

Malaviya's vision on science and technology: celebrating his 150th birth anniversary

A great patriot, educationist, editor, lawyer, civil resister, jailbird, parliamentarian, silver-tongued transcendental orator, three-time Congress President, vice-chancellor and rector of the university he founded, a spotless and flawless religious leader of highest secular order, Mahamana Pt Madan Mohan Malaviya (Figure 1) (25 December 1861–12 November 1946) was aptly named *Devata Purusha* (a man of God) by Mahatma Gandhi. With purity in his expression and divinity in his look, he would always summon, 'Practise truth and do your duty'. He aimed to generate national spirit through the power of education and righteousness, and to achieve the economic development of the country by combining teaching of science and technology with that of religion. The Banaras Hindu University (BHU) was built and nourished by Malaviya from contributions made by beggars to kings, so it is truly a people's university. This 'Temple of Learning' glorifies a unique blend of academic excellence and dedication. Sir Sunder Lal and Sir Pazhamaneri Sundaram Sivaswami Iyer respectively served as the



Figure 1. Madan Mohan Malaviya.

first and second Vice-Chancellors of BHU during 1916–1919. The Maharaja of Mysore, Krishnaraja Wadeyar, was the first Chancellor. While celebrating Malaviya's 150th birth anniversary, this piece reveals how he served as BHU's third Vice-Chancellor from November 1919 to September 1939, and thereafter as its life rector, handing over the charge of Vice-Chancellor to Servedpalli Radhakrishnan.

How Malaviya viewed the excellence in science and technology in the presence of Bhatnagar and Narlikar in his dream campus is described here. While spotting talent he had heard of V. V. Narlikar¹ who was pursuing his research as an Isaac Newton student at the University of Cambridge under Sir Arthur Eddington, one of the most prominent and important astrophysicists of his time. While on a visit to the UK for a round table conference, Malaviya visited him in Cambridge in 1931 and invited him to join BHU as a Professor of Mathematics. Narlikar, who was 24 years old at the time, preferred the offer over visiting Caltech and served the university for 28 years from 1932 to 1960. He was also in charge of the University Telescope. In his 'A few recollections and reflections', V. V. Narlikar² writes, 'My memories of the Banaras Hindu University (1932–1960) are so many, so rich and so happy that they make the University to me *Madhur Manohar Ateev Sundar* [So sweet, serene, infinitely beautiful]'. The BHU Kulgeet was composed by S. S. Bhatnagar, one of the most renowned scientists, who was a Professor in Chemistry at BHU for three years during 1921–1924.

Malaviya used to attend popular lectures on science organized by S. S. Joshi of Science College and other professors of the university. For the first time in India, he established departments for mechanical and electrical engineering, glass technology, pharmaceutical chemistry, mining and metallurgy, chemical engineering as well as Sanskrit and ayurveda, apart from many other courses which existed in other institutions in India. He attracted the brilliant scholars such as U. C. Nag, Charles A. King, A. B. Dhruva, Ganesh Prasad, Birbal Sahni, S. S. Bhatnagar, V. V. Narlikar,

R. K. Asundi, and many others to guide the students. This reflects his scientific vision for the technological advancement in service of the nation.

Malaviya visioned to link the heritage of ancient knowledge with modern development of science and technology. He pleaded for whole-hearted cooperation in building a modern Nalanda and a modern Takshashila in Kashi with a blend of the best of the East and with the best of the West. While he was proud of Oxford and Cambridge with their centuries old traditions, he was also proud of his university. In the 20th century, Srinivasa Ramanujan, J. C. Bose, M. N. Saha, S. N. Bose, C. V. Raman and many others asserted their intellectual potential in science. When we attained independence, many new institutions of excellence were established. It is no wonder that the BHU graduates played a pivotal role in shaping modern India – Devendra Lal, U. R. Rao, J. V. Narlikar, C. N. R. Rao, T. V. Ramakrishnan, to name a few. C. N. R. Rao's educational and spiritual experiences at BHU in Kashidham (as he calls Kashi or Benaras) are described with warmth in his recently published autobiography, *Climbing the Limitless Ladder: A Life in Chemistry*. His first research paper was on the work he carried out at BHU during Master's. Responding to the honour of D.Sc. (*Honoris Causa*) from his alma mater, C. N. R. Rao said, 'No honour is greater than the one from one's own *alma mater* ... When I entered this capital of learning in 1951 to pursue M.Sc. in Chemistry, the first thing I did was to take off my shoes at the main entrance and walked bare-foot to pay my respects to the Mahamana'.

Malaviya had a global view with regard to inviting persons of outstanding ability. To achieve his goal, he had correspondence with eminent scientists including Ernest Rutherford, Sir Arthur Eddington and others. In his cherished ambition, Malaviya tried hard during 1935–1936 to persuade the timeless legend in science and society, Albert Einstein to come over to India and BHU for a suitable period, on his own terms in perhaps some joint scheme and cooperation with Sir C. P. Ramaswami Aiyer, Vice Chancellor of the Travancore uni-

versity (presently Kerala university)³. Sometime in 1940, Einstein probably wrote to Malaviya, expressing his desire to serve this great university⁴. Unfortunately, both Malaviya and Radhakrishnan were away from town and his letter met with the usual bureaucratic procedure. By the time, Malaviya warmly invited him, Einstein was on his way to settling in America.

The eminence of academic pursuit embedded in excellence in every branch of human knowledge in his dream campus, was Malaviya's mission. Carrying

forward his vision would be a tribute to Malaviya while celebrating his 150th birth anniversary.

1. Narlikar, J. V., *Bull. Astr. Soc. India*, 1997, **25**, 37.
2. Narlikar, V. V., In *Inspiring Episodes on Mahamana Pt. Madan Mohan Malaviya, Part I* (in English; collection and compilation by U. D. Tiwari), Mahamana Malaviya Foundation, Varanasi, 2002, pp. 49–57.
3. Joshi, S. S., In *Mahamana Malaviyaji Birth Centenary Volume*, All-India Malaviya Cen-

tenary Celebration Committee, BHU, Varanasi, 1961, p. 105.

4. Menon, C. N., In *Mahamana ke Prerak Prasang, Part I* (in Hindi), Mahamana Malaviya Foundation, Varanasi, 2004, p. 283.

B. N. DWIVEDI

*Department of Applied Physics,
Institute of Technology,
Banaras Hindu University,
Varanasi 221 005, India
e-mail: bnd.app@itbhu.ac.in*

Defining hydrogen bond through IUPAC

During the four years from 2006 to 2009, SciFinder has added 44,262 papers containing the term 'hydrogen bond'. To be precise, these many papers were added between 26 December 2005 and 13 January 2010, when the searches were made. This amounts to about 30 papers a day, a few more than one every hour. Hence, it is surprising to find that most authors still feel uncertain about what a hydrogen bond is. There are numerous definitions and it appears that the only consensus till now is that there is no universally accepted definition for the hydrogen bond¹. Considering the enormous interest and following our suggestion, the International Union of Pure and Applied Chemistry (IUPAC) formed a task group with 14 experts to come up with a modern definition of the hydrogen bond. The task group was chaired by E. Arunan (Indian Institute of Science, Bangalore) and S. Scheiner (Utah State University, USA) was the co-chair. Along with them, G. R. Desiraju (Indian Institute of Science, Bangalore), R. A. Klein (University of Bonn, currently at Cambridge, UK) and J. Sadlej (University of Warsaw, Poland) formed the core-group. I. Alkorta (Instituto de Quimica Medica, Spain), D. C. Clary (University of Oxford, UK), R. H. Crabtree (Yale University, USA), J. J. Dannenberg (City University of New York, USA), P. Hobza (Academy of Sciences of the Czech Republic), H. G. Kjaergaard (University of Copenhagen, Denmark), A. C. Legon (University of Bristol, UK), B. Mennucci (University of Pisa, Italy) and D. J. Nesbitt (University

of Colorado, USA) were also part of the task group.

The task group organized a discussion meeting in Pisa during September 2005 in which 12 of the task group members and 12 other experts spoke on hydrogen bonding. Extensive discussions on all aspects of hydrogen bonding took place and a definition was proposed. This was deliberated at length through electronic-mail within the task group. A year later, in September 2006, the core-group met in Bangalore. There was a one-day discussion meeting where four core-group members and five other experts made presentations. Following this, the core group produced a recommendation for the definition of hydrogen bonding. This proposal now had a short definition that insisted on some evidence for bond formation. Six criteria were given which could be taken as evidence for hydrogen bond formation; six other characteristics were listed completing the recommendation. Several foot-notes were added for clarifications where necessary.

Following discussions within the task group and after considering the comments from numerous experts across the world, the recommendation was revised and submitted to the Physical and Biophysical Chemistry Division of IUPAC in 2007. The Division felt that a detailed manuscript should be produced which summarizes the history of hydrogen bond research and provides a rationale for the new definition. The task group produced a consolidated technical report which was submitted to IUPAC in January

2010. After an extensive review process by the Division, a technical report on defining the hydrogen bond² and the recommendation on the definition of the hydrogen bond² have been accepted for publication in *Pure and Applied Chemistry* in October 2010. The recommendation has appeared in the IUPAC website as a provisional recommendation and IUPAC will accept comments on this recommendation until 31 March 2011. It can be viewed at the following website: http://media.iupac.org/reports/provisional/abstract11/arunan_310311.html

In addition, the details of the task group activities can be found at the following websites: IUPAC: <http://www.iupac.org/web/ins/2004-026-2-100>; IISC: <http://ipc.iisc.ernet.in/~arunan/iupac/>

Anyone interested in hydrogen bonding is welcome to go through the task group recommendation and send comments during the review period. The report and recommendation are available from the author as well.

1. See <http://ipc.iisc.ernet.in/~arunan/iupac/> for a compilation of definitions over the last century.
2. Arunan, E. *et al.*, *Pure Appl. Chem.*, 2011; Preprint available at: http://media.iupac.org/reports/provisional/abstract11/arunan_310311.htm

E. ARUNAN

*Department of Inorganic and Physical
Chemistry,
Indian Institute of Science,
Bangalore 560 012, India
e-mail: arunan@ipc.iisc.ernet.in*