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Science in India

This refers to the article 'Science in India: 1947–1997' by Avinash Khare (*Curr. Sci.*, 1998, **74**, 191). Fifty years have passed since India got independence and we are celebrating the golden jubilee of our freedom. This may be the appropriate time to look back and examine whether we have fared well or badly in the last fifty years. In India we have had a rich tradition of teaching and learning in the past and we have a glorious history. On this auspicious occasion when the Indian state is fifty, science should have been getting good coverage in the media. Unfortunately it is a pity (on the part of science) that excepting a few instances, the picture is the opposite. Avinash Khare, whose initiative can be seen as an effort to remedy the present situation, has come up with some notable points and suggestions. The foundation of the Indian Association for Cultivation of Science in Calcutta by Mahendra Lal Sircar in 1876 during British India is seen as a pioneering endeavour for the promotion of science in the country. At this institute, C. V. Raman worked for a notable period of time while he was in the accounts service. The vice-chancellor of the Calcutta University, Asutosh Mukherjee played a key role in encouraging original research by C. V. Raman, M. N. Saha, S. N. Bose, P. C. Mahalanobis and S. K. Mitra. P. C. Ray who in the true sense was an Indian chemist, established the Bengal Chemical and Pharmaceutical Works, as an indigenous venture to move towards self-reliance in industry. Raman, Saha and Bose are of course the torch-bearers of Indian science. Raman was awarded the Nobel Prize for Physics in 1930 for his discovery of what is now well-known as Raman Effect. He was the first Asian to have received this award and since then over 6000 research papers have been published throughout the world on the Raman Effect. Raman set up an institute in Bangalore which is now called the Raman Research Institute. Saha is known for his theory of thermal ionization. He established the Saha Institute of Nuclear Physics in Calcutta. S. N. Bose is known for his work on the Bose–Einstein condensation. Bose has sometimes been called as the Einstein of India (his work though deserving a Nobel Prize was overlooked due to some technicality). The mathematical genius of Ramanujan, who had no university education, was introduced to the world by G. H. Hardy.

Nehru, the first prime minister of independent India was a man of scientific outlook and rational thinking. He felt that India could make rapid progress only by adopting science. It was due to his patronage and the great foresight of Homi Bhabha, Vikram Sarabhai and others that India today has a recognizable position in space and nuclear science on the world stage. S. S. Bhatnagar was the founder–director of the Council of Scientific and Industrial Research (CSIR) which is the largest scientific body with 40 laboratories. These laboratories are working in a wide variety of fields. In the field of health and medicine, we have made admirable progress. The life expectancy which at the time of independence was around 31 years, has now risen to 62 years. A lot of diseases have been eradicated or controlled. We now have our own life-saving drugs and vaccines. In the last two decades we have developed nearly 90 new medicines. The Central Drug Research Institute, Lucknow has developed the first non-steroidal oral contraceptive in the world which is marketed by the name of 'Saheli' (one notable aspect of the drug is that it has to be taken once in a week rather than daily). This institute has developed a memory enhancing-drug from Brahmi (*Hydrocotyl asiatica*) and a cholesterol-reducing drug from the extracts of gugul (*Comifora mukul*). Chitra, the indigenously developed artificial heart valve is 10 times cheaper than the imported one. In the field of advanced computing, we have now our own supercomputer called 'Param' which is designed and fabricated by the Centre for Development of Advanced Computing (C-DAC) based at Pune.

We are moving towards complete self reliance in the field of nuclear technology. We are able to design and operate atomic reactors. In chemical industries, India is the fifth largest chemical-producing country. So far as space science is concerned, we are capable of sending satellites with our own launch vehicles. In remote sensing, we have mastered the field and are now selling data to the USA. We are just a few nuts

and bolts away from making our cryogenic rocket to launch communication satellites in a geosynchronous orbit at an altitude of 36,500 km. India has entered the commercial market as a provider of launching facility. One cannot forget the painful memories of food scarcity in the country and subsequent import of the food grains to meet its need in the decades of fifties and sixties (under PL-480 from US). Now after independence, we have increased our food grains production by a factor of four. This miracle has been possible due to the green revolution and the role of agricultural scientists has been admirable in this regard. The story of striving hard and succeeding has been long. I appreciate the balanced and unbiased view of Khare while journeying through the science lane. I would request *Current Science* to publish invited articles from experts in various disciplines of science.

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Declining interest towards science research

The recent article by Kumar *et al.* (*Curr. Sci.*, 1998, **74**, 20) regarding declining interest of the younger generation towards a science research career is both interesting and painful. No country in the world can progress, especially not a country like India if its scientific manpower is not developed. Science research is thwarted because of lack of interest in it.

Though the authors of the cited article have dwelt with the pre- and post-doctoral research students, I must say that the overall interest in science and science education have unfortunately decreased. The number of students who qualified in the NET test conducted by CSIR for science subjects from the western region of India is very low. From Gujarat only about 20 students have qualified in NET in Chemistry in the last 12 years. For Madhya Pradesh and Rajasthan, the results are not much different. There are various explanations for such dismal results and most of them are associated with the socio-cultural conditions of the region.

This year, i.e. in 1998, about 1.95 lakh students will appear in higher secondary examination in Gujarat. Only 22% of them will be in science. The average passing rate in the last five years has been approximately 48%. This means that about 20,000–21,000 students will flock to the colleges. There are about 6500 seats for professional courses (i.e. medicine, engineering, pharmacy, etc.) in the state. The top students among the successful candidates of the higher secondary examination prefer to go to these courses. The rest come to science courses. Our experience shows a large drop out rate. In MS University, in last five years, the total intake remained the same for F.Y.B Sc course when none who wanted to join and live in and around Baroda was refused admission. Another interesting feature is that every university gets almost 10 applications for each available seat for their M Sc Chemistry courses. However after admission test and interview we have found it very difficult to fill up the seats. Even at M Sc the drop rate is about 20%. Personal discussion indicates that very few students prefer science research as a career.

The above facts are true for almost all universities in the western region. The overall picture, however, is similar all over the country. It should be noted that even in the USA, there is a declining tendency of science students doing Ph D. It shows the decrease of interest in science as a career (*C&EN*, 26 August, 1996). The above facts should be seen in the background of population increase particularly in India. I hope the education ministries of various states as well as of the centre will take timely action.

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Assessment of health risk

Ramola *et al.*[1] have come to an utterly sensational and speculative conclusion on the basis of a jerky and out-dated model[2]. They calculate an estimated risk of lifetime lung cancer due to environmental radon exposure for a total population of Garhwal area under study to be 0.68%. The mean relative loss of life expectancy is estimated to be 0.26% for chronic exposure at the measured radon level. They observe that the radon values (104 Bq/m^3 for cemented houses and 123 Bq/m^3 for mud houses) inside the dwellings are higher than the international recommended values.

All these conclusions are flawed in view of ICRP recommendations[3,4]. The authors did not bother to use risk projection models for lung cancer based on later epidemiological studies[3,5,6].

Using the radon data of the authors and multiplicative projection models for lung cancer risk co-efficient[4], the calculated risk of radon-induced lung cancer for a mean annual exposure of 0.74 WLM works out to be