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What will it take for a resident Indian to win a Nobel Prize

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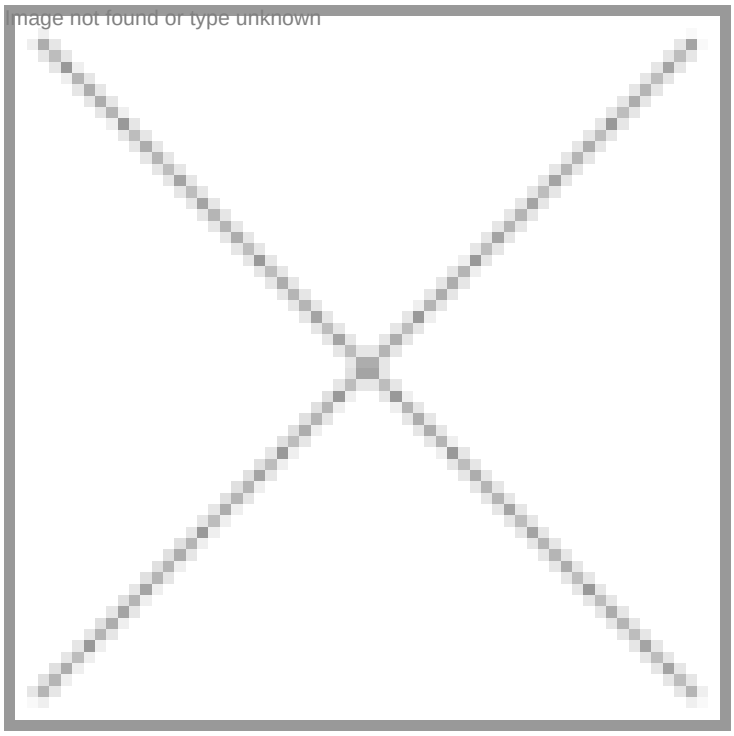

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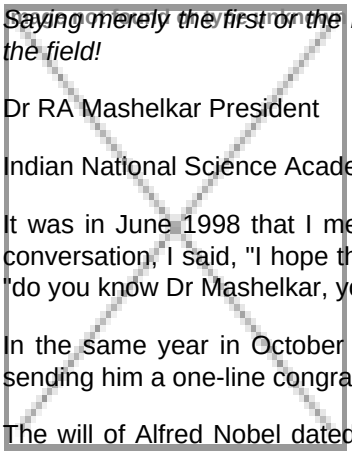

Saying merely the first or the last word in science is not enough. What one says must have a lasting and indelible impact on the field!

Dr RA Mashelkar President

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It was in June 1998 that I met Amartya Sen for the first time at India International Centre in Delhi. At the end of our brief conversation, I said, "I hope this will be the year for the big one." My reference was to the Nobel Prize. He laughed and said, "do you know Dr Mashelkar, you have to be ten times as good to win the Nobel Prize, if you are an Indian!"

In the same year in October 1998, the Nobel Prize in Economics was declared. Amartya Sen won the prize. I remember sending him a one-line congratulatory message "after all you were ten times as good!"

The will of Alfred Nobel dated 27th November 1895 states clearly that "in awarding the prizes no consideration be given to the nationality of the candidate." Therefore, more seriously, if the breakthroughs are truly Nobel Prize-worthy, then there is no reason as to why a scientist should not get it despite his nationality.

But what does history tell us? In more than 100 years, 776 Nobel prizes have been awarded till the year 2005. In science,

only three of them have gone to the 'developing countries' for the work done in their respective countries. One of them happens to be our own Sir CV Raman. This is not an encouraging statistics.

Let us return to the issue of an Indian winning a Nobel prize again. This year the Nobel Prize in Physics has been shared by Roy Glauber, John Hall and Theodor Hansch. Glauber is the winner of half of the Noble Prize "for his contribution to quantum theory of optical coherence." This has raised a controversy since it was felt by some that contribution of ECG Sudarshan, a scientist of Indian origin in the US, has been overlooked by the Nobel Committee. Sudarshan himself has written to the Nobel Committee saying "it would distress him and many others if extra scientific considerations were responsible for this decision". Some Indian scientists have also formally protested to the Nobel Foundation.

In science, they say that only two people will be remembered, those who say the first word in science and those who say the last word in science. Of course, saying merely the first or the last word is not enough. What one says must have a lasting and indelible impact on the field!

Did Sudarshan say the first word? The Nobel committee says "Sudarshan drew the approach to the use of coherent state representations for the approach to classical physics, at this point, he refers to Glauber's work". Thus, the committee is subtly suggesting that Glauber had said the first word! These subtleties are beyond me, since I am not an expert. But the implied emphasis on saying the first word is clear.

As an Indian, I would have been truly proud if Sudarshan had won the Nobel Prize, as did so many other scientists in the past, who deserved it. What does our past history say?

Jayant Narlikar has written a book The Scientific Edge, which has been published by Penguin (2003). He lists the top ten achievements of Indian science and technology in the 20th Century. There are five before 1950 and five after 1950. Interestingly, the five before 1950 are all individual efforts, namely, the work by Ramanujam (mathematics), Meghnad Saha (ionization equation), SN Bose (particle statistics), CV Raman (Raman Effect) and G.N Ramachandran (molecular biophysics). After 1950, he lists the other five achievements as nuclear power, green revolution, space program, superconductivity and CSIR's transformation. All these five are government-funded big team initiatives. The moot question is â€“ what has happened to individual excellence after 1950?

However, if one looks at what happened before 1950, CV Raman did get the Nobel Prize but others did not. SN Bose's work leading to Bose-Einstein condensate is winning Nobel prizes today. Many Indians feel that GN Ramachandran's work on triple helix should have won him the Nobel prize, but he did not.

Let us look at the history of Nobel prizes. There are three Nobel prizes for 'sciences', one each in chemistry, physics and medicine. In chemistry, of the total 152 prizes, 54 went to the US alone, followed by Germany 27 and the UK 25. Similarly in physics, of the total 182 prizes, 79 went to the US alone, followed by Germany 23 and the UK 21. Similar is the story with Nobel prizes in medicine. Of the total of 186, 89 went to the US followed by the UK 24 and Germany 15.

Why is the US the leader? Why that other economic superpower Japan has not been as successful? Many people believe that this has to do with the culture of questioning that exists in the US as against the culture of compliance that exists in Japan.

A potential Nobel laureate needs to be, first and foremost, a true innovator. What is the definition of a true innovator? Innovator is one who does not know that it cannot be done. Bednorz and Muller won the Nobel Prize because they tested materials, which through accepted wisdom, were not supposed to show superconductivity!

Innovator is also one who sees what everyone sees but thinks of what no one else thinks. Look at this year's Nobel Prize winners for medicine, Robin Warren and Barry Marshall. Everyone had thought that the cause of gastritis inflammation and stomach ulceration is excessive acid secretion due to irregularities in diet and life style. Warren & Marshall postulated that the causative agent was in fact a bacterium called Heliobacter pylori. They were ridiculed but they stuck to their guns. They could see and think beyond what others saw and thought.

Indians can always argue that we do not win Nobel prizes, because our investment levels are low. The US spends $250 billion on R&D as against India's $5 billion dollars. Size of the funding is, of course, important. You build large critical mass in a given field, setting up a competition. You empower the scientists hugely with modern tools so that they can run faster and arrive at the results first. But to me, it is not the size of funding but the size of ideas that ultimately matters. If tomorrow any Indian thinks of an out-of-the-box idea to get a material, which shows superconductivity at 20ºC, he cannot be denied the Nobel prize, even if he is an Indian, so profound will be the impact of his discovery on our lives!

The question is how do we make people think out-of-the-box? I tried to promote this when I was the Director of National Chemical Laboratory. We created a "kite flying fund", where an out-of-the-box idea with a chance of success of one in one thousand will be supported. When I moved to CSIR, I created "New Idea Fund" with a similar objective. Eventually, I found that it was not lack of funds but it was lack of ideas that was the bottleneck!

One corollary of the statistics that I have cited is that the traditional and conservative societies, which include China and Japan along with India, appear to be at a disadvantage for a fundamental reason â€“ namely the culture. But can this culture be changed? I believe we can. But we do require a change at all levels right from school science education to the way we fund and the way we do research.

We have to remold the school science education to the mode of "learning by discovery" and 'learning by doing' in contrast to the prevailing "learning by rote" method. Rather than memorizing the products of science, the child needs to learn the beautiful process of science. Questioning and dissent in the classroom and at home must be respected and not punished.

Indian scientists and institutions are risk averse. We must take risks. We must be more tolerant of failures. A certain amount of irreverence is essential for creative pursuit in science. True pathbreakers in science will refuse to preserve the status quo because they enjoy the fun of creation of new ideas and destruction of old dogmas. We need to identify and support such scientists to the hilt.

Eliticism in science needs to be promoted. A potential Einstein or a Ramanujam will have to be identified and nurtured from early on just as the genius of Sachin Tendulkar was recognized at the age of fourteen! There is nothing like "intellectual democracy". Our current research funding pattern, which is too conservative and democratic today needs to change. Out-of-the-box thinking needs to be done not only by scientists but also by those who manage science too!

Can we speculate about the potential Nobel laureates from among the current resident Indians? In a recent survey, the two names that came up prominently were CNR Rao and Ashoke Sen. It augurs rather well that CNR Rao won the Dan David prize recently, which is supposed to be among prizes that get counted as being next to Nobel prize. But is there a way to predict as to whether resident Indians will be in a zone of contention?

The Institute for Scientific Information (ISI) has been publishing citation analysis of each Nobel prize winner's work. All Nobel laureates tend to have exceptionally high level of productivity (articles per author), author impact (citation per author), and article impact (citations per paper). The citation data have frequently been used to forecast the future Nobel awardees. The results indicate that high rankings by citation frequency are strongly correlated with "Nobel Class" authors. In the highest percentile, eg, the top 0.1 percent of authors, a significant percentage have won the Nobel prize or go on to win the prize in later years. Unfortunately, the Indian presence in this highest percentile is rather rare. Our presence here as well as our strong presence internationally through partnerships is going to be critical.

What does it take to win a Nobel prize? One of the Nobel laureates himself said that first and foremost, you have to be very clever. Second, you have to work very very hard. But thirdly, and most importantly, you have to be very very very lucky! He is absolutely right. But luck favors only the brave. In order for a resident Indian to win the Nobel Prize, Indian science must become brave. I hope the emerging brave new young India will also create some unusually brave scientists, who will go on to win Nobel prizes.