Academic to the core. Manmohan Singh is reshaping the higher education landscape.

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Q&A: MANMOHAN SINGH

India's Scholar–Prime Minister Aims For Inclusive Development

NEW DELHI—Indian Prime Minister Manmohan Singh vowed last month to more than double the nation's R&D spending to $8 billion a year by 2017. The pledge was no bolt from the blue. Since taking office in May 2004, Singh has launched initiatives to entice overseas scientists to return home, create elite universities, and establish a grants agency modeled after the U.S. National Science Foundation (see p. 891).

But the largesse announced at the Indian Science Congress comes with a sobering assessment. "Over the past few decades, India's relative position in the world of science had been declining, and we have been overtaken by countries like China," Singh declared. In an exclusive interview with *Science*, Singh reiterated that concern, observing that "China is in many ways far ahead of India."

In academic circles, Singh enjoys a form of street cred. "He's a scholar, a thinker," says Raghunath "Ramesh" Mashelkar, former director general of India's Council of Scientific and Industrial Research. Born in 1932 in Gah, now part of Pakistan, Singh walked to school and studied by the light of a kerosene lantern as a boy in his unelectrified village before becoming a professor at the Delhi School of Economics. As finance minister from 1991 to 1996, Singh presided over reforms that have transformed India into one of the world's fastest growing economies.

Gentle and modest, Singh's soft-spoken demeanor belies the grit he has shown on some issues of importance to scientists. He staked his government's future on nuclear power when, overriding fierce opposition, he inked a controversial deal with the United States in 2008 that opened India's civilian nuclear industry to the outside world. He has struck a cautious stance on genetically modified (GM) foods; in 2009, he did not intervene when his former environment minister rejected a scientific panel's advice and banned commercial planting of GM eggplant, or brinjal, until additional safety trials are completed.

On balance, Indian scientists give Singh high marks for his tenure as prime minister. Last month, they elected him general president of the Indian Science Congress Association during its centenary year—the first prime minister to receive that honor. In an interview at his residence here with Editor-in-Chief Bruce Alberts, Asia news editor Richard Stone, and India correspondent Pallava Bagla, Singh shared his thoughts about competing with China, foreign interference in the GM food debate, and how to tightly harness R&D to development in a country in which 42% of children are malnourished. The following transcript is edited for clarity and brevity.

–PALLAVA BAGLA AND RICHARD STONE

Q: At the Indian Science Congress last month, you said that "we need to do much more to change the face of Indian science." Please elaborate.

M.S.: Well, we need to spend a lot more on research and development. Our share of GDP which we spend on R&D is about 1%, and I said that we should raise it to about 2% of GDP. We need to spend a lot more money on the areas where our development needs are actively served by developments in science, technology, and innovation. So in our country today we have a situation where as far as the public sector is concerned, our proportion of GDP going into R&D in science and technology is roughly the same as the other developing countries, but it is the private sector in our country which has to do a lot more.

Q: What kind of incentives might work for industry?

M.S.: These matters cannot be decided upon merely in a short period. It is a medium-term process. We have a plan which will be launched from April for the next 5 years. Our effort will be to increase gradually the proportion of money spent on R&D and at the same time create a system of incentives which will induce the private sector to increase their spending on science and technology.

Q: In the United States, 17% of total research and development spending is spent in higher education systems, whereas in India the number is about 4%. It is the lowest percentage of any of your peers. Is this a problem that needs to be fixed?

M.S.: Well, we need to spend a lot more money on education, more so on higher education. We have increased the number of IITs [Indian Institutes of Technology]. We have increased the number of Indian Institutes for Information Technology in a massive way. We are going to increase the number of what we call innovation universities. So I am confident that the landscape of higher education in India will change enormously in the next 5 to 10 years.

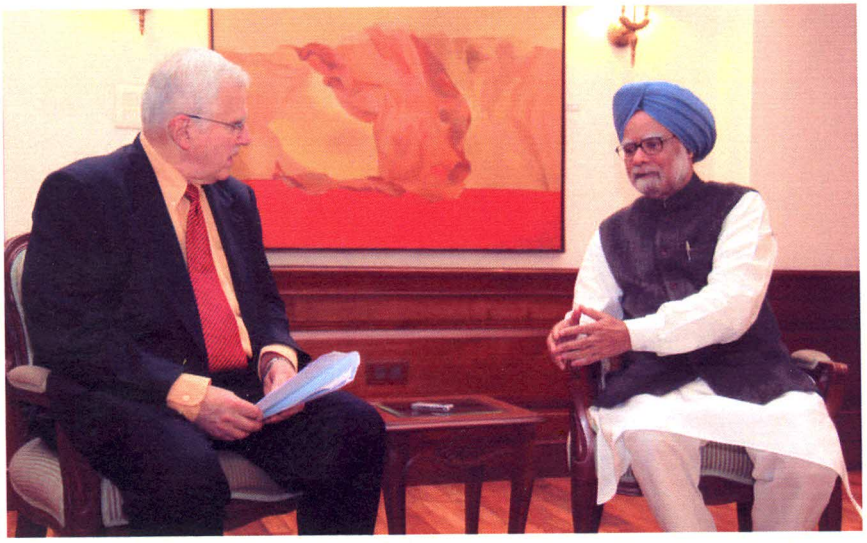
Our real problem is quality teaching staff. We are trying to induce more people to go for Ph.D. degrees in science and technology. I

think we are making some impact, but not as fast as we need in order to meet the needs of our higher education system. Therefore, we must also find innovative means to draw upon the Indians working in the universities abroad, particularly in the United States, to find some time to spend teaching in our country.

Q: You also mentioned in your speech at the science congress about the need to do more to address the developmental needs of India through research. A good example is [agricultural scientist] M. S. Swaminathan's efforts to bring the benefits of science to Indian villages. Does India need to do more to invest in that kind of science and if so, how might it be done?

M.S.: We need to pay a lot more attention to the development of our agriculture. That will accelerate the tempo of rural development, which will help to increase the opportunities for our scientists to work in rural areas in development of water-management technologies, in development of environment-friendly technologies, and also communicable diseases. We have to pay a lot more attention to R&D, tackling the problems of communicable diseases. We are victims of a double whammy. There are diseases which are peculiar to developing countries, but there are also diseases, which I think know no level of development, and in both these areas we have opportunities.

The Indian agricultural research system could also be made much more productive in tackling problems of what I have often described as ushering in a second green revolution. We have difficulties in increasing the productivity of dry land agriculture. That means technologies which will save water and technologies which will conserve energy also should get a lot more attention.



Candid exchange. In an interview with *Science* Editor-in-Chief Bruce Alberts and colleagues, Manmohan Singh shared his concerns about GM foods, nuclear activists, and China.

Q: Why did your government put a moratorium on the release of Bt brinjal?

M.S.: Biotechnology has enormous potential, and in due course of time we must make use of genetic engineering technologies to increase the productivity of our agriculture. But there are controversies. There are NGOs, often funded from the United States and the Scandinavian countries, which are not fully appreciative of the development challenges that our country faces. But we are a democracy, we are not like China.

You know, for example, what's happening in Kudankulam [in southern India, where local NGO-led protests have stalled commissioning of two 1000-megawatt nuclear reactors]. The atomic energy program has got into difficulties because these NGOs, mostly I think based in the United States, don't appreciate the need for our country to increase the energy supply.

"Science and technology are the ultimate salvation for finding meaningful new pathways for developing our economy."

—MANMOHAN SINGH

Q: After the Fukushima disaster in Japan, do you still think that nuclear energy has a role in India?

M.S.: Yes, where India is concerned, yes. The thinking segment of our population certainly is supportive of nuclear energy.

Q: At the science congress, you mentioned your feeling that China has overtaken India in science. Are you competing with China?

M.S.: Well, we are competing, yes and no. India and China are engaged in a stage of development where we have both to compete and cooperate. We are the two largest developing countries and the two fastest growing countries. China is our great neighbor. Now, we've had in the past problems way back in the 1960s, but we are finding pathways to promote cooperation.

Q: India has invested very large amounts of money in space.

M.S.: And it has paid off.

Q: The country wants to put astronauts in space. Indian astronauts from Indian soil using Indian rockets. Is that something you support?

M.S.: We supported the Chandrayaan lunar missions. And satellite technologies, rocket technologies—those are, I think, highly favorable outcomes of the Indian space program, and we need to do more.

Q: But what about the astronaut program? The Indian Space Research Organisation is asking for $2.5 billion. You talk of inclusive growth. In that inclusive growth, how does human space flight fit in?

M.S.: Well, ultimately science and technology must be viewed as an instrument of raising the standard of living of our people. Now, if information technology can be seen to promote the development of our country, particularly in the inclusive style of development, I think people will see space technology also as a new way of dealing with the ancient scourges of poverty, ignorance, and disease. Science and technology are the ultimate salvation for finding meaningful new pathways of developing our economy.

Q: Where do you see the future of Indian science in 20 years?

M.S.: Indian science has a very bright future. I have no doubt that we will scale new heights, we will explore new frontiers, and more and more young people will take to science as a career. Things are already changing for the better.

One has to be optimistic. In poor countries, unless one is optimistic, one is overwhelmed by the dimension of the development task that we have to accomplish.

CREDIT: PALLAVA BAGLA