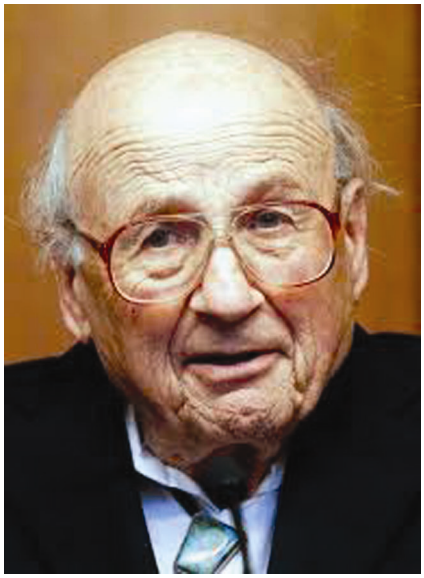
Walter Kohn (1923–2016)

The long and amazing life journey of Walter Kohn ended in its 94th year on 19 April.

Walter Kohn was born in 1923 in Vienna, Austria, and during the tumultuous period of 1938–1945, lost his home, his parents, was interned in two continents, lost his chosen first career of a farmer (he wanted to be one, having seen too many intellectuals without work) and found himself set on the life path of a professional physicist, as his theoretical talents unfolded.

Kohn was born into an upper middle class Jewish family in 1923, in Vienna. That world crashed in 1938 with the annexation of Austria by Hitler. His father continued to manage the family business of making high quality, painting-backed, picture postcards but without compensation, till he and his wife were taken to the Auschwitz concentration camp where they were killed. Kohn's elder sister emigrated to England quickly after the Anschluss. He himself was shipped out to England along with many other Jewish boys and girls in 1939, in the kinder-transport programme, just before the Second World War broke out. He initially wanted to be a farmer, having seen too many out-of-work intellectuals. He started training for it, but within a few months, an attack of meningitis left him too weak for such a career. His host family in Sussex put him in a school. In 1940, he was interned as an enemy alien, and was one of the thousands sent off to a Canadian camp near Trois-Rivieres, Quebec in July 1940. His high school education continued in the prison camp, with other internees as teachers. He also worked as a lumberjack during this period, and saved the 20 c a day he earned so that he could buy science books. He cleared himself of being a 'spy', and kept trying to get into the Canadian Army until in 1944 he was accepted into their Infantry Corps. He could not see action but used his knowledge of heavy tops to make suggestions of use to the Army, and to publish a mathematical paper on the subject.

The war ended in 1945, his Canadian foster family persuaded him to join the University of Toronto and get a degree, and a chance encounter with a famous associate of Einstein led to his joining Harvard for a Ph D with the precocious Professor Julian Schwinger, another Nobel laureate. A quick Ph D and a clear recognition of his muse as a practitioner of solid state physics, were among the outcomes. The field of solid state physics was nonexistent then; Kohn recounts that in 1951 or so, when he spent time in Copenhagen in the institute of Niels Bohr, the great man had never heard of the expression.



By now, Kohn was firmly set on the life path of an intellectual, a scientist, a physicist, and a solid state physicist! He recalled that when he moved to his first job in the Carnegie Institute of Technology (now Carnegie Mellon University) in Pittsburgh, the driver of the van which helped him cart his belongings there returned his generous tip, gently remarking that Kohn had more need of the money! It was from here that he, by his work and of his students, by interacting with a wide circle of colleagues and his regular summer visits to the legendary Bell Telephone Laboratories, succeeded (along with a handful of others) in giving heft to the field of solid state physics. The transistor was just being invented. The first quantum technology was being born; the ubiquitous cellphone is a mature product of that semiconductor technology. Kohn and Luttinger, perhaps more than others, laid the theoretical basis for the basic properties of current carriers in semiconductors. The Kohn style of spare, solid, mathematically elegant theory, always concerned with fundamentals and married to an instinctive conviction in the experimental wellspring of modern science as well as efforts to contact that reality, began to come through. It was hugely influential.

In 1963–64, just a few years after Kohn had moved to a new campus of the University of California (in La Jolla, near San Diego) came, out of the blue, the density functional theory. Its promise was immense; one could treat any quantum mechanical system of many electrons in terms of a very real classical thing, the density of electrons! All the mysterious effects of their quantum nature are contained in how the energy is determined by this density, namely the kind of functional the energy is of this quantity, which varies from place to place. While the elegant, superficially simple, and austere work attracted many physicists, for nearly two decades the approach was a very intriguing 'toy'. The toy got better and better. It also was realized that computations of electronic behaviour are so much simpler here than in other methods. Then came the explosion which had been building up. It became evident with the use of methods which theoretical chemists had developed over the decades, married to the constantly improving density functionals and the huge expansion in computer power, that an ever expanding class of questions in chemistry, materials science and biology could now be meaningfully addressed. A few scattered examples are: what is the geometry of complex molecular systems, what are the pathways for different chemical reactions (e.g. what is the pathway of oxygen respiration in the protein complex cytochrome C), what systems are suitable for photosynthetic reactions, and what ternary compounds, unknown so far, lurk there and will they be single phase or multiphasic? Maybe with the enormous increase in computer power and its accessibility, the superior results obtained from today's codes would have led to a suspicion that something, some principle, must be at the back of it. The thing at the back was the deep insight of Kohn more than five decades ago, and emerged when there was not much evidence for it. It is no surprise that of the ten most widely cited papers published in all the journals of the American Institute

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.