

Biotechnology Education

Information Literacy as a Core Value

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The multidimensional explosion of information in virtually every aspect of the biological sciences has provided enormous opportunities for practitioners of science. At the same time, it creates a special challenge to educators who are charged with providing students with learning experiences producing a competence sufficient to enable them to participate at a high level in the science and business of biotechnology.

An interesting and innovative educational model has been presented in this issue of *BAMBED* [1]. To provide a context for teaching and learning, the authors characterize information literacy as "... the ability to locate, retrieve, evaluate, manage and use information effectively and efficiently" [1]. Without question, this suite of skills comprises a core competency that is essential for all levels of scientists and engineers who are going to lead our bioscience industries in the 21st century. This is especially important for those who are going to integrate the science and business aspects of the industry. Ward and Hockey [1] propose a program of study that embeds the activities required for information literacy into a 3-year Bachelor of Medical and Pharmaceutical Biotechnology degree at the University of South Australia, including numerous learning skills, activities, and outcomes expected. Not only does this program outline an innovative and important approach to a crucial educational goal, it also brings up the issues that resonate with all of us trying to teach this skill set to a variety of educational levels and environments.

Each of the components of "Information Literacy" requires instruction and practice using a variety of problem-based approaches as illustrated by Ward and Hockey [1]. However, in our totally electronic and interconnected world, one particular issue appears to be especially problematic and deserving of special attention in the context of our journal: evaluation. The challenge arises at two levels of information assessment—first, the validity and reliability of the source, and second,

the detailed evaluation of the data presented from any source.

First, it is far too easy to use free publicly available search engines to retrieve citations and even data, which can lead to the naive temptation to accept them as scientifically valid. Even an exploration of the web site from which the information resulted might not reveal the interest or bias (commercial or political, for example) of the source, or the degree to which information has been filtered, altered, or censored. Although the web has increased the ability of respectable scientists to communicate important results rapidly, the volume of pseudoscience and hucksters selling the modern equivalent of snake oil has kept pace. It is imperative that our students learn to evaluate the source, giving appropriate weight to the extent and validity of peer review and acceptance (at least partly by citations) by reputable scientists. This begs for a discussion of the problem of how mainstream ideas find a more accepting home in most of our journals, and radical new ones need to struggle to gain acceptance. Nonetheless, this is how science operates, and we must devise educational exercises to illustrate these points.

The second challenge with information assessment is with regard to data analysis and interpretation and requires the development of exercises and cases where this can be explored by the students. It is not likely that all of our students (especially at levels other than the PhD) can participate in sufficient laboratory experimentation to become sufficiently proficient at data analysis to make their own conclusions from complex experiments involving numerous technologies. This is especially difficult where clinical research data are involved: the experiments are extremely difficult to interpret given relatively small sample sizes and the numerous confounding variables in human behavior and genetics. Nonetheless, we must attempt to achieve a high level of competency for evaluating complex data if students are going to be valuable biotechnology contributors. Therefore, this is going to require new approaches and many more "cases" that need to be made available for use in teaching.

Although there is a challenge in teaching how to evaluate both the source and quality of any specific data,

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there is no shortage of opportunities for creating challenging and instructive case-based teaching. The quantity of research data emerging from our laboratories has never even approached what it is today. The quality is also improving in line with our expanding technologies for obtaining information as well as the availability of ever more powerful computational tools for evaluating these data. Therefore, the challenge is to use or research outputs to create educational cases for

the students to explore. These could be exceptionally useful adjuncts to building literacy skills in our students and to integrate our research with our teaching as a way to create excitement and interest in the great work going on the life sciences at all our institutions.

REFERENCE

- [1] H. Ward, J. Hockey (2007) Engaging the learner: Embedding literacy skills into a biotechnology degree, *Biochem. Mol. Biol. Ed.* **35**, 374–380.