Breathing life into biology

Mriganka Sur says that life sciences will prosper in India once research and teaching reconnect.

When I was a teenager, I thought I had only two choices — to be a doctor or an engineer. Growing up in Allahabad in the northern state of Uttar Pradesh, students like me were so frequently asked to choose between these two careers that most of us never considered any other options. Becoming a biology researcher did not figure on the list.

There is no question that to capitalize on the life-sciences and biotechnology revolution, India must build excellence in life-science training. In most countries, this is the task of universities. Unfortunately, the Indian university system is in serious decline — acknowledged to be so both within India and elsewhere — and unequal to this task.

As it turns out, I eventually became a neuroscientist, driven mainly by my interest in understanding how the brain works. I never had a university-level course in biology — there were simply none to be taken at the Indian Institute of Technology (IIT) in Kanpur, where I studied electrical engineering as an undergraduate in the early 1970s. But in a sign of the increasing importance of the life sciences, the IITs are beginning to embrace biology. When I went back to give a lecture at the IIT Kanpur a few years ago, I was asked to advise the institute on its newly created Department of Biological Sciences and Bioengineering and a new programme in cognitive sciences.

At the IIT Kanpur, I attended classes taught by excellent teachers and had a few hands-on projects. But the IITs are largely an exception. Most Indian universities are ill-equipped to tackle the complex, interdisciplinary nature of modern biology. Faculty members at both undergraduate teaching colleges and universities offering advanced degrees are largely concerned with teaching, and tend to focus more on theory than on experimental science. But as most scientists can attest, research and teaching are inseparable components of a modern science education.

Many Indian universities don't have the equipment or the faculty members and staff to give students a solid grounding in techniques and instruments. At some biology departments, even introductory procedures such as DNA extraction are merely described.

This unfortunate division between research and teaching runs deep. The Indian government decided more than 50 years ago to create focused research institutes. The scheme set up distinct priorities: universities would focus on teaching, and the institutes would concentrate on research. That policy led to a handful of excellent scientific institutes but also impoverished university-based research. There is no shortage of funds for university research or teaching laboratories, but a heavy teaching load, an overly bureaucratic system of appointments and promotions, and the lack of infrastructure have all made it difficult to recruit capable researchers.

The institutes, meanwhile, have good research projects, but little teaching. Yet good researchers are also often the better teachers.

Still, many institutes have begun training students by evolving graduate-level courses for small classes. Unfortunately, the top students who train at these institutes often choose to leave India and complete their PhDs abroad — at least in part because few of the centres can match the breadth of education at a first-rate university in the United States or Europe.

What might be done? There is little question that the government should actively support university-based research. Universities need help in upgrading their research infrastructure and laboratories, and in recruiting scientists with dedicated research space and healthy start-up packages. The government could contribute to these costs. Perhaps federal research grants can include infrastructure costs.

There are signs that the government is responding to these concerns. In March 2005, the Science Advisory Council recommended setting up a National Science and Engineering Research Foundation, on the lines of the US National Science Foundation, to support research in various disciplines. Universities are expected to be important beneficiaries.

As funding for these universities increases, there should be accompanying changes in culture. Research and teaching should be valued as mandatory components of faculty appointments and promotions. Universities should also institute periodic review of the faculty members; this approach is also beginning to find favour in China, a country beset by similar problems.

The particular structure of Indian science also suggests solutions. For instance, funding agencies might consider establishing long-term research faculty positions within universities. New research centres could be closely allied with or even located on university campuses. The researchers would be required to teach in the university, and university students would have access to research labs.

One model for effectively integrating research and teaching already exists within the IITs. These institutes continue to attract the best Indian undergraduates in engineering and the physical sciences, and give them a world-class education. Their success has positioned India as a key player in the IT industry. One small step towards boosting the life sciences may be to encourage the IITs to expand their biological sciences curriculum. But that cannot be the only solution, if only because a wider transformation is needed.

Innovation in universities is part of a broader theme in how a society educates not only its élite but all of its citizens. A hard look at education in the life sciences is particularly urgent for a country such as India, which has both a strong need for development and the ambition to match it. ■

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Indian universities focus on theory rather than experiments, says Mriganka Sur.

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