

*Book Review***Best Practices in Biotechnology Education**

Edited by Yali Friedman

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Biotechnology is a high cost, high risk enterprise and it needs people, both scientists and entrepreneurs. Developing, attracting and retaining a workforce to support the biotechnology industry is a challenge, the more so in the USA where there is a huge concentration of such industries. Workers at various levels need to be trained, not only in the science, but also in the other aspects of biotechnology such as patent law, good laboratory practice, commercialisation and entrepreneurship generally, as well as in bioinformatics. In addition, there needs to be a clear way of converting academic learners to productive laboratory workers. This book contains 21 chapters which are case studies from various universities and colleges, one each from S. Africa, Australia and New Zealand, two from Canada and the rest from the US. The levels are from technician (in community colleges in America) to Bachelors, Masters and PhD (it has always been somewhat controversial as to whether Biotechnology can be a first degree subject – in the case studies here all possibilities are showcased). In addition, some institutions offer schemes that allow people from industry to come back into university for 1–2 years to brush up on their knowledge and skills, and many others do outreach to local schools in various ways, aimed at both school children and teachers. The case studies are, of course, ‘show-and-tell’ but for anyone contemplating starting up a degree scheme they give ample examples of what might be done. I thought that there was perhaps less evaluation of the success of the courses than there might have been — although I suppose it is early days for many of the courses. Typical quotes are that “Graduates were very positive about their experience”, and there are many statements along the lines: “The course is intended to...”; “The course aims to...”; “Students acquire an understanding of...” — we really want to know to what extent these objectives are being achieved. Nevertheless, it is generally reported that the graduates are eagerly snapped up by the biotech industries. In terms of translating the extent of the schemes on offer, one needs to be familiar with what, in American terms, a ‘course’ is, and what ‘points’ are, and what a credit is worth in terms of contact hours and hours of student work. These will be completely transparent to American readers but not necessarily to those from Europe who have not worked in an American teaching institution.

Some chapters use what to me were new ‘bio’ words such as ‘bioclusters’, but perhaps more useful to readers is that the majority of chapters contain email addresses and abundant web URLs. Other key points are that it is almost mandatory to have people from the biotech industries come in and give seminars on Current Progress in Biotechnology, probably more on the entrepreneurship/patent/finance areas than the science, and it is important that internships in the industries should be arranged (with mentoring by individuals in the industries: the industries seem to welcome this). In the US many companies also make substantial financial contributions to support courses, alongside significant Federal Government contribution. This is not unimportant: purpose-built labs are essential and equipment and especially reagents are expensive. However, I was cheered to read of one course that they had a ‘no kits’ policy (p.279). Students have to construct the kits (or design the assays) from scratch, making all the solutions, etc. Clearly this helps develop the important skill of troubleshooting. (How many times have I heard in a PhD viva the response?: “Don’t know why it didn’t work — the kit didn’t work.” — next question: “What’s in the kit?” — “Don’t know!”)

So, in summary, this book reveals that a lot of imagination has gone into devising courses, including developing links with the biotech industries, which is regarded as extremely important. For those contemplating setting up a course there are lots of ideas, although I have to say that I was somewhat concerned that some writers indicated that there were not enough graduate assistants to do the teaching (lab presumably). There are thoughts about entrepreneurship and how it might be taught (see pp. 106, 113, 115 and 118) or perhaps experienced during internships. Here is an interdisciplinary definition of biotechnology that might satisfy both educators and venture capitalists: *You make loads of money in biotechnology by brewing genetically-engineered wine in swimming pool sized, stainless steel vats while wearing a space suit* (and if you read the financial pages of the newspapers, you will know that many biotech companies go bust every year, too). Overall, in terms of education, there is much more here about the structure and content of courses than about the pedagogy to be used and whether it has been successful. The impression is that the students joining the courses are bright and highly motivated, and so consideration of the ways used to teach might seem to be less important. There is one chapter, entitled 'Distance Education' that seems slightly out of place in this collection, although it is very interesting and well written: indeed, it is really the only chapter that considers the pedagogy and methods of delivery of a course.

The book's editor is Chief Scientific Officer at Washington, DC-based New Economic Strategies and is a PhD Biochemist. He regularly gives guest lectures on the Johns Hopkins MS/MBA program in Biotechnology, and edits several journals concerned with Biotechnology.

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