in the difference between life and death for many. Any discussion of cellular differentiation and apoptosis would certainly be enlivened by including descriptions of the scientific focus of any of dozens of companies attempting to use stem cell therapies to cure diseases ranging from diabetes to Alzheimer disease. Similarly, lessons on monoclonal antibodies can be enriched by referencing an example from one of the many companies that employ them at the heart of their strategies for both treating and diagnosing tumors. Finally, as one who has labored many years to make enzyme kinetics relevant to students, I can now see how my job could have been easier if I had access to, for example, case studies about the exploitation of protease inhibitors or Cox-2 inhibitors by companies. Such stories would have been effective not only in helping my students appreciate the mechanisms of enzyme inhibition but also in exploring the range of ethical issues that these examples generate.

Think of the possibilities. Professors could relate to their students examples of basic science discoveries made at their institution that then led to the development of local businesses. As a community of educators, we should embrace these opportunities as they are often relevant because they are familiar and a source of community pride. What is needed, therefore, is a forum that provides case studies that derive from the business of bioscience in a format that is usable in the classroom and reflects the depth and breadth of the impact of the science and business of the bioscience industry. BAMBED should be a place to publish material that can be used in our classrooms and would be very interested in publishing such case studies after peer review. How they should be formulated and archived are still questions that need to be resolved. Should answers also be published, or only available on a protected site? I would be interested in your comments.

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