

CORRESPONDENCE

Doing good and great science in India

Bob Perry, who is a Member of the US National Academy of Sciences, seemed to echo in his annual Christmas letter the feeling I myself have been getting of late about doing science. And the feeling is that a sort of law of diminishing returns seems to be operating in our research. This is how it is put in the letter: 'Bob's scientific research continues to give him great satisfaction. This year his lab made considerable progress in their studies of the transcriptional regulation of ribosomal protein genes. As always his enthusiasm is based on a belief that his findings will have important implications for the general problem of gene regulation. However, because of the vast number of scientific publications that appear every day, it is increasingly difficult for a particular piece of work to be recognized and appreciated by a wide audience. This era of specialization is tough on generalists!'

Surely, if an American with access to a superfine infrastructure, steady inflow of new first-hand information and critical forums for discussion gets this feeling, we in India must feel left in the scientific backwaters, so-to-speak. Then, how did C. V. Raman and Satyen Bose do it in the past? One explanation may be that science was a relatively virgin field to plough and that not too many workers were there. So, the competition was not crushing and the memory was not overloaded with too much information. The framework was still being worked out. Should we then conclude that our handicaps are bigger than those of Raman and Bose or is it that inexorably a rise is followed by a decline? But can we say that India became a Mecca of physics in the sense Max Born's

Gottingen was? Perhaps, this sort of a thing cannot be codified. Nevertheless, let me discuss the example of the field of genetics which even though founded in Europe in the 19th century moved to the US in the 20th century.

The first laws of genetics were discerned in 1865 by an Augustinian monk—Gregor Mendel—in Brno, then in Austria but now in Czechoslovakia. Mendel came from peasant parentage and because of lack of resources, but ambition for higher studies, joined the monastery which then made it possible for him to study with Christian Doppler for a while in Vienna. On return, amongst other things he did experiments for about eight years on figuring out the rules of inheritance of characters in peas and other plants. Briefly, his findings were that inheritance is discrete and not blending. But no matter how hard he tried to convince a leading botanist Karl Nageli in Munich, he could not succeed and his paper lay forgotten for 34 years! At the turn of the century, Mendel's laws were rediscovered by three *continental* Europeans. Bateson, an Englishman, then championed Mendelism and his place became a sort of clearing house for discussion of these principles and their implications.

Bateson even obtained early evidence for linked characters but could not take the conceptual leap, which T. H. Morgan of Columbia University did, that genes reside in chromosomes. This was the first flight of genetics to the US.

Later, Oswald Avery working at Rockefeller Institute scooped Europeans the second time when he showed that Transforming Principle (genetic material) is DNA. Finally even the prowess in X-

ray diffraction bequeathed by the Braggs to Cavendish Lab at Cambridge could not stop Linus Pauling. His bold and brilliant alpha-helical model of protein chain pre-empted Europeans once again. Although, part of the position was retrieved by the Cambridge group winning a few Nobel Prizes in the 1960s, the swell of Genetics in the US was unstoppable. Part of this may be due to the fact, that US industry suffered very little from the ravages of the two wars. Partly, it may have been due to a 'secular' genius of Americans, providing opportunities for a very wide participation of people from different strata. Their broad-based education became the envy of others and with massive resources at their disposal, they promoted life and other sciences on a broad front. It would be anybody's guess whether the Japs are waiting in the wings to overtake them.

The problem of doing great science in India is (i) 'mastering' of a particular field with identification of attendant deep problems awaiting elucidation, (ii) think-alikeness and teammanship, (iii) poor access to new and first-hand information, (iv) inadequate infra-structure and (v) lack of informed and objective criticism. Material support is required of course, but the foregoing requirements may be needed in equal measure. Good competent science, of course, is being done in several labs.

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