

of Physics (since its founding more than a century ago) the two most widely cited are by him, and three others are directly influenced by his work.

Kohn went on to found and direct the Institute of Theoretical Physics in Santa Barbara, California whose success can be gauged, among other ways, by the number of such institutions which have sprung up all over the world in the thirty seven years since then. Most of them are consciously modelled on the first.

During his lifetime, due to his work and influence as well as that of a few titanic figures like him, the physics of condensed matter, called solid state physics earlier, emerged from obscurity to be the major current activity in physics, and perhaps the one in physics of the greatest relevance to science and to society. He was awarded the Nobel Prize in Chemistry in 1998, because he hewed a path in 1963–64 which three decades or so later led scientists to an understanding of how a large number of chemical and

biochemical systems function at the atomic level.

Kohn, in later years, became a steadfast proponent of renewable energy, in particular solar energy. (His visit to India in 2009, when he was more than 86, was to propagate this idea.) In the last few years of his life, sensitive to the macular degeneration which impaired the vision of his wife Mara, he worked on the theory and construction of optical devices to enable such people to see better.

Walter had genuine interest in people, and specially liked to listen to and interact with young people. This was evident not only in the Lindau gatherings of Nobel laureates and young scientists, but also in the real care, warmth and affection with which he interacted with the young, not talking down, not pretending.

Kohn was a friend and admirer of India and its culture. He was a frequent visitor to the country; he admired the spirit which animated modern Indian science. He felt, for example, that the word

‘cultivation’ in the name of Indian Association for the Cultivation of Science, Kolkata (which he visited to give the first memorial lecture named after his illustrious student Chanchal K. Majumdar) was deeply right. It was the way one should approach science (or anybody of knowledge).

Walter Kohn was also actively concerned with the public consequences of science for peace and war, with disarmament, etc. He brought to these activities his convictions, his meticulous attention to facts and his openness.

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M. V. Bhatt (1924–2016)

Professor M. V. Bhatt passed away in Bengaluru on 19 April 2016.

Mangalore Vivekananda Bhatt was born on 1 February 1924 in Mulki, Dakshina Kannada district, Karnataka to Taranath Krishna Bhatt and Tulsi Bai Bhatt. He was ‘Vivek’ to his family and childhood friends, ‘Bhatta’ to his close friends and MVB to his students.

MVB was the eldest amongst three brothers and a sister. His father was a doctor, with an MBBS degree from Grant Medical College in Bombay and practised first in Bombay. But during the Independence Movement, he was imbued with the Gandhian spirit and moved to a small village/town, Sringeri in Karnataka – a place where there were no doctors, no roads and no schools. Therefore, young Vivek was sent to his paternal grandfather’s home in Mulki, near Mangalore, so that he could go to the village school there. By his own accounts, Vivek did rather poorly in school. He later went to Aloysius College in Mangalore for the pre-university class (12th standard) as it was called then. He fared better in his

studies there but his father was not pleased with his son’s progress. Subsequently, Vivek moved to Tiruchirapalli (Trichy) in Tamil Nadu, and joined the St Joseph’s College. He made many



friends in the hostel and his friendship with some lasted life-long. Vivek arrived in Trichy with a strict warning from his father to perform well and he did live up to his father’s expectations. In Trichy, Vivek became deeply interested in chemistry and mathematics and soon his interest turned into fascination. He graduated (B Sc) with a first class and first rank. Soon after, as a teenager (19) in 1943, he joined the Organic Chemistry Department of the Indian Institute of Science (IISc), Bengaluru as research assistant. When he first arrived at IISc, coming from a small town, he felt overwhelmed – he spoke poor English – and suddenly he was required to be very proficient in English. There were many British professors still around. So every night, he read the English classics – everything from Dickens to the poetry of William Wordsworth and Oliver Goldsmith. In later years, people commended on his proficiency in English and his familiarity with English classics – he could quote from Shakespeare to Tagore from memory.

MVB completed his Associateship of IISc in 1948 and Ph D in 1954. Soon after he married Sarojini Nayak in 1955 and together they had four children. From 1954 to 1957, he was a post-doctoral fellow with D. K. Banerjee at IISc. He travelled on a Fulbright Fellowship to Washington University where he did his post-doctoral work with C. D. Gutsche from 1958 to 1959. MVB's second postdoctoral stint from 1959 to 1960 was with Herbert C. Brown (1979 Chemistry Nobel Laureate) at Purdue University, USA. He also spent a year (1977–78) in Brown's group as a visiting faculty. Brown must have been quite impressed with MVB as many of the students of MVB subsequently worked with Brown as post-doctoral associates.

MVB returned to IISc in 1960 as Lecturer and was promoted to Associate Professor in 1965. From 1969 to 1984, he served as a professor, during which time he was also Chairman of the Department and Dean of the Science Faculty. From 1984 to 1989 he was an Emeritus Scientist. After 1989, he found new interest in cooking, travelling and literature on medicinal plants to keep himself engaged. In 2005, his wife, Sarojini passed away. MVB's life touched many people – he was known for his helping nature – some years ago he was given a bravery award for saving the lives of two coal-tar road workers from burning to death at the risk of putting his own life in danger.

As a professional chemist, researcher and a teacher, MVB's expectations from his students, co-workers and colleagues were quite demanding and it was not easy to live up to his expectations. His expectations from himself were equally high, that at times we wondered whether he lived up to it. In other words, he preached what he practised. His enthusiasm and energy to try out new ideas and concepts were so intense and compelling that some of his students used to refer to MVB as Maha Veer Bhatt! His measure of 'good research' was the 'one that stood the test of time' and the only piece of research that was worth attempting was that 'which broke new grounds'. Perhaps, one of the lacuna of fixing sky high standards for himself was that some of his results remained unpublished, as he was not convinced that they were worth publishing. He however was completely different at a personal level. He was very soft spoken (but nevertheless firm!) and kind to people around him. He

was generous in offering the facilities and chemicals available in his group to students from other groups. He was of the opinion that all the resources that were available in his group were obtained from tax payer's money and hence should be available to all. He was in fact quite critical of the faculty members who personalized their research-related resources.

MVB's daily routine was to go around the laboratory in the morning starting between 9.30 and 10.30 am. The students were expected to tell him about the chemistry they were attempting to do. However, he would be content if the student reported 'nothing new Sir'. He perfectly understood that 24-hour period was not long enough to report new advances in research. Nor did he insist that every one of his co-workers be present in the laboratory when he visited in the morning. He was open to discussion, ideas and friendship. This was evident since several students working with other faculty members in the organic chemistry department, joined him for tea. His thought process always revolved around chemistry and he could barely contain his excitement when he solved a problem.

MVB was a self-taught physical organic chemist as this area of chemistry was in its infancy, especially in India, when he started his independent research group at IISc. Major contributions of his group were in the areas of ring-chain tautomerism, new reagents and reactions and quinone studies. He also collaborated with faculty members from the departments of Chemical Engineering, Biochemistry and Microbiology and Cell Biology at IISc. He published papers on kinetics and mechanistic studies in these areas. Notably, he published a series of papers on different aspects of ring-chain tautomerism in *American Chemical Society* and *Royal Society of Chemistry* journals. His initial studies in ring-chain tautomerism pertained to the structure of *ortho*-benzoyl benzoic acid. This acid exists in equilibrium with the hydroxy-lactone form in solution. He extended the studies to understand the reactions of *ortho*-benzoyl benzoyl chlorides with nucleophiles and studied the kinetics of hydrolysis of esters and amides of *ortho*-benzoyl benzoic acid. The results of this piece of research encouraged MVB to extend the studies to other *gamma*-keto acids and their derivatives. By now he had realized that the studies in tautomer-

ism that he initiated had grown into a new area of research for which he coined the phrase 'neighbouring group effects' (to distinguish these effects from the classical 'neighbouring group participation') although the series title of journal publications was maintained as 'Aspects of tautomerism'. Subsequent research in this area was aimed at unravelling the effects of one functional group on the reactions of another functional group present in close proximity, in the same small organic molecule. His opinion was that an understanding of 'neighbouring group effects' in small organic molecules would aid unravel complexities of reactions in biological systems. He was ahead of his time in designing isotopic (D, N¹⁵ and O¹⁸) labelling experiments to understand mechanisms of organic reactions developed by his group. He practised and advocated research in physical organic chemistry in the larger interest of understanding and exploiting the efficiency and specificity of chemical reaction that occur with unparalleled efficiency in living systems.

Other contributions of his group were: (a) Hammett correlation of electrochemical reduction potentials of quinones; (b) chemical model systems for biological oxidations which had implications on the mechanisms and intermediates involved in the chromic acid oxidation of naphthalene and phenanthrene derivatives to quinones; (c) oxidative rearrangements during the electron transfer oxidation of aromatic rings which are relevant for understanding the mechanisms of analogous enzyme catalysed reactions; (d) new reactions of oximes; (e) new reagents for functional group transformations such as ether cleavage, reduction of sulphoxides and sulphonyl chlorides, etc. It is likely that his work in Brown's laboratory (contra-thermodynamic isomerization of olefins via hydroboration) catalysed his interest in physical organic chemistry and in developing new reactions and reagents for organic transformations. He also published several reviews and book chapters. Unfortunately, he could never realize his dream of writing a book on physical organic chemistry for undergraduate and graduate students. He was a passionate teacher and highly valued the teaching profession. He believed that the status of teaching in India could be raised by organized trainings for teachers. He was involved in summer school programmes for teachers and

PERSONAL NEWS

some of his Ph D students were teachers who had joined IISc on the Faculty Improvement Program (FIP).

MVB was a Fellow of the Indian National Science Academy (1984), Indian Academy of Sciences (1981) and served as Indian representative of IUPAC. He published around 135 papers, review articles and book chapters, obtained 10 Indian and 2 foreign patents and guided 26 Ph D students including 2 from Egypt. He was always there to extend his

helping hand and giving useful suggestions to his students even after they left IISc. It is our privilege to have worked with Bhatt as his students at IISc.

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