presently established scientific framework is not able to explain it[6]. But this has been found to be a reliable seismic precursor prior to all destructive earthquakes in all countries.

(e) People and NGOs are becoming active and use of the Right to Information (RTI) Act could lead to unforeseen legal action after any deadly seismic contingency, against scientists, disaster managers, administration and the government.

(f) Incidentally, the two sentences, '. . . An earthquake of magnitude *M* would occur at place *X* on such and such date', and '. . . Earthquake of magnitude *M* will not occur at place *X* on such and such date', convey opposite meaning. But both are predictions! Paradoxically, the former statement is mostly ridiculed, whereas the latter is accepted.

In the interest of seismic safety and saving lives, it is essential that a suitable viable solution to the problem should be found out at the earliest. The government could formulate suitable guidelines for this problem, which is progressing from a simple to a highly complex state. It is possible, under the present conditions, that even after confirming the possibility of occurrence of a destructive earthquake based on purely scientific observations, due to fear, it would not be announced by the scientists and administrators. The Ministry of Earth Sciences, Department of Science and Technology, concerned scientists, research institutions and disaster management experts should deliberate upon the issue and come out with a viable solution which could protect scientific freedom, ease disaster management, make provisions for avoidance of any legal action arising out of prediction (or lack of it) of earthquakes; the main objective should be to save the lives of people. This would create faith in the administration and research. Otherwise people would be required to undergo the agony of 'legal aftershock' after a destructive earthquake.

1. *Nature*, 2010, **465**, 992.
2. Billham, R., Gaur, V. K. and Molner, P., *Science*, 2001, **293**, 1442–1444.
3. Bapat, A., *Curr. Sci.*, 2007, **93**, 1468–1469.
4. Geological Survey of India, Report on seismic microzonation of Dehradun urban complex, Uttarakhand, 2007, pp. 1–48.
5. Khattri, K. N., *Tectonophysics*, 1987, **138**, 79.
6. Bapat, A., *Curr. Sci.*, 2010, **98**, 1287–1288.

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Scenario of science Ph Ds produced in India by 12th five-year plan

The economic growth of any country is related to knowledge-based innovations which are directly associated with human capital. Doctorates in science and technology (S&T) are the most significant S&T indicators that promote innovations.

During 2005–06, only 52% of all senior secondary-level students opted for graduate-level education. The postgraduate enrolment was just 13% of the graduates and the number of students enroled for Ph Ds in all subjects during the corresponding period was just 4% of the postgraduates[1]. According to the India Science Report 2005, 22.3% of 39.2 million graduates, 19.4% of 9.3 million postgraduates and one-third of 0.3 million doctorates during 2004 were from the science stream. During 2001, India produced 4616 Ph Ds in science, which increased to 5539 in 2003. According to the Ernst & Young EDGE-2008 report on 'Globalizing Higher Education in India', there is a 58% shortfall of engineers and 80% shortfall of doctorate scientists in the country[2].

The existing trends (Table 1) and the estimated number of Ph Ds produced during the 11th and 12th five-year plans (Figure 1) clearly indicate that the number of Ph Ds produced is small compared to the number of students enroled for postgraduate studies (M Sc).

Efforts are being made to motivate more students with M Sc to register for Ph D and take up science as a career. The Government has recently approved a CSIR proposal on 'increase in number of Junior Research Fellowships (JRF) through CSIR–UGC National Eligibility Test (NET)' during the 11th five-year plan (2007–12), by at least twofold over the number (~ 6000) of fellowships (JRFs) awarded during the 10th five-year plan period (2002–07). The Rajiv Gandhi National Fellowship (RGNF) scheme funded by the Ministry of Social Justice and Empowerment and the Ministry of Tribal Affairs has been instituted for candidates belonging to the Scheduled Caste (SC) and Scheduled Tribes (ST) to pursue higher studies leading to the award of M Phil and Ph D degrees in science, humanities, social sciences, and engineering and technology. About 1300 fellowships are available for SC, and 600 for ST candidates every year for all subjects. The Department of Science and Technology has instituted the 'Innovation in Science Pursuit for Inspired Research (INSPIRE) Scheme' to attract more students towards science in the country. The basic objective of INSPIRE is to communicate to the youth of the country the excitements of creative pursuit in science, attract talent to the study of science at an early stage and thus build the required critical human resource pool for strengthening and expanding the science and technology system and R&D base.

There are about 1.5 lakhs core researchers in India compared to 8–10 lakhs in China. The number of persons doing research in India is 156 per million of the population in contrast to 334 per million in Brazil, 7000 per million in the Scandivan countries and 4700 per million in the US[3]. Though China was producing less number of Ph Ds than India till 1995, it has now surpassed India in terms of the number of Ph Ds produced in science and engineering. During 2001, China produced 3812 Ph Ds in science, which increased to 5665 in 2003, with a growth rate of 48.6% compared to India's 20% growth during the same

Table 1. Number of students enroled in M Sc and number of Ph Ds awarded by Indian academic institutions during 2000–2006 in science

Year	M Sc enrolment[a]	Ph Ds awarded in science[b]
2000–01	NA	4616
2001–02	159,393	4793
2002–03	232,142	5988
2003–04	238,439	6638
2004–05	198,719	6437
2005–06	239,285	6744

Source: [a]Ref. 1. [b]www.nsf.gov/seind08 and UGC Annual Reports.

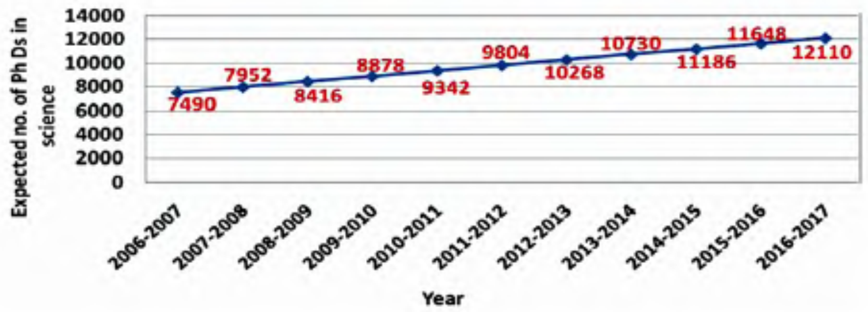

Figure 1. Expected number of Ph Ds in science determined on the basis of current trends using equation of least squares.

period[4]. The strong science and engineering Ph D programmes are a catalyst for the growth in China[5]. China Scholarship Council affiliated to the Ministry of Education provides 12,000 study abroad scholarships per year and 10,000 study-in-China scholarships per year[6]. Student/staff exchange, joint-run schools (programmes), and joint research projects are some of the best practices adopted by the Chinese higher education institutions regarding internationalization. This has been accompanied by a doubling of the gross enrolment ratio in higher education over the last seven years with a corresponding increase in the governmental support for higher education[6].

The 11th five-year plan (2007–12) envisages to take the GER to 15% by the end of the Plan and to 21% by the end of the 12th five-year plan (2012–17) (ref. 7). Emphasis is being laid on both capacity building in terms of quantity and quality by establishing/upgrading state-of-the-art institutions and substantially increasing the number of fellowships for doctoral research. Knowledge clusters which promote necessary synergies, sharing of resources, ideas and facilities are also being established to promote innovation[7]. The projected trends of Ph Ds by the end of the 11th and 12th five-year plans may help to further strengthen Ph D programmes in science to promote knowledge-based innovations and help India emerge as the leading country in terms of economic development.

1. Education Statistics 2005–06, Department of Education, Ministry of Human Resource and Development, Government of India, 2008.
2. Sinha, A., Finishing school's for engineers; http://in.news.yahoo.com/48/20080913/814/tnl-finishing-school-for-engineers.html
3. Hasan, S. A., Khilnani, S. and Luthra, R., *Manpower J.*, 2009 (accepted).
4. Prathap, G., *Curr. Sci.*, 2008, **94**, 1113.
5. Pai, M. A., With more Ph Ds, India can be a superpower; http://www.rediff.com/cms/print.job?docpath=//money/2006/mar/10iit.htm
6. Xinyu Yang, In Conference on Emerging Direction in Global Education (EDGE), Bangalore, 2008.
7. Eleventh Five Year Plan Document on Education, Planning Commission, Government of India, 2007–12.

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The history of 'two cultures': can we bridge the gulf?

The story of 'two cultures', as told by C. P. Snow, in the middle of the last century and the aftermath of it is still haunting the academic milieu. The editorial by Balaram[1], 'Social Scientists, Natural Scientists and Sociobiology' raked up the Snow anecdote, while discussing the issue of sociobiology. The two cultures, emanating from the 'behavioural traits' of the social and natural scientists, are not limited to the peripheral dichotomies of 'sit and stand', 'speak and read' of a seminar. Though Balaram referred to the context of sociobiology and the points raised by Gadagkar's lecture[2], a review of the Snow-phenomenon from a historical perspective may be useful to judge whether 'coalescence' is possible or an attempt to bridge the two is essential. For centuries, humanities like literature, languages, philosophy, economics, anthropology, fine arts and other social sciences had been sheltered under the 'arts' faculty, with an 'untouchable' distance from the so-called mundane sciences. Fine arts were assumed to be a part of divine machination and treated with exclusiveness in academics too, for a long time. However, civilizations flourished, consuming everything good from any source. This eclectic nature of social development was quite apparent when the Oxford University[3], founded in AD 1171, had initially been started with four branches: magic, music, logic and mathematics. A good blend of arts and sciences indeed!

The material knowledge and creative faculties travelled together for centuries