

# Of Science and Scientists Making India Great

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**L**earning gives  
creativity, Creativity  
leads to thinking  
Thinking provides  
knowledge, Knowledge  
makes you great

This famous quote by Dr APJ Kalam is true not only for individuals but also for nations. Scientific knowledge, which mainly accounts for the technical progress in any society, has come to be looked upon as the foundation of a nation's economy in the modern world. This is amply brought to fore in a path breaking study by the Nobel laureate economist Robert Solow who showed that seven eighth of the growth of US from 1900 to 1950 was accounted for by technical progress, while only one eighth was driven by capital. In a treatise, 'Science—The Endless Frontier' on post-war science policy in US, Vannevar Bush observed, "New products, new industries, and more jobs require continuous additions to knowledge of the laws of nature ... This

essential new knowledge can be obtained only through basic scientific research." National Science Day, celebrated in India on 28 February every year to mark the discovery of the Raman Effect, provides us an occasion to remind ourselves of the contributions of science and scientists in making India great.

**Science Roots of India**  
India is a nation with a soul and by all accounts thrived as a knowledge society in the past. It is not quite in the distant past that the country was known as Sone ki chidiya (golden sparrow). In an exhaustive work based on authentic references from across the world Dr. Dharmapal discussed the highly developed status of science, technology and education in India till the 18th century before the invasion of British rule. The colonial interlude extending over centuries systematically eroded the knowledge base of India. According to Felix Padel Darwin (<http://timesofindia.indiatimes.com/city/lucknow/>), "India was far more developed than Britain in terms of multi-cultural ethos and in its manufacturing skills. After the

British rule, the quality of manufacturing in many things like cloth declined radically and went in the 'de-developing' mode". About the indigenous culture of the tribal communities he observed, "They are egalitarian, have excellent environmental knowledge. Tribal societies are far more developed than the mainstream industrial society, especially if we look at living sustainably". It is motivating to rediscover our own strengths in science and technology through examples from history. Table 1 presents a few examples, taken from the work of Dr Dharmapal ('Indian Science and Technology in the Eighteenth Century', Other India Press, 2000), that convince us of our remarkable achievements in science and technology.

## India Recognizing the Power of Science

The strong science roots helped India to quickly realise the power of science and technology in the shaping of a nation in modern times and several individual and group efforts in this direction contributed to making India a greatly developing nation. This is evident from our spectacular

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Table 1 Examples from History of our Remarkable Achievements in Science and Technology

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| Smallpox inoculation was practiced in India long before the British knew about it. In ancient India smallpox was prevented through the <i>tikah</i> .  |
| The drill plough, which was introduced in England in 1730, was used in India from time immemorial.   |
| The observatory at Varanasi was treated as one of the five 'celebrated observatories' of the world by the <i>Encyclopaedia Britannica</i> in its editions till 1823.   |
| There was considerable use of surgical techniques in different parts of India in the 18 <sup>th</sup> century. This included removing ulcers and cutaneous eruptions of the worst kind. Cataract operations were practiced with great success from time immemorial.  |
| Plastic surgery has been reported to be prevalent in Western India and there were reports of 'putting on noses on those who lost them' and of 'Caute', the cement used for 'uniting animal parts'.   |
| Besides widespread artificial irrigation, the practices of (i) crop rotation, (ii) manuring, (iii) sowing by means of the drill plough, and (iv) use of a variety of other implements were fairly widespread. According to the observation by Alexander Walker, 'the practice of watering and irrigation is not peculiar to the husbandry of India, but it has probably been carried there to a greater extent, and more laborious ingenuity displayed in it than in any other country'. |
| The sample of <i>wootz</i> steel sent to Sir J. Banks, the President of the British Royal Society, was found in general to match the best steel then available in Britain. He found it 'excellently adapted for the purpose of fine cutlery, and particularly for all edge instruments used for surgical purposes.'  |

Table 2 India's Achievements in Science

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| <ul style="list-style-type: none"> <li>• With the launch of the Mars Orbiter Mission, also called Mangalyaan, on 5 November 2013, India became only the fourth nation in the world to reach Mars, the first Asian nation to reach Mars orbit and the first nation to do so on its first attempt.</li> <li>• PARAM, the superconducting machine built indigenously by the Centre for Development of Advanced Computing, placed India second after USA in the field of supercomputing.</li> <li>• India has become only the second country outside Europe to join the European Molecular Biology Organisation, which consists of 1,700 eminent scientists and 84 Nobel laureates, and aims to encourage research in the field of life sciences.</li> <li>• The proposed Laser Interferometer Gravitational-Wave Observatory (LIGO) facility in India will only be the third such laboratory in the world and the first outside the United States.</li> <li>• With the development of the self-sustaining missile developing programme called BrahMOS, India became one of the few countries to develop its own ballistic missiles. It is the world's fastest anti-ship cruise missile in operation.</li> </ul> |
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achievements in the fields of space exploration, information technology, agriculture, healthcare and nuclear technology. Indian scientists have contributed significantly to scientific knowledge and elevated India's status as one of the major scientific centers of the world. We are the second largest group of scientists and engineers in the world and are among the very few countries which have developed indigenous nuclear

technology and ballistic missiles. Table 2 includes some of our monumental scientific achievements. However, roots of every great scientific achievement of a nation can be traced to the motivation of one or more individuals who enlivened the above quote by Dr Kalam. These individuals were driven by curiosity and passion that led them to learn in pursuit of creativity. This creativity led them to think beyond the

mundane goals of marks, degrees, power and money. Through this process they earned the precious knowledge and also the wisdom of using this knowledge for the benefit of society, nation and mankind. Knowledge and wisdom made them great and also brought rich laurels to India. Table 2 enlists some pioneers of scientific developments in India.

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|---|--|---|---|---|--|
| <p>Sir J C Bose (1858 – 1937): One of the fathers of radio science, father of Bengali science fiction</p>               |   | <p>Sir M Visvesvaraya (1861 – 1962): Father of modern Mysore state, Bharat Ratna (1955)</p>                             |   | <p>Sir C V Raman (1888 – 1970): Nobel Prize in Physics (1930), Bharat Ratna (1954)</p>  |   |
| <p>Sir Shanti Swaroop Bhatnagar (1894 – 1955): Father of research laboratories</p>                                      |   | <p>S N Bose (1894 – 1974): Developed Bose –Einstein (BE) statistics and the theory of BE condensate</p>                 |   | <p>Homi Bhabha (1909 – 1966): Father of the Indian nuclear Program</p>  |   |
| <p>Vikram Sarabhai (1919 -1971): Father of India's space program</p>  |   | <p>APJ Abdul Kalam (1931 – 2015): Missile Man of India, 11th President of India, Bharat Ratna (1997)</p>                |   | <p>U. R. Rao (Born 10/3/1932): The man behind The first satellite launched by India – Aryabhata (1975)</p>                        |   |
| <p>C.N.R. Rao (born 30/6/1934): One of the world's foremost solid state and materials chemists, Bharat Ratna (2014)</p> |  | <p>J V Narlikar (born 19/7/1938): Champion of steady state cosmology – an alternative to the popular Big Bang model</p> |  | <p>Sam Pitroda (born 4/5/1942): Pioneer of telecom revolution in India, Chairman of National Knowledge Commission (2005-2009)</p> |  |

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The Science, Technology and Innovation Policy-2013 of India aspires to position India among the world's top five scientific powers. Investing in our own rich legacy holds a sure promise for our aspiration towards a knowledge destination or rather towards regaining our own glorious knowledge status.



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