

Balawant Shankar Joshi (1924–2017)

Dr Balawant Shankar Joshi, popularly known as Bal Joshi, was born on 28 December 1924 in Jamkhandi, Karnataka as the eldest child of Parvatibai – a Gandhian and Shankarrao Joshi – a renowned Kannada writer. His early childhood was surrounded by the village greenery that deeply impressed him with the household uses of plants in worship, in food and for healing diseases. He studied in Karnataka College, Dharwar, and Fergusson College, Pune and earned his B Sc (Tech) degree from the University of Mumbai. He also took part in the ‘Quit India’ movement.

From 1947 to 1951, Bal worked at the Bombay University Department of Chemical Technology (BUDCT, now Institute of Chemical Technology (ICT) – a deemed university), Mumbai, under the guidance of K. Venkataraman (K.V.) and obtained his Ph D (Tech) degree. The thesis was entitled ‘Synthesis of Islandicin and other anthroquinone colouring matters’. One of their earliest papers was in *Current Science* on the synthesis of lucidin¹. All his early research publications on anthroquinone and anthrone series at BUDCT, under the guidance of K.V., were with B. D. Tilak and N. Parkash. Bal had other outstanding colleagues at ICT, including Nitya Anand and Sohrab Munshi. He was closely associated with ICT and created endowments which have benefited scores of students. Many distinguished speakers have given lectures under Dr Balawant S. Joshi Endowment.

In 1952, Bal got married to Prabha Garde, a Sanskrit scholar. In 1953, he was awarded the Akbarnavis Fellowship of the Bombay University for a period of three years. K.V. wrote to Alexander Todd, who readily agreed to have Bal at Cambridge. He sailed for England with some outstanding students – S. Varadarajan, Makarand Dehejia and Kunda Bhatt.

The chemistry laboratory of Todd at Cambridge in the fifties, was a major hub which attracted brilliant students from all over the world. Todd assigned to Bal the problem of structure determination of the aphid pigments. With his colleagues, Bal went on bicycle rides to scout for aphids on the willow trees and in the pea farms. This reminded him of his childhood rides in the countryside of India. The work on

aphid pigments – protoaphin, chrysoaphin and erythoaphin – was published in the *Journal of Chemical Society*².

Bal was inspired by the lectures delivered at the King’s College, London by Todd, Joseph Needham, J. B. S. Haldane and others. He also cherished meeting E. M. Forster and receiving an author-signed copy of *Hill of Devi*.

In 1955, Todd asked Bal to submit his synopsis and commence writing the thesis for his second Ph D. At that time, the instrumentation available for structure determination was limited to UV, IR spectra and polarimetry. Bal was awarded his second Ph D within three years of his work at Cambridge.



Soon Bal had a lucrative job offer from ICI, Andeer, Switzerland for their new explosives factory in India. But he accepted a postdoctoral fellowship (1955–57) with Morris Kharasch at the University of Chicago, USA.

The Institute of Organic Chemistry was separate from the Chemistry Department of the University and the focus was on free radical chemistry. Bal was asked to study the reactions of sterically hindered phenols and especially their oxidations. He studied the reactions of 2, 6-di-*tert*-butyl phenol. This work led to the isolation of the stable free radical ‘galvinoxyl (Gox*)’. He had two publications with Kharasch in the *Journal of Organic Chemistry*³. Now, there is widespread use of Gox* for antioxidant assays, by EPR and GC-MS. Some unique studies with curcumin showed that the Gox* molecule has a high steric hindrance that

prevents chemical reactions with curcumin, unlike with H₂O₂, HO*, ROO*, etc. The industrial and research uses of Gox* are significant.

After unsuccessful attempts to find a job in the US, Bal and his family returned to India in 1957 with a break in their journey to meet Todd. The two years when Bal was away from England, had seen the development of NMR and MS.

Soon Bal joined as Senior Scientific Officer at the National Chemical Laboratory, Pune. He worked on lac, the red resin secreted by *Laccifer lacca* Kerr. (*Coccus laccae*). The structure was revised and assigned to erythrolaccin. This work under the guidance of K.V. was done with K. G. Dave and A. V. Patwardhan, who later became his colleagues at CIBA Research Centre, Mumbai. The work was published in *Tetrahedron Letters*⁴. He also developed simple methods to detect adulteration of ghee and had two Indian patents.

Albert Wettstein, Director of CIBA, had asked K.V. whether he could suggest names of some chemists for a new Research Centre, being planned at Mumbai with T. R. Govindachari as its Director. As Bal was interested, K.V. recommended him for the job and he was selected and deputed to spend a year at Basel, Switzerland and Summit, NJ, USA, to get acquainted with the CIBA drug discovery programme. He also worked on the Commemoration Volume for K.V. (60th birthday) with Tilak, *Chemistry of Natural and Synthetic Colouring Matters and Related Fields*⁵. Other scientists, recruited for Mumbai, were also present at Basel. They worked in a model laboratory which was designed for the Research Centre at Goregaon. It was called Woodward Laboratory and Karl Heusler was the Director.

Bal then went to Summit, NJ, and worked on the structure of pimprinine isolated by Bhatte at Hindustan Antibiotics⁶. It was for the first time that he used the Varian A-60 NMR spectrometer. A dimeric indole alkaloid villalstonine was isolated from the roots of *Alstonia macrophylla*⁷. During a short stay of six months in the US, Bal published four papers in leading journals.

The Joshis then returned to India and Bal joined the CIBA Research Centre, which was inaugurated by the Prime Minister of India Pandit Jawaharlal Nehru in 1963. The occasion was a rich intellectual feast, as Todd, Robert Woodward and Vladimir Prelog, besides other leaders of chemical research in India, delivered invited lectures.

As a Group Leader in the Division of Pharmaceutical Chemistry at the CIBA Research Centre, Bal extensively investigated the chemistry of medicinal plants, in collaboration with T. R. Govindachari, N. Viswanathan, V. N. Kamat, A. K. Ganguly, P. C. Parthasarathy and others. Over 1000 plant species were collected, identified with the botanical expertise M. R. Almeida and investigated for their chemical constituents and biological activities. Bal has summarized his massive research work at CIBA, in his biography and several reviews^{8,9}. The work on Piperaceae alkaloids led to significant new structures and synthesis. These compounds could have interesting immune-modulating activities, in view of the use of this plant in Ayurveda. Many of the plant extracts and phytoactives were subjected to biological screening for activity in the animal models of hypertension, epilepsy, parasitic infections, tuberculosis, etc. However, there have been only a few publications related to the activities. There were a series of articles on chemical investigations of some Indian plants published in the *Indian Journal of Chemistry*. The study of the phenolic constituents of *Semecarpus anacardium* led to interesting findings¹⁰. Anticancer property of the plant still holds interest.

I cherish my close association with Bal at CIBA Research Centre for twelve years, regarding basic and clinical research on medicinal plants. We discussed about the discordance between the clinical uses of the plants in Ayurveda and relatively low or no activity in some extracts or compounds in animal models. We established a clinical unit at the

Podar Ayurvedic Hospital, Mumbai with Vaidya D. S. Antarkar in 1970, for placebo-controlled screening of Ayurvedic formulations and plants in patients with diabetes mellitus. About 30 plants/formulations were studied; 6 of them showed antidiabetic activity. This eventually led to the development of a novel approach of reverse pharmacology by us (from bedside to bench), for new drug discovery from traditional medicine. It was later taken up by CSIR, ICMR and also globally^{11,12}.

After two decades of significant research at CIBA, Bal retired at the age of 58 years and went to the US, to work with Pelletier at the University of Georgia, Atlanta (1982–2000). At that Institute of Natural Products Research, he and his collaborators isolated more than 50 new diterpenoid alkaloids and assigned structures to these compounds, making extensive use of carbon-13 NMR spectroscopy. This was quite a productive period in his career.

During his research career, spanning half a century, Bal isolated more than 80 new, naturally occurring compounds, determined their structures and synthesized several natural products. Several of the plants investigated do have medical uses in Ayurveda and traditional medicine. These need to be pursued with reverse pharmacology. He has authored over 210 research publications, and contributed chapters and articles in several books and monographs. He was on the editorial boards of the *Indian Journal of Chemistry* and *Indian Journal of Pharmaceutical Sciences*.

He was highly respected by the scientific community of India and received several awards and honours. He was a member of the Sectional Committee for Chemistry, Indian Academy of Sciences (IASc), Bengaluru (1981–83); member of the National Committee for IUPAC (1981–1983); member of the Executive Council of the Maharashtra Academy of Sciences, Pune (1981–1983), and member of the Research Advisory Council of

the Indian Institute of Chemical Biology, Kolkata (1981–1983). He was awarded the Sc D degree by the University of Cambridge, England (1983). He was a Fellow of IASc (1975), and Fellow of the Maharashtra Academy of Sciences (1979). He has delivered several Endowment lectures as well as invited lectures. He also played a significant role in the Indo-Soviet Scientific Exchange Programme.

His wife passed away in 1992 in the US. The Joshis are survived by their two daughters.

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