

**Indian Science and IISER: Raising Aspirations,
Climbing New heights**

by

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I consider it to be a great privilege and a special honour to deliver this convocation address of our Indian Institute of Science Education and Research, Pune as it completes a decade of its glorious journey.

At the outset, let me congratulate the graduands of the day, their teachers and their parents. To the parents especially, I want to say that education is the best gift you could have given to your child.

My young friends, my special congratulations to you that you decided to opt for science as a career. The recent crisis before India has been that the best of our young minds do not turn to science, and those, who do, they do not stay in science.

I do hope that you will all continue to stay in science. Over the past five decades, I have myself relished the unique fun, joy and excitement of science. And I assure you that you will find it an equally exhilarating and fulfilling experience.

You will be stepping out of the portals of this great Institute today in a world that is full of challenges but also great opportunities.

India today is not just being looked at as a third world country - it is being looked at as potentially a third most powerful country in the world.

My young friends, it is going to be your responsibility to build this great future of our beloved nation.

My convocation address today is divided into two parts. The first is about the Institute itself and the second is about its very purpose, science.

More specifically, the first part is about IISER itself, its birth, its journey, its future, and more specially, the lessons in new institution building. The second part is about my thoughts on what will it take India to be a leading player in world of science.

I have vivid memories of the birth of this institution, because right from its conceptualisation to its final realisation, I was personally involved in some way or the other.

When it comes to a new institution building, there is invariably a powerful confluence of positive winds coming from different directions. They all carry seeds of new thoughts, which finally bear fruit. And so was the case with the birth of IISERs.

I must acknowledge here the visionary blueprint created by late Professor V.G. Bhide and Professor Govind Swarup over two decades ago. They were amongst the first to give a clarion call for action on building a world class science education and research institution.

I remember that I was a member of the Science Advisory Committee to the Prime Minister (SAC-PM). Dr. Manmohan Singh was then the Prime Minister. Our nation's foremost scientist, Professor C.N.R. Rao, was its Chairman.

In a SAC-PM meeting, I remember making a presentation to the Prime Minister, among other things, about the rapid growth of science institutions in neighbouring countries like China, South Korea, Taiwan, etc., where both physical and intellectual infrastructure for science education and research was being built at a feverish pace.

And then I brought out the sharp contrast in India. I mentioned that for a country of a billion, surprisingly, in around hundred years, India built only one institute dedicated solely to science. I said it was going to celebrate its centenary in 2008. It was Indian Institute of Science in Bangalore. And for an effect, I added that it was not built by the Government, but by Jamsetji Tata, indeed some people still call it Tata Institute!

In the discussion that followed, there emerged a full consensus that for fulfilling the aspirations of emerging India, the Government had to take a call on a massive expansion of our educational and research infrastructure, with great emphasis on Institutions fully dedicated to science.

But a good intent has to be followed by action. Our nation was lucky to have Professor C.N.R. Rao as a thought and action leader at the helm of

affairs. With his incredible dynamism and persistence, he worked with the Government and ensured that the dream of building five such institutes of science education and research in the country will be realised.

Then there was the discussion of where to locate these institutions in India. I was in the meeting, when this discussion took place. I was then the Director General of CSIR, with NCL as one of its 40 laboratories. I remember I was the first one instantly offering 100 acres of NCL land, if an IISER was to be set up in Pune. (Incidentally, I had taken no permission to make such an offer! But I have always thought from my heart, rather than my head!) As you can imagine, the issue of IISER, Pune was settled there and then!

Giving a quick and hassle free start to an Institution is important. I have seen a number of IISERs suffering here. I had a first-hand experience of such struggle, as I was the Chairman of two of the five IISERs, namely Mohali and Kolkata.

But IISER Pune did not suffer. Here again, I remember offering the entire complex of a vacated CSIR laboratory, MERADO, adjacent to NCL, with ready laboratories to IISER. This helped to kick-start IISER.

Location of an Institution is extremely important. Flowers do not bloom in a desert! And here again IISER was very well positioned. Let me explain.

To my mind, education, research and innovation must go hand in hand. Education disseminates known knowledge. Research creates new knowledge. Innovation converts knowledge into wealth and social good.

In that context, what do we have here? IISER, a great educational and research institution. NCL, a world class national laboratory. NCL Innovation Hub, which has received the inaugural prize of the best start up incubator of our nation at the hands of the President of India. All within a few hundred meters of each other.

How lucky that IISER was created in surrounding, which had a great confluence of world class education, research and innovation, and that too right at the start!

We can achieve a great synergy if we break the walls between the three of them. And I am so glad that to see that there are no walls between the three. And here is our big opportunity to make one plus one plus one, not three, but hundred and eleven!

And I must emphasise that this opportunity exists for Pune as a whole. Pune already has a reputation of being the educational and cultural capital. It can become the innovation capital.

Just look at richness and power of over a dozen educational and research institutions just within a circle of a radius of a couple of kilometres from where we are meeting today. Can you believe me if I tell you that over a thousand PhDs are produced annually in this circle?

Having focussed on IISER as an Institution, let me focus on its purpose. Its purpose is to advance science. Get Indian science a pride of place in the world of science. How do we do that?

In science, as someone has said, only two people matter. Those, who say the first word in science. And those, who say the last word in science.

I have often complained that we have not done enough of that in Indian science.

Forget about my views. Let's see what our very own revered scientist Jayant Narlikar has to say.

In 2003, Jayant Narlikar wrote a book 'The Scientific Edge' where he listed the top 10 achievements of Indian science and technology in the 20th century, of course, according to his own judgement? There are five before 1950 and five after 1950.

Interestingly, the five before 1950 are all individual efforts, namely, the works by Ramanujan (the products of his mathematical genius are still researched on), Meghnad Saha (his ionization equation played a vital role in stellar astrophysics), S.N. Bose (his work on particle statistics was path breaking), C.V. Raman (his Raman effect discovery led to the one and only Nobel prize that an Indian scientist doing work in India has won) and G.N. Ramachandran (he was the father of molecular biophysics).

After 1950, Jayant Narlikar lists the other five achievements, namely the green revolution, space research, nuclear energy, superconductivity and transformation of CSIR in the nineties.

In these, except for the superconductivity research, in which the likes of C.N.R. Rao made pioneering contributions, the rest are all government funded 'organised' science and technology.

The question to ask is why is it that in the second half of 20th century, we could not recreate the magic of the early part of the century created by Ramanujans, Ramans, Boses and so on? How do we get back to that magic?

The Nobel Laureate Richard Feynman had famously said, 'the difficulty with science is often not with the new ideas, but in escaping the old ones. A certain amount of irreverence is essential for creative pursuit in science.'

The first grand challenge before Indian science is that of building some irreverence. Our students are too reverent. Our existing hierarchical structures kill irreverence. Promoting irreverence means building the questioning attitude. It means building education systems that do not have rigid unimaginative curricula, it means replacing 'learning by rote' by 'learning by doing', it also means doing away with the examination systems with single correct answers.

More often than not, in our systems, paper becomes more important than people. Bureaucracy overrides meritocracy. Risk taking innovators are shot. Decision making time cycles are longer than the product life cycles. Therefore, the second grand challenge is that of creating enabling, dynamic and positive 'innovation ecosystems'.

I am happy to see that our political leadership at the highest level is seized of this.

On 3rd of January every year, thousands of Indian scientists witness the inauguration of the Indian Science Congress by successive Prime Ministers of India.

In 2001, Prime Minister Atal Behari Vajpayee said, “for Indian science to flourish, the administration and government officials should serve as facilitators of science and not as masters of scientists.”

In 2010, Prime Minister Singh lamented “it is unfortunately true that red tape, political interference and lack of proper recognition of good work have all contributed to a regression in Indian science.”

In 2015, Prime Minister Narendra Modi said "We want our scientists and researchers to explore the mysteries of science, not of government procedures."

And in fact he went more specific, addressing many of the present pain points of scientists. He said "Funding proposals must not take too long

to clear; meeting application requirement should not become more complex than research; approval process should not become a deterrent for international conferences and our scientific departments must have flexibility of funding decisions based on the uncertainties inherent in research activities."

We all have seen our present Prime Minister's valiant efforts to free all our systems from bureaucracy including using the prowess of technology. We are also witness to our current HRD Minister, our very own Prakash Javadekar, working valiantly to grant true autonomy and freedom to our institutions. So we are all hopeful that things will change for far better and that too sooner than later.

The third grand challenge is to develop amongst our scientists an ability to see what everyone else sees but think of what no one else thinks.

Take the 2005 Nobel Prize winners for medicine, Warren and Marshall, for instance. Everyone had thought that the cause of gastritis inflammation and stomach ulceration is excessive acid secretion due to irregularities in diet and lifestyle. Warren & Marshall postulated that the causative agent was, a bacterium called *Helicobacter pylori*. They were ridiculed but they stuck to their guns. They saw what the others did not see. And they were ultimately proved right.

The fourth grand challenge is the ability to pose, rather than merely solve, big problems.

For example, James Watson felt sure that it was going to be possible to discover the molecular nature of the gene and worked hard at it – even to such an extent that he was fired from the Rockefeller Fellowship that he was holding.

Einstein, when he was 15 years old, asked himself what would the world look like if [he] were moving with the velocity of light. This big question led finally to his special theory of relativity.

So while making the choice of the problem itself, we must ask the question, 'so what?'. Meaning, even if I succeed, will it make any difference to the world of science?

The fifth grand challenge is to create new mechanisms by which out of the box thinking will be triggered in Indian science.

In the early nineties, when I was the Director of the National Chemical Laboratory, we tried to promote this by creating a small “kite flying fund”, where an out of the box idea with even a one in hundred chance of success would be supported. Bold thinking was applauded and failure was not punished. The result was remarkable. Some of the 'free thinking' of our scientists gave us a few breakthroughs. We need more of this.

I must also add that besides meeting the demands of the five grand challenges that I have highlighted, IISER also must meet the requirements of building India's future work force. It must work

consciously to build among our young generation the top skills that will be needed in future. What are these?

First, dealing with complexity. Second, critical thinking. Third, creativity. Fourth, emotional intelligence. Fifth, cognitive flexibility.

And constantly, we must work on the ability of co-working, co-creation and that too with both men and machine together.

President Obama had famously said "innovation and education are going to be the currencies of the future."

I go one step forward and say, "innovation in education and education in innovation' is going to be the key to future"

And I am very happy to see all this is happening in our IISER. A great deal of innovation in pedagogy is taking place. In a bold experiment, for instance, students themselves are involved in setting questions.

And I am particularly happy to see that IISER is specially preparing for the five grand challenges that I mentioned. It is building an ecosystem, which is nurturing amongst its students a questioning spirit, inquiring minds, free and bold thinking, and borderless research endeavours. This will augur well for its future.

I wish to congratulate IISER on its magnificent decade long journey so far.

Dr Ganesh, your leadership has been truly inspiring. You and all your colleagues have done the nation proud. The collegiate spirit that you have created is the key to a sustainable institution.

I strongly believe that the formidable foundation has been laid for IISER to not just leap frog to the league of not only front ranking Institutions in India but in the world.

When IISER celebrates its silver jubilee in 15 years' time, I won't be there. But I am sure, the new India of that time will be celebrating with pride IISER and its magnificent imprint on not just Indian but global science.

All my best wishes to our young graduates of the day, to IISER, for a great, fulfilling rewarding, and a remarkable journey ahead.