Before I conclude, I will like to draw your attention to yet another thought of mine relating to BARC. As you are aware, the Indian nuclear energy programme is more than 60 years old. Thanks to the foresight of Homi Bhabha, today we have a scientific and technological competence in this area comparable to that of many developed countries. We are perhaps the only developing country having full control over the entire fuel cycle. We can take pride in our capabilities in the fast reactor domain. Keeping everything in mind, some of my friends ask me whether the research mandate of BARC is as relevant today as it was in the early years of the programme. I am of the view that it is still relevant today. As you are well aware, the whole world is looking for nuclear reactor designs that have a level of safety far more than those in operation today. I keep hearing about the Gen-IV reactors and I am sure that BARC leads the exercise in India. There are several unresolved issues in the management of spent fuels that warrant intense research in the coming years. There could also be new technologies round the corner waiting to displace the conventional nuclear fission reactors. For example, fusion systems for power generation have been on the drawing board for several decades. Accelerator-driven sub-critical systems for power generation offer inherently safe nuclear power. Are these likely to become standard work horses of nuclear electricity in the coming decades? We do not know. But without a vibrant research programme and a human resource to support it, none of these can be realized. I am therefore of the view that the research mandate of BARC will continue for a long time to come.

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Second Swadeshi Science Nobel Prize – a mirage?

A recent report on why IITs have failed to produce Nobel laureates has reignited debate on the topic[1]. Such a debate appears transiently every year around the months of October and December when the Nobel Prizes are announced and awarded. I would like to extrapolate the question to include premier institutions like the Indian Institute of Science, Jawaharlal Nehru Centre for Advanced Scientific Research, National Centre for Biological Sciences, International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, Institutes under the Council of Scientific and Industrial Research, University of Hyderabad and University of Delhi, which have state-of-the-art infrastructure and get prime attention in funding. These institutions have quality faculty and do attract the best graduate students. The moot question is why these and other premier institutions did not produce a single Nobel laureate during the last 85 years after the only Nobel Prize in science was awarded to C. V. Raman in 1930. To answer this question we must understand what constitutes 'Nobel science', the cultural ethos and academic ambience of the institutions which have been winning Nobel Prizes at regular intervals[2–4].

(i) The institutions winning Nobel Prizes at regular intervals[4] have stalwarts working in frontline areas with original ideas and well-defined objectives for a breakthrough. We know brilliance breeds brilliance. They are either Nobel laureates or belong to the 'Nobel class'[2,5] and attract graduate students and postdocs with a passion for high-end research and earning global recognition.

(ii) Could Har Gobind Khorana, Subrahmanyan Chandrasekhar and Venkatraman Ramakrishnan have won the Nobel Prize had they continued in one of the institutions in India? Perhaps not. In addition to individual brilliance, academic milieu and ambience of the institutions play a pivotal role in fostering creativity[6]. The greatest challenge is to make our institutions and laboratories attractive for the most brilliant and competitive, who often leave the country after graduation.

During the last decade or more, China has recognized and appreciated the above points and set a target for creating institutes of global significance. Our premier institutions do have a large pool of brilliant researchers of international repute, but remain short of winning the coveted 'Prize'. This implies that there are issues which hold us back. A disinterested view of the scenario in our country reveals that we are progressing too slow and too late to make a tangible impact. This is evident from the data in Nature Impact 2014 (ref. 7) and Nature Impact Asia-Pacific 2015 (ref. 8). There is no rigorous mechanism for a reality check of the institutes for quality parameters. Similarly, a fresh look at the cultural ethos of the institutes for novelty and innovation is highly desirable. It is high time to do soul-searching for our global status notwithstanding our achievements in space, atomic energy and agriculture. The recent miracle in science education and research is China rushing to overtake USA[7,8]. The obvious question is why we cannot do what China has done? A pragmatic recipe for a turn around and pathway to meritocracy in Indian science has been given by Yamuna Krishnan[9]: 'To catapult India into the top five scientific nations, the country needs enabling policies that money can't buy. India has huge positives but it is hamstrung by socio-cultural issues, two of which I address here: a herd mentality and a paucity of early-stage mentorship. My ideas, stem from my 15 years as a graduate student and young research-group leader in India.'

After taking a holistic view of the global scene in science education, research and cultural ethos of high-ranking institutions the following points emerge for urgent consideration of the planners for science education and management:

- Mission statements of the institutions should clearly enunciate a time-bound goal for innovation, achieving global high ranking and winning international recognition, including a Nobel Prize.
- Faculty hiring criteria should be rigorous with a long-term perspective[10]. To quote Ian Gibson, British politician:

'Science is not just about laboratories and fancy new institutes; it is about the people inside them too'.

- It seems mentoring is one of the weakest links in our science education and research. We lack role models as well. Faculty and scholars should be encouraged to set long-term higher goals of achievement rather than hanker after short-term local recognition, mundane awards and race after positions of management and power[11].
- A clear message should go that meritocracy would prevail. It should be visible in the form of full transparency. There should not be any scope for pressure groups, cliques and coteries.
- Encouraging a culture of scientific race and hot chase of out-of-the-box ideas and frontline research problems.
- Frequent brain storming in the research groups on what is new with a culture of 'Think Big'.
- Having stalwarts, including Nobel laureates on the campus, may be, by inviting them as visiting scientists.
- Any sense of adhocism and short-term quick-fixes should end.
- Administrative reforms for speed in processing of hiring, and transparency in funding[12] with commitment to root out red-tapism, feudalism and shaking up status quo.
- Science management positions should be donned by the academic leaders with intellectual prowess, international visibility and moral authority by virtue of demonstrated excellence. Much is desired on this front as is obvious from the sacking of Vice Chancellors for getting positions with fabricated CVs and other malpractices[13,14]. It is common knowledge that potential candidates start looking for 'contacts' and political patronage as soon as any management position in academics and research falls vacant. In many states, the Vice Chancellors change with the change in governments. This sends a wrong signal to scientists and academicians.
- Candid inputs from the faculty as well as scholars for achieving excellence would help fix the issues in the earnest and bring in happiness for the bench workers.
- Cultivating compulsive thinkers and creative students, preferably at the school level.

Winning a second Swadeshi Nobel Prize in science latest before 2030, the year of centenary celebrations of the first and the only award so far, would be the most fitting tribute to the genius and creativity of C. V. Raman.

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Maternal iron supplementation: one size does not fit all

Anaemia is the most common nutritional deficiency worldwide. The prevalence of anaemia in non-pregnant and pregnant African women (47.5% versus 57.1%) and Southeast Asian women (45.7% versus 48.2%) suggests that majority of reproductive age women at risk for anaemia reside in these countries[1]. Anaemia in pregnant women from developing countries remains as a major public health concern despite a few decades of efforts through special policies and national programmes.

In developing countries, anaemia is attributed primarily to iron deficiency (~50%); however, other concurrent micronutrient deficiencies of vitamin A, folic acid, vitamin B_{12}, copper, and riboflavin can increase the risk of anaemia. Diets of pregnant women in these countries are less diverse with poor access to animal sources of food to meet the increased nutrient requirements of growing maternal and foetal tissues. Further, parasitic infections, acute and chronic infections, diseases that influence the absorption and metabolism of nutrients, and haemoglobinopathies can cause low haemoglobin status (i.e. haemoglobin concentration <110, <105 and <110 g/l in the first, second and third trimesters of pregnancy respectively) or anaemia[1]. The dual burden of undernourished and overweight/obese women adds a different dimension to the challenge of managing anaemia in these countries.

Given the multifactorial etiology of anaemia, to diagnose iron deficiency anaemia (IDA), pregnant women should be screened using a combination of hematological indices such as haemoglobin and serum ferritin. In certain developing countries, often due to lack of resources and local laboratory facilities, women are less routinely screened for anaemia, or not at all. In areas where laboratory facilities are available, women are screened for any anaemia using only haemoglobin