and of mad dogs', they were still 'inclined to think favourably of it, and encourage the hope that further experience might confirm its good character'. There cannot be a better example of scientific temper combined with humility. In modern times we are no longer surprised to read about 'toad venom' or 'scorpion venom' being researched to produce newer and more powerful analgesics to mitigate the sufferings of terminally ill cancer patients. To quote from *Lehninger's Principles of Biochemistry* (V edn, p. vii) 'Science is both a way of thinking about the natural world and the sum of the information and theory that result from such thinking'.

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Indian American whiz kids

An article in *Washington Post* (12 May 2012) about the results of the National Geographic Bee held the previous day, mentioning that a number of Indian American children were winners, piqued my curiosity and made me look deeper into it.

The National Geographic Bee[1] is a contest held annually since 1989, open to children from fourth to the eighth grade across the US; about five to six million students enter each year. After exhaustive tests at various levels, each state is represented by a state-level champion for the national contest and finally 10 finalists are assembled in Washington, DC. Each of the 10 participants is guaranteed a reward of US$ 500, with the top four given scholarships of US$ 25,000, US$ 15,000, US$ 10,000 and US$ 1000, in that order. The national champion is also given a lifetime membership of the National Geographic Society and a trip to the Galapagos Islands.

I was amazed to find an impressive number of Indian American children among the top 10 finalists in the most recent nine years, including the first position in six of those nine years (Box 1). In addition, many state champions each year were Indian Americans.

Clearly, one, two, three or all four of the top four positions have been taken by Indian American children in each of the last nine years (2014 to 2006), with as many as 7 and 8 out of the top 10 positions in 2012 and 2013 respectively. This record is particularly striking since the Indian Americans constitute less than 1% of the US population[2].

Intrigued to find out if this is a rare phenomenon specific to one subject, namely geography, I examined two more topics, science and technology, and English spelling, in order to establish if there is a general trend with the young Indian Americans.

The Intel Science Talent Search[3] began in 1941 as the Westinghouse Science Talent Search. In 1998, INTEL took it over and renamed it the Intel Science Talent Search (ISTS). The ISTS is the most prestigious competition in science open to high-school seniors in the US and encourages students to tackle challenging scientific questions and develop skills necessary to solve the problems of tomorrow. Typically about 1600 students in the US enter this contest every year. Of them, 300 are selected as semi-finalists based on the project proposals they submit. Then, in the next stage, 40 are chosen as finalists after a detailed examination of their proposals and invited to Washington, DC to compete for the top 10 awards. The top three winners get a scholarship of US$ 100,000, US$ 75,000 and US$ 50,000 respectively, while the fourth to the tenth place winners get US$ 25,000 each. Many of the earlier winners have made their mark in science nationally and internationally, winning eight Nobel prizes, two Field medals, five National Medals of Science and 17 MacArthur Foundation fellowships.

Considering the prestige and challenge associated with this most coveted award among the brightest high-school students in the US, it is commendable and heart-warming that Indian American high-school seniors have exhibited exemplary, even enviable performance. Just considering the most recent seven years (2008–2014), two Indian Americans won the first place (Shivani Sud in 2008 and Nitin Tumma in 2012), one won the third place (Akhil Matthew in 2010) and nine in the fourth to tenth place (Narendra Tallapragada, Preya Shah and Nilesh Tripuraneni in 2009; Neel Patel and Anirudh Prabhu in 2012; Akshay Padmanabhan and Sahana Vasudevan in 2013; Anand Srinivasan and Shaun Datta in 2014) making up a total of 12 out of 70 finalists in this 7 year period. It may be mentioned that three more (Vivek Venkatachalam in 2002, Naveen Sinha in 2003 and Ryna Karnik in 2004) gave impressive performance among the top ten. In addition to these top winners, a number of others were in the 11th to 40th positions (6 in 2004, 5 in 2005, 3 in 2006, 3 in 2007, 7 in 2008, 6 in 2009, 5 in 2010, 8 in 2011, 4 in 2012 and 8 in 2013). As high as 25% of the finalists in 2004–2014 are Indian Americans, an amazing record. Out of the 300 semi-finalists, there were 52, 61 and 65 Indian American children in the three most recent years (2011–2013), amounting to nearly one in 5 semi-finalists. It is heartening to note that a large number of girls are among the top ranks.

The research topics proposed by these young winners, who are high-school students and 18 years or younger, are advanced and, indeed, mind-boggling.

Nitin Tumma (1st in 2012): project for slowing the growth of breast cancer cells, a step which may help in treating the disease.

Shivani Sud (1st in 2008): a bioinformatics and genomics project that focused on identifying stage II colon cancer patients at high risk for recurrence and the best therapeutic agents for treating their tumours.

Akhil Matthew (3rd in 2010): a mathematics project on Deligue categories, a setting for studying a wide range of algebraic structures with ties to theoretical physics.

The Scripps National Spelling Bee[4] competition is being held annually since

Box 1. Top ten finalists in the contest during the past nine years

2014 Akhil Rekulapalli (1st), Ameya Majumdar (2nd), Pranit Nanda, Krish Patel and Asha Jain.

2013 Sathwik Karnik (1st), Sanjeev Uppaluri (3rd), Akhil Retupalli (4th), Neelam Sandhu, Harish Palani, Pranit Nanda, Asha Jain and Neha Middela.

2012 Rahul Nagvekar (1st), Vansh Jain (2nd), Varun Mahadevan (3rd), Raghav Ranga (4th), Karthik Karnik, Gopi Ramanathan and Neelam Sandhu.

2011 Nilai Sarda (2nd) and Karthik Karnik.

2010 Aadith Moorthy (1st), Karthik Mouli (3rd), Pranav Bhandarkar, Abhinav Kurada and Vansh Jain.

2009 Arjun Kandaswamy (2nd), Shantan Krovvidi (3rd), Shiva Kangayan, Siva Gangavarapu and Vansh Jain

2008 Akshay Rajagopal (1st), Nikhil Desai and Milan Sandhu.

2007 Suneil Iyer (2nd)

2006 Bonny Jain (1st), Neeraj Sirdeshmukh (2nd), Yeshwanth Kandimalla (3rd), Suneil Iyer and Krishnan Chandra.

Box 2. The Scripps Spelling Bee champions of Indian origin

Year	Winner	Year	Winner
1985	Balu Natarajan	2008	Sameer Mishra
1988	Rageshree Ramachandran	2009	Kavya Shivashankar
1999	Nupur Lala	2010	Anamika Veeramani
2000	George Thampy	2011	Sukanya Roy
2002	Pratyuksh Buddiga	2012	Snigdha Nandipati
2003	Sai Gunturi	2013	Arvind Mahankali
2005	Anurag Kashyap	2014	Ansun Sujoe and Sriram Hathwar

1925 in Washington, DC. Though called 'National', students from other countries also participate. The eligibility criteria are: The speller must not have passed beyond eighth grade, must be below 15 years and must not have repeated any grade. So far, 47 girls and 41 boys have become champions. The champion is given a prize of US$ 30,000 in cash, a trophy, US$ 2500 savings bond, US$ 5000 scholarship, US$ 2600 in reference books from the Encyclopedia Brittanica and an on-line language course.

The Spelling Bee champions in recent years of likely Indian origin are listed in Box 2.

Attention may be drawn to the fact that Indian American children had an unbroken winning streak of eight winners from 2008 to 2014, and 13 in the last 16 years (from 1999 to 2014) and two more in earlier years. Besides the top slot, they have often won second, third and fourth positions as well.

The data presented above may be examined to explore pointers to propel more young people into this unique high-performance stream.

(1) The schools have an important role to play. Schools in the US are supported by local taxes. Therefore schools in affluent communities have better qualified teachers and good facilities and send a larger percentage of their students to college, compared to those in poorer communities and in inner cities. Parents use the quality of schools as an important parameter in deciding where to live. The winners in national contests come largely from these schools.

(2) The interest taken by the parents in providing motivation and support for the pursuit of academic excellence by the children is critical. The educational level of the parents may be a factor in this respect, but not always.

(3) Besides intense study and hard work over long hours, some financial resources may be needed. It may be noted that the average annual income per Indian American family was US$ 90,529, substantially more than the national average per American family (US$ 50,522) in 2010 (ref. 2).

(4) While America is built on and continues to implement equal opportunities for all, the achievement levels clearly depend on the focus and effort put in by each individual. Here the immigrants, particularly the first-generation ones, seem to grab the opportunities available passionately, since such avenues may not have existed in the country of their origin. Therefore, they work hard to derive maximum benefit in the shortest possible time, say in one generation. They drive their children to perform to the limits of their capability[5]. This may not continue to the later generations. In this connection, the recent analysis of the academic advantage of Asian Americans over whites by Hsin and Xie[6] and further insights by Zhou and Lee[7] are interesting. They conclude that Asian Americans exert greater academic effort and their cultural differences in beliefs regarding the connection between effort and achievement and recent immigration

status are important factors in this regard. On the flip side, they note that Asian Americans are less psychologically adjusted and socially engaged in school and have more conflict with their parents than the whites.

(5) The fact that the students in other countries are achieving far better scores in science and mathematics in international standardized tests has been brought out by many studies, including by the US National Academy of Sciences. It has become the focal point in emphasizing and funding of STEM (science, technology, engineering and mathematics) programmes in schools and colleges, since it is seen as an important path to future careers and well-being of people and to national economy.

(6) Different children are interested in different areas. The US system provides them opportunities to pursue their interests and, as a result, there is a better chance for each child to excel in his/her area of interest, as amply demonstrated above by the winners in three diverse areas, namely geography, science and spelling.

(7) Forward-looking industrial establishments and non-profit organizations furnish attractive scholarships and awards for successful contestants.

Is there something here that we in India should examine and emulate? I personally believe, yes. Our school children are as bright as any in the world. The school system should create the opportunities and the teachers should pose the challenges and motivation for their inherent talent to blossom to the fullest. At least in the case of the brightest students, we should devise ways to nurture, encourage and find outlets for full fruition of their originality and creativity, and there should be a clear departure from the standard procedures which tend to encourage 'rote learning'. Our Academies of Science and Engineering and professional societies can take a more active leadership role in establishing challenging opportunities for gifted school children, our next generation thought leaders. Our forward-looking, and socially conscious large corporations should come forward with handsome awards and scholarships purely based on merit. These opportunities should be available to all interested and motivated students. All this is doable.

1. www.nationalgeographicbee/geebee/
2. Kumar, N. and Steenkamp, J. B. E. M., *Harvard Business Review*, October 2013, p. 127.
3. www.Intel.com/sciencetalentsearch/winners.html
4. www.spellingbee.com
5. Chua, A., *Battle Hymn of the Tiger Mother*, Penguins, New York, 2011.
6. Hsin, A. and Xie, Y., *Proc. Natl. Acad. Sci. USA*, 2014, **111**(22), 8416–8421.
7. Zhou, M. and Lee, J., *Proc. Natl. Acad. Sci. USA*, 2014, **111**(22), 8321–8322.

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Biography of Vainu Bappu

The lengthy review of the book *Vainu Bappu: The Man Who Knew the Stars* is unduly harsh and critical[1]. The book, less than 170 pages long, has earned a review of almost four pages in *Current Science*, complete with notes and acknowledgements, more like a journal article.

The reviewer has had no good words to say and has picked on a number of things, some quite trivial, to denigrate the book. He has also blamed the quality of production, copy-editing and small size of the photographs, etc, things which were not directly under my control. Although much had been written about Vainu Bappu's 'stellar' role in shaping the course of modern Indian astronomy, there had been no biography of his available to the common reader and the book sought to fill this gap. Perhaps the phrase 'formal biography' was a bit out of place, but the foreword by M. G. K. Menon and my own introductory chapter made clear the purpose of the book and the kind of readership it was seeking. Readability and affordability were among my major concerns. I did not know Bappu personally and came upon the idea of writing the biography as I looked at the broad development of science in independent India and was convinced that the example of Bappu's life and work had to be placed before the general public. The publication of the book in English (the Kannada version appeared at least a year before) gave a rare sense of satisfaction.

I would like to point out several inconsistencies and unfair allegations contained in the review. The reviewer has spelt out a prescription for writing a biography and states at the end that my attempt in writing a 'formal' biography has not been up to the mark. The fact remains that I had done exactly what the reviewer has prescribed, namely familiarizing myself with all that had been written about Bappu and his work, authenticating much of the information thus gathered by consulting primary sources available at the Indian Institute of Astrophysics (IIA), meeting many of the individuals who knew Bappu well and had worked with him, and then collating the entire material to the best of my ability to produce the book. I have also tried to place Bappu's work in the larger context of the development of astronomy in post-independence India. The many people I spoke to include Vainu Bappu's wife Yemuna Bappu, his college mate L. K. Doraiswamy, and several of Bappu's colleagues at IIA. I was in constant touch with D. C. V. Mallik, a colleague of Bappu's since 1973. I also communicated with his colleagues K. R. Sivaraman and Ch. V. Sastry, who now live in the United States, and A. P. Jayarajan who lives in Bangalore. I might not have spoken to all who knew Vainu Bappu and surely, my most notable omission has been to not consult Kochhar. The book contains several rare photographs that Yemuna Bappu provided and it is perhaps the only writing on Bappu where Doraiswamy's reminiscences have been recorded. Doraiswamy knew Vainu Bappu right from his student days and was with him even in Harvard. What the reviewer calls unnecessary digressions are in reality scientific explanations and