of Europe and USA in order to promote interdisciplinary research.

During 1970s, when I returned to India after my doctorate in high-energy nuclear physics abroad, the situation was much worse. There were no high-energy accelerators in India for doing irradiation experiments on-line. So I decided to undergo training in radiation biophysics under G. N. Ramachandran at IISc in 1974, but I failed to get a research project of my choice. Then, I shifted to geochronology and ultimately settled down in geophysics. However, I was at a disadvantage during interviews for promotion and when being nominated for Fellowships to the various Science Academies, as the selection committees failed to appreciate my contribution in an interdisciplinary research area. The Department of Physics, GND University, Amritsar took the initiative to introduce interdisciplinary courses at the Master's level in geophysics, energy sciences, applied physics, and history and philosophy of science during 1980s.

I support the arguments of the authors[1] to introduce interdisciplinary courses of study in Indian institutions. The proposal for Direct Recruitment of Highly Skilled Repatriates Abroad (DRHSRA) would go a long way to fulfil the needs of expat Indian scientists opting to return to India.

1. Daniel, R. S. and Srivastava, A., *Curr. Sci.*, 2017, **112** (5), 904–905.

HARDEV SINGH VIRK

PDP Department,
Punjabi University,
Patiala 147 002, India
e-mail: hardevsingh.virk@gmail.com

Making progress, but not rapidly. Comparison between India and China

I read the article by Arunachalam *et al.*[1] on 'Chemistry research in India: making progress, but not rapidly' with interest. The comment 'making progress, but not rapidly' perhaps applies to Indian science as a whole. It is also appropriate to compare the Indian performance with that of the Chinese. In the 1980s, I recall an internationally acclaimed science journalist describing India as the superpower of Third World science. That is no longer true. China has progressed by leaps and bounds, and has left us far behind. I would like to submit that one reason, probably the primary reason, for this disparity is the difference in the level of support for science in the two countries. Around 1990, the R&D expenditure in China and India was at a comparable level. The situation is entirely different today. In 2015 the R&D expenditure in India was 0.85% of the GDP, whereas it was 2.1% of the GDP in China. In the same year, the GDP of China was nominally 5.06 times that of India[2]. On PPP terms, the ratio was 2.39. Thus the R&D expenditure of China was 6–12 times that of India, depending on the way GDP is estimated. This disparity in financial input needs to be taken into account when comparing the performance of the two countries. Post World War II, science has become a highly organized effort and performance substantially depends on the level of funding[3]. Therefore, in terms of funding itself, it is not surprising that China has outperformed India so substantially in recent years.

I do not suggest that funding is the only issue. There is much else that we need to do to improve our performance in scientific research. I have already dealt with some of the issues in a few recent articles in *Current Science*[4–7].

Obviously I am not intimately familiar with Chinese science. However, I have formed some impressions about the organization and direction of Chinese science from the half a dozen visits that I have made to China during 1986 to 2011, and the detailed discussions I have had with Chinese scientists. Interestingly, the period of my visits roughly corresponds to the period in which China leapt forward from the status of a developing country to that of a superpower. One of the aspects which impressed me is the consistency with which science was supported in China. On the contrary, during the same period we went through a roller-coaster ride with ups and downs in support for science in our country[8]. The scale at which Chinese operate is also different from what we are used to. Even our premier institutions of science like the Indian Institute of Science, Indian Institutes of Technology and Tata Institute of Fundamental Research are small in size by global standards. Most other scientific institutions in India are in my opinion subcritical in size. We need to scale up our scientific endeavour. Furthermore, it appears to me that the Chinese strategy has been to harness all available talent, irrespective of age. We tend to pose the issue as young versus old, while it should be young as well as old. Youth and experience are complementary and need to be harnessed simultaneously. It is also important to promote talent wherever it is available. Furthermore, the effort should be to support and fund 'all' projects which have been adjudged worthwhile by peers. This would not involve spreading the butter too thin, as the number of available worthwhile projects is not all that many. In any case, the availability of butter should be much higher than what it is today! Only then we can unleash the creative potential of Indian science.

To sum up, it is desirable to take into account the level of support and working conditions when assessing performance.

1. Arunachalam, S., Madhan, M. and Gunasekaran, S., *Curr. Sci.*, 2017, **112**, 1330–1339.
2. https://en.wikipedia.org/wiki/List_of_countries_by_research_and_development_spending
3. Vijayan, M., *Frontline*, 4 December 2009, pp. 96–99.
4. Vijayan, M., *Curr. Sci.*, 2011, **100**, 815–816.
5. Vijayan, M., *Curr. Sci.*, 2011, **101**, 605–606.
6. Vijayan, M., *Curr. Sci.*, 2012, **102**, 377–378.
7. Vijayan, M., *Curr. Sci.*, 2015, **108**, 775–777.
8. Vijayan, M., *Curr. Sci.*, 2015, **108**, 1575–1576.

M. VIJAYAN

Molecular Biophysics Unit,
Indian Institute of Science,
Bengaluru 560 012, India
e-mail: mv@mbu.iisc.ernet.in