# Health of Indian science

During the last decade, a debate has been carried out in the correspondence columns of *Current Science* regarding the health of Indian science. Scientometric studies of scientific research in India[1–3] present a gloomy picture. The maladies of Indian science and some suggested remedies have been highlighted by Virk[4] and Dhathathreyan[5]. Dadhich[6] has made some bold suggestions to improve scientific research in Indian universities. But the commentary of Prathap[7] on the slowing down of Indian science is most convincing and it demolishes some of the myths created by government-sponsored agencies[8] regarding the quantity and quality of Indian scientific research. I fully agree with his analysis and feel that we are heading towards a crisis situation. It is alarming to note that Indian research suffered a setback after the 1980s both quantitatively and qualitatively and this slide down still continues unabated. Two main conclusions are noteworthy: (i) We need to increase our scientific effort 50-fold by opening more research institutes, and (ii) One should be encouraged for open-ended research at all levels to improve the health of Indian science. I believe this slowing down of Indian science cannot be reversed, so long as globalization and market forces dominate the Indian economy.


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3. Virk, H. S., *Curr. Sci.*, 2000, **78**, 1280–1281.
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# The concept of *ātman*

With reference to the views expressed by Narasimhan[1] and Chattopadhyaya[2], I wish to add the following remarks. The concept of *ātman* arose from the observation that something seems to escape from a living body at the time of its death. It was called *caitanya*, the living principle. The Indian atheist school of *cārvāka* philosophy rightly pointed out that *caitanya* is an emergent attribute and not a substance. Giving a familiar example, they argued that sugar and yeast separately have no inebriating property which arises from their combination. Similarly, *caitanya* arises due to a specific association of material substances. Attributes have no independent existence. Many philosophers, however, made a categorical mistake in holding that *caitanya* is a *dravya* (substance) and not an attribute. The living principle was termed *ātman* or *dehī*. Elaborating the concept, it was stated that *ātman* cannot be cut, burnt, soaked or dried. Further, it was claimed that *ātman* transmigrates from one body into another during the cycle of rebirths, just as one leaves aside old clothes and wears new ones.

A similar mistake engendered the idea of phlogiston. Something seemed to escape from burning substances and it was called phlogiston. However, the erroneous idea was abandoned by scientists when the real process of combustion was elucidated. Vitalist philosophers, on the contrary, have continued to cling on to an old idea which now stands rejected.


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2. Chattopadhyaya, M. K., *Curr. Sci.*, 2004, **86**, 626.



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# Milk production in India

India is a country of villages. Almost 70% of Indians live in villages and a majority of them are engaged in agricultural and allied activities. The Green Revolution in the early 70s is a milestone in the history of Indian agriculture, due to which India could produce surplus foodgrains. Punjab, Haryana, Uttar Pradesh and Rajasthan have greatly benefitted by the Green Revolution. Dairying, one of the expanding branches came out of the Green Revolution. It is an agro-based industry, expanding fastest throughout the world. A decade ago only 5% of the milk produce came into the dairies, whereas today it is 10% and it is increasing. Recent reports by the Ministry of Agriculture reveal that the dairy industry has the potential to offer about 4.2 crore jobs per year, whereas today hardly about 60,000 trained professionals are present in this field.

India's estimated milk production in the year ending March 1999, of 74 million tonnes, was 13% of the world's milk production. This has been appreciated by the United Nation's Food and Agriculture Organization (FAO), which has declared India as the world's largest producer of milk. FAO-estimated milk production of 71 million tonnes by USA in the same year is placed second in the list.

Data on estimates of milk production in the world and India during 1985–2000 reveal that a linear regression $Y = a + bt$, where $t$ is the year and $Y$ the estimate of milk production, is the best fit to the data. For India, the estimates of $a$ and $b$ are 41.14 and 2.28 respectively, and for the world they are 501.85 and 3.80 respectively. This implies that an annual increase in estimate of India's milk production is found to be 2.28 million tonnes ($P < 0.01$), whereas it is 3.8 million tonnes ($P < 0.01$) for the world. Assuming that the rate of increase will remain the same for the year 2010, estimates of India's milk production will be 100.52 million tonnes, whereas the world's milk production is estimated to be 600.56 million tonnes.

The demand for milk products would increase as a result of increase in national GDP. In order to meet the demand, it is essential to have consistent increase in milk production, which will be possible on successful implementation of 'Operation Flood' and evolution of new animal breed.

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# Geoscience curriculum

The article by U. Aswathanarayana[1] gives an insight as to how the earth science courses should be framed. But seldom are such views brought into practice. As rightly pointed out by the author, the subject of geology is a combination of various disciplines of science, but a candidate possessing a degree in geology has hardly any avenue in the job market today. This is due to the fact that geoscience education has failed to respond to the professional and practical knowledge that one needs. For example, the geological community has been taking up the issue of water crisis in India today seriously, but their voice is given the least priority. Engineers from departments like irrigation normally discuss water issues but a groundwater geologist's views are rarely taken into account. It is at the level of postgraduate degrees (M Sc, M Tech) that the course of hydrogeology should be designed in such a way that it incorporates the engineering aspects of groundwater and also surface water.

In a recent symposium called 'Jal Parishad' in Pune, Sunita Narayan pointed out that 80% of agriculture in India is carried out by groundwater. This is an eye opener to geoscientists; the educators involved in design of courses should include applications of groundwater to agriculture also. The practicals related to groundwater should be carried out in collaboration with State Groundwater Boards, wherever possible or with a recognized agency. A student studying for M Sc/ M Tech degree should be sent with hydrogeologists from the Board to conduct surveys, carry out well inventories and study watershed management, especially during the summer months, when the water situation is grim.

The other aspect is that GIS techniques are normally not included in M Sc courses. The institutes that deal with teaching GIS courses should start distant learning courses for the benefit of those who have done their postgraduation and are working. Ceramic industry also has openings for geologists if the subject is taught well in industrial geology or industrial mineralogy. Energy sector is a potential employer and the opportunities in this sector are growing. The question is whether geoscience, as a multidisciplinary subject, is prepared to take up challenges in this sector? After the government of India has invited private sector investment in energy, especially in oil and gas exploration, a lot of employment opportunities would be generated, particularly in deep sea reservoir studies, gas hydrates exploration, coal bed methane projects, etc.

As rightly pointed out by Aswathanarayana, the disciplines of geology, geophysics and meteorology tend to work as separate entities with hardly any coordination. All these disciplines should have a holistic approach instead of working differently. It would benefit students and researchers also in understanding the subject and would contribute in a large way to make geoscience a truly multidisciplinary subject and more importantly a job-oriented one.

1. Aswathanarayana, U., *Curr. Sci*., 2004, **86**, 766–767.

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