

The next generation

To the Editor:

Your editorial in the December issue¹

argues that the education of the next generation of biotechnologists should include active development and cultivation of entrepreneurial skills. It is suggested that while the success of early biotech breakthroughs has seen “many academic institutions set up teaching programs to capture the rapid advances being made in recombinant technology,” the majority of these programs have “largely ignored the mysteries of commercialization”. I believe this is true.

Most educational programs in science, particularly those within academia, tend not focus on how to relate work done in the laboratory to the ‘real’ (commercial) world outside those walls. What I would argue, however, is that any shift in education to include the cultivation of entrepreneurial skills should be accompanied by an equal emphasis on the development of programs, courses and exercises in how to communicate with the public and reflect on potential social and ethical aspects of the work in question.

These skills represent a vital element of what it takes to achieve commercial success in today’s post-genetic-modification (GM)-controversy world. This is already being recognized in the emerging field of nanotechnology, in which new educational programs (be they at a high school, bachelor or postgraduate level) are including information and activities relating to social dimensions and ethical questions around the science. In nanotechnology, this emphasis on the importance of scientists being aware of and engaging with these types of issues is said to be based on ‘learning the lessons’ of what happened with biotech, specifically the controversy surrounding GM crops. The key idea here is that commercial success is not only about what you can do, but also about what society thinks you should do. For the

next generation of biotechnologists to be educated as successful entrepreneurs, I would

argue that they, too, need to learn the lessons from controversies in their field and find ways to incorporate the cultivation of skills in social and ethical reflection into their education. Without this, they run the serious risk of their products lacking one of the most crucial elements for success, that of social robustness.

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1. Anonymous. *Nat. Biotechnol.* **26**, 1313 (2008).

To the Editor:

Your December editorial calls on the old guard of biotech to devote more energy and time to developing the upcoming generation of young entrepreneurs¹. You note that this demographic group is characterized by a revolutionary streak—not only showing “openness to new ideas,” but also a persistence in pursuing them. To shed some more light on the views of the next generation, I present below the results of an informal survey of entrepreneurially orientated students that asked three questions: What motivates them to pursue a career in biotech? What do they identify as the major opportunities and challenges in biotech? And how willing would they be

to take on a job in a biotech startup in the current financial environment?

A standardized open-ended questionnaire was e-mailed directly to students from 16 major biotech clubs across North America during December (Box 1). The universities were selected arbitrarily based on accessibility to student e-mails from preexisting contact via extracurricular involvement. A total of 703 individuals were e-mailed with 161 (23%) from all 16 institutions (Supplementary Table 1 online) responding in full to the e-mail. They ranged from 18 to 27 years of age across undergraduate (22%), doctoral (51%), medical (16%) and MBA (11%) student populations. Incomplete or incoherent responses were discarded from the results. There was little variability in the responses according to geography, although the sample size was not sufficiently large to enable differentiation (Fig. 1).

When we asked students what motivated them to pursue a career in biotech, the top reason they gave was the opportunity to help others. “I want to be able to cure a million patients at the same time” was a common refrain among the respondents. This provides direct evidence for the “Yes we can” philosophy that you attributed to this generation in your editorial. The second and third most cited reasons, as expected, were intellectual stimulation and monetary incentives (Supplementary Data online).

The second question regarding major opportunities and challenges for biotech yielded answers across the spectrum. In response, students cited such goals as the potential of personalized medicine to transform healthcare or for environmental



Box 1 Questionnaire to upcoming biotech entrepreneurs

1. Age?
2. University affiliation?
3. Program of Study (MBA, Medical, Doctoral, Undergraduate)?
4. What motivated you to choose biotechnology as a career pathway?
5. What are the major opportunities in biotechnology today?
6. What are the major challenges or obstacles to pursuing biotechnology today?
7. Would you join a biotech startup in today's difficult financial environment?