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EDITORIAL

Higher education in science

It is hard to attend any gathering of scientists, where the conversation does not eventually drift towards a discussion of the rapidly diminishing interest of good students in pursuing careers in science. Academic researchers lament the decreasing quality of students enrolling for doctoral degrees. In some disciplines like physics and mathematics, even the best of institutions in India base their annual selections for Ph D programs on a limited pool of applicants. The decline of interest in science starts early, with students, as they leave school, opting for engineering, medical or even commerce courses, in preference to science. As the number of engineering and medical colleges has mushroomed, even students with moderate academic attainments have little difficulty in getting admitted to these favoured courses. Undergraduate science courses are left depleted, sometimes serving as the last refuge for those whose options are limited. Indeed, in some undergraduate colleges in states like Karnataka some science courses suffer a sudden reduction in the size of the classes, when supplementary admissions to the myriad engineering and medical colleges are announced. Clearly, science is not perceived as an attractive career option by both parents and children; many other professions appear to offer greater opportunities. But given the enormous size of the student pool in India, there must still be a very large number of students who are motivated to study science; often attracted by the glamour and mystique associated with scientific discovery. Why is it that many of these students also end up in other courses? Even the few motivated students who enter undergraduate science colleges appear to be driven by a desire to use a science degree as a passport to postgraduate education overseas. Some of those who survive the undergraduate and master's courses enter the portals of our research institutions and university departments in search of Ph D degrees; it is their declining numbers and quality that trigger the familiar lament on the state of higher education in science today.

Can undergraduate science courses be made more attractive? Can the decaying structures of our science colleges and universities attract new students harbouring high ambition? Can latent talent blossom and flower in

surroundings that are far from inspirational? Is it possible that the very fact, that undergraduate engineering education in the IITs is extremely well organized and challenging, is sufficient to attract the best of students, since they are guaranteed a sound technical grounding, which will serve as a launchpad to a future career. The IITs have indeed acquired over the past forty years an enviable reputation for rigorous student selection and high standards of training, providing in today's parlance a 'brand equity', which can hold its own in the global marketplace for human resource. Unfortunately, there are no equivalents in science. A rather critical observer of the academic science scene caustically pointed out to me that 'ivory tower scientists' discuss the issue with enthusiasm, but take little initiative in working towards innovative strategies for enhancing the quality and attractiveness of undergraduate and postgraduate education in science.

Some years ago the depressing state of science education in India was starkly highlighted in a proposal to establish a National Science University (NSU). The proposal which had a foreign origin, with its principal champion being a non-resident Indian, prompted an outcry from the scientific community, in a debate in the columns of this journal (*Curr. Sci.*, 1994, **67**, 502–519). The idea of spending large sums of government money on a new, apparently elitist institution for science seemed abhorrent. The proposal died, its demise hastened by a deluge of adverse reaction. Subsequently, indigenous versions of the NSU proposal surfaced briefly, only to drown in a sea of lethargy. All these proposals had a common theme; the creation of a new national institution, where undergraduate science education would flourish alongside frontline academic research, exposing prospective entrants to science to an academic culture which might prove seductive. This approach would have been in sharp contrast to our existing model where teaching is largely relegated to colleges, where little research is practised. The success of many major American universities, where undergraduate education and research coexist, seemed to provide a rationale for these proposals. But, in India the historical development of institutions has followed a different path. Research in many disciplines

of science has slowly become concentrated in national laboratories and institutions which have no teaching programs in science; the focus is exclusively on research, leading to Ph D degrees. Even in most central universities, teaching in the science departments is limited to Master's students. The gulf between students who have just left high school and research departments has been occasionally bridged in integrated M Sc programs in sciences at a few IITs, but the number of entrants to these courses has been very limited. In most university science departments, both teaching and research are at a low ebb. In the research institutions, complaints about the background of entering Ph D students are shrill and frequent, but little by way of teaching and training programs have been introduced. Many national laboratories admit large numbers of Ph D students, who will eventually submit doctoral theses to universities to which they are only formally associated. At these institutions Ph D students are viewed as the means by which research is carried out; there is limited interest in their overall training in the broad disciplines in which they supposedly specialize. In such an environment, faculty interest in teaching activities is minimal. Ironically, many of these institutions would now like to acquire the status of 'deemed universities'; a convenient device by which they will be able to give their own degrees, despite the complete absence of academic structures which define a conventional university.

Could the research institutions play any role in an attempt to reconstruct higher education in science? Is it possible to imagine an activist scenario in which attrac-

tive teaching programs emerge in institutions whose predominant concern, thus far, has been research? Would existing institutions be prepared to forge partnerships and invest their resources, human and material, in creating undergraduate and postgraduate programs, which attract the best of students? If the answers to these questions are affirmative, we may have the seeds of an experimental initiative which may prove to be a good, long-term investment for the research institutions.

The importance of 'educating future scientists' was the subject of editorial comment in *Nature* (2001, 414, 673), ending in the gentle admonition: 'Now is the time for researchers—some of whom are reluctant even to engage properly in undergraduate education—to seek these out and participate in them.' In India there have been a couple of instances where sophisticated research institutes have been built within university campuses, presumably with the hope that a fruitful symbiosis between research and teaching would emerge. Unfortunately, these institutions are now fortresses insulated by a wall of security from their surroundings. The number of foreign universities who now vigorously recruit science students in India, for their programs, is on the increase. Our research departments face the threat of a further erosion in the quality of their input and the number of applicants who knock on their doors. It may indeed be an opportune time to once again talk of research and teaching in the same breath.

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