

## Funding basic research

I read with great interest the editorial 'Funding basic science' by P. Balaram (*Curr. Sci.*, 1998, 75, 77). After returning to India nearly 2 decades ago, I have been watching the Indian scientific scene with great sorrow. I completely agree with the observations regarding the state of science in our country. Of course, a number of *Current Science* readers also have been expressing their anguish over this matter.

Perhaps it would be appropriate to recall the words of Vannever Bush from his report to the American President immediately after the Second World War: 'Basic research leads to new knowledge. It provides scientific capital. It creates the fund from which the practical applications of knowledge must be drawn... Today it is truer than ever that basic research is the pace-maker of technological progress... A nation which depends upon others for its new basic scientific knowledge will be slow in its industrial progress and weak in its competition in world trade, regardless of its mechanical skill.' (Vannever Bush in *Science: The Endless Frontier*, A report to the President (of USA) on a programme for postwar scientific research, July 1945. Reprinted July 1960. National Science Foundation. Washington DC, p. 19.)

There is a prevalent misconception in India that basic research is a luxury that can be indulged only by a few rich nations of the world. As the above statement of Vannever Bush amply demonstrates, basic research is an absolute necessity if we really are to prosper.

Unfortunately, often in our country, doing basic science is equated with 'ivory tower research' and intense pressure is put on short-term goals. It is ignorance that makes people feel that (i) a developing country cannot afford investing in basic research and (ii) answering fundamental questions requires a lot of money. Both these concepts are wrong. As long as we do not develop our own technologies in fundamentally new directions, we will remain mere followers. Secondly, more than large sums of money, answering basic questions requires unconventional thinking and encouragement from those around.

The prevailing trend now seems to be to encourage projects with megabucks rather than doing good science. A bad project with populist aims and 'political correctness' has a better chance of getting funded than a good one on understanding the basic mechanisms. At the other extreme, we are all busy doing 'xerox research', copying the best of the worst from the Western laboratories 'indigenizing failure' (as you so aptly term it!). Science has stopped being the art of the soluble and has become the practice of the possible in our country. No wonder even after 50 years of independence, India is yet to bag a Nobel prize in science. One wonders how people like Chandrasekhar and Khorana would have fared had they stayed in India.

I have seen many a good scientist either dropping out of science or leaving the country because of pressure to do

short-term, populist research. A good Indian scientist (particularly one who does not have the 'right' connections) should not feel that the best place to serve his country is from outside India. Unless steps are taken to encourage basic research by scientists whose only qualification is a creative mind, the following words may indeed become very true for those who want to do it: 'It has been a sad but enlightening experience to recognize that the universality of science does not imply unbiased acclaim for scientific truth and a true history of science, and that if one has neither powerful alliances nor influential sponsors, he should learn to do science for its own sake and not be depressed by lack of appreciation' (E. C. G. Sudarshan in *Pions to Quarks*).

Encouraging basic research will go a long way in turning capable scientists from doing 'politically correct' or 'fashionable, band wagon' research to those who can generate the scientific capital necessary to place our country in the forefront. I am really glad that in the last few years, *Current Science* has done much by discussing many of these issues. I hope that someday this constant hammering from journals like *Current Science* will help us to change our attitude towards the type of science needed in this country.

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## Regulation and control of groundwater management and development

The opinion article of B. P. Radhakrishna (*Curr. Sci.*, 1998, 75, 542) entitled 'Groundwater: Wake up before it is too late', made interesting reading. Recent developments in the country for regulation and control of groundwater management and development are worth noting.

In the matter of groundwater depletion, the Supreme Court passed various orders on 25 May 1996, 21 November 1996 and 5 December 1996 for setting up of an authority under Environment (Protection) Act, 1986 with directions to the Government of India to declare Central Groundwater Boards (CGWB)

as an authority under Environment (Protection) Act and delegate powers under the Act for the purpose of regulation and control of groundwater development. The Court directed that the authority should regulate the indiscriminate boring and withdrawal of groundwater in the country and issue

necessary regulatory directions with a view to preserving and protecting the groundwater.

On 14 January 1997, the Ministry of Environment and Forests vide its notification SO 38 (E) constituted Central Groundwater Authority under sub-section (iii) of Section 3 of Environment (Protection) Act, 1986 (GOI, 1997) (ref. 1).

As per the notification, the jurisdiction of the authority will be the entire country and it will function under the administrative control of Ministry of Water Resources. The Central Groundwater Authority (CGWA) is vested with powers under Section 5 and 15 to 21 of Environment (Protection) Act, 1986 to carry out its functions. The Ministry of Water Resources prepared a model bill for enactment by all State Governments for regulation and control of the development of groundwater under Groundwater (Control and Regulation) Act (GOI, 1992) (ref. 2). Here, the procedures for constitution of State Groundwater Authority (SGWA), powers to notify areas and grant permission and restrictions for control and regulation of groundwater development have been described in detail.

CGWA is issuing notices to persons/agencies engaged in construction of wells to get registered. They should also submit information about the number of drilling machines and ancillary equipments, area of operation, etc. to the Regional Directors at 16 Regional Offices of CGWB before 31 December 1998.

Radhakrishna has rightly pointed out the important measures to check further

deterioration of the groundwater. CGWA is vested with powers to conserve the groundwater resources and regulate the development of groundwater. The contention of Radhakrishna that Government agencies are not taking any interest is not true. The government of Andhra Pradesh has recently started an innovative scheme for storing of surface water for recharging the groundwater reservoir.

Wetlands including ponds and lakes should not be affected or used for any development activity in villages, towns and cities. The local panchayats and the State Governments have more role to play in this regard. Areas with declining groundwater level, pollution, salinity hazards, etc. should be immediately identified to help authorities to take appropriate steps to evolve district-wise groundwater management and planning programmes in the State.

Apart from this challenging problem to control the depletion of groundwater, more threat is now felt about pollution of groundwater sources. The ground water contamination is posing severe health hazards in many areas. The data collected by CGWB, Bhubaneswar for Orissa (CGWB, 1998) (ref. 3) reveal that groundwater is contaminated with high salinity, iron, fluoride and nitrate in many districts.

The pollution of drinking water sources need to be immediately tackled by concerned District authorities before it becomes a catastrophe for the human survival in these areas. Groundwater contamination has been reported in many parts of the country including

many areas in West Bengal and Delhi. The local voluntary organizations, the district authorities and village panchayats should also help CGWA to take appropriate action and chalk out strategies for management of groundwater development. Industries, mining and housing organizations must not harvest groundwater resources in those areas where already significant adverse impact has been noticed. They must ensure that effluent discharge to any water source must meet the prescribed norms. Zero discharge concept is always advisable for projects to save precious water resource. Surface water harvesting may be encouraged in these areas.

It is hoped that the concerned authorities will act responsibly and the problem of groundwater depletion and pollution will be contained with the help of the public and legal instruments in force.

1. GOI, 1997. Notification No. SO (38E) dated 14.01.97, Ministry of Environment and Forests, New Delhi.
2. GOI, 1992. Model bill to regulate and control the development of groundwater, Government of India, Ministry of Water Resources, New Delhi.
3. CGWB, Groundwater quality problems in Orissa. (Table 11.1) Central Groundwater Board, South Eastern Region, Bhubaneswar, 1998.

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## 'Terminator' transgenics

'Genetically engineered crop seeds that turn sterile after first use threaten Indian farmers'; 'Scientists flay terminator gene; seek immediate government intervention'; 'Terminator seed'; 'Seed material with terminator gene banned'; 'Terminator gene may sneak in despite ban'; 'US co. not to be granted patent for terminator gene'; 'Centre warned of the repercussions if terminator gene sets foot on Indian soil'; 'IISc caught in terminator wars'.

The above is a sample of the headlines that have appeared in the past few

months in our reputed general and financial newspapers. Much more than due publicity has been given in the press to the so-called 'terminator' gene technology and its hazards have been over-exaggerated. I wish that the newspapers give equal coverage to the more positive developments in crop biotechnology. The over reaction, not only of the activists and reporters, but also of the agricultural scientists calls for a more rational, scientific appraisal of the possible hazards. The multinational company Monsanto which is indicted

for the 'terminator' refers to the new concept as 'the gene protection technology'. Monsanto has clarified that the technology is conceptually developed by Delta and Pine Lands (D&PL), and an idea patent has been filed jointly with the US Department of Agriculture in USA<sup>1</sup>. While Monsanto has stated that 'terminator' seeds or plants do not exist, one report mentions that the technology has been tested in tobacco and cotton<sup>2</sup>. It is also reported that the Government of India has banned the import of this technology, and further, the pat-