

Guest Editorial

Unsaturated Sugars: Syntheses and Applications. A Special Issue in Honour of Professor Kalpattu Kuppaswamy Balsubramanian.

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A Tribute to Prof. K.K. Balsubramanian

Kalpattu Kuppaswamy Balsubramanian (popularly and affectionately addressed as KKB) was born on September 5th 1939, at Mylapore, Madras (now Chennai), Tamil Nadu, India, in a family gifted with tradition in the noble profession of teaching. His father was a teacher and principal of a reputed school at Chennai. His elder brother, Dr. K. Nagarajan, and younger brother, Dr. K. Vijayakumaran, are both noted organic chemists in India. Perhaps it is also a delightful coincidence that he was to become a teacher in the future, as September 5th is now celebrated in India as "Teacher's Day" every year. In 1960 he received his B.Sc. (Honours) from Loyola College, Chennai, and his M.Sc. degree from the University of Madras, Chennai, a year later. Immediately thereafter, he joined the group of Prof. B. S. Thyagarajan at the University of Madras for his Ph.D. program and he subsequently obtained his Ph.D. degree in 1965. During his Ph.D. he worked in the area of molecular rearrangements, mainly on the Claisen rearrangement of 1,4-diy1-but-2-yne aryl ethers. He then joined the group of Prof. C. L. Stevens at Wayne State University, Detroit (Michigan, U.S.A.) for his postdoctoral research, where he gained experience in working with carbohydrates. After spending a couple of years at Prof. Steven's group, he returned to India and joined the University of Madras, Chennai as a scientific officer. In 1971 he moved as a lecturer to The Indian Institute of Technology - Madras, Chennai, where he spent the next three decades until his retirement as a full professor in 2001. Currently he is an Executive Director, R&D, Shasun Chemicals and Drugs, Chennai - a private company involved in synthesis and manufacture of bulk drugs and fine chemicals.

During his illustrious research career, Prof. Balasubramanian and his co-workers have made significant contributions in the area of molecular rearrangements (especially the Claisen and Cope ones), radical chemistry, carbohydrate chemistry, electrochemistry, photochemistry and synthesis of natural products, etc. In all his research contributions have resulted in about 150 publications in reputed international journals and some selected significant contributions from his group are described in more detail below:

Molecular rearrangements

KKB's passion for molecular rearrangements (especially the Claisen rearrangement) started during his Ph.D. days and continued until his retirement. One of his earlier accomplishments was the Claisen rearrangement of bispropargyl ethers and propargyl thiobenzimidazoles [1]. He has also made significant contributions to the synthesis of coumarins, chromenes and their derivatives using Claisen rearrangements [2]. An important discovery was the fact that ethylene glycol has a remarkable effect on the rates of Claisen rearrangements of aryl propargyl ethers [3]. His group was also the first one to report an aromatic Claisen rearrangement in carbohydrates and to notice a remarkable reversal in the reactivity of anomeric aryl glycosides towards Claisen rearrangements [4].

Radical Chemistry

KKB's most significant contribution in the area of radical chemistry, among others, is the synthesis of pterocarpanes by radical cyclization, which was perhaps the very first report of a radical cyclization proceeding through a *disfavoured 5-endo-trig* process [5]. His group has also developed a radical route for the stereoselective synthesis of C-glycosides [6].

Photochemistry

Synthesis of chromanones via photochemical isomerization of epoxyprococene was also reported by his group, as was the intramolecular cyclization of 1,5-biradicals generated by irradiation of 2-(alkenyloxy)- and (2-alkynyloxy)benzophenones to 2-alkenyl-3-phenyl- and 2-ethynyl-3-phenyl-benzofurans [7]. He has also developed a novel photochemical transformation of substituted isoflavones to benzofuro[2,3-b]benzofurans [8].

Carbohydrate Chemistry

KKB's most significant contribution in the area of carbohydrate chemistry is the synthesis of 2-C-formyl glycals using the Vilsmeier-Haack reaction [9]. This procedure is being followed world-wide by several groups for the synthesis and applications of 2-C-formyl glycals [9]. His group has developed a carbohydrate based route to optically active furano[2,3-b]benzofuran system, a key feature present in aflatoxins [10]. His research towards developing a better catalyst for the Ferrier rearrangement in carbohydrates has resulted in the finding that InCl_3 is the best suited for this reaction [11]. Subsequently, several other groups have used InCl_3 to carry out this rearrangement. His group was also one among the first to report the use of microwaves in carbohydrate chemistry [12].

Electrochemistry

Balasubramanian's contributions towards the use of electric current to bring about organic transformations is quite remarkable. He has used electrochemistry to synthesize compounds that are not generally attainable by conventional methods. Notable among these are his synthesis and isolation of *o*-allenylphenols and selective reduction of bromine in the presence of an epoxide functional group [13]. Apart from these areas, his group has also contributed significantly towards the synthesis and reactions of allenes [14], flavanoids [15], chromenes [16], indoles [17], etc.

Professor Balasubramanian: Mentor, Teacher and Recognized Scientist

Balasubramanian has guided about 30 students for their Ph.D. degree all of whom are well settled and well placed in multinational companies as well as in reputed academic institutes both in India and abroad. He has always been admired by students as one of the best teachers of his time at IIT-Chennai. His many noteworthy research contributions have been recognized both nationally and internationally. At the national level, he is an honorary fellow of the Indian Academy of Sciences, and the Indian National Science Academy, and he has delivered several endowment lectures and special lectures at various educational institutions in India. Internationally, he has been an Alexander van Humboldt (AvH) Foundation Fellow (1984-84), and Senior AvH Visiting Fellow (1997), a Guest Scientist at the National Institute of Standards and Technology, Gaithersburg, USA (1994), Visiting Professor at the University of Nancy (1984) and INSA-JSPS Visiting Fellow to Japan (2000). He has also visited several universities in the USA, UK, Germany, The Netherlands, France, Japan, and Switzerland to deliver special lectures. On the personal side, Balasubramanian has enjoyed a long and happy married life with his wife Mrs. Chandra. His only son, a mechanical engineering graduate from IIT-Madras, Chennai, is currently pursuing his postdoctoral research at NIST, Gaithersburg, USA. Balasubramanian is also noted for his fondness of South Indian classical music.

It is our pleasure and honour to guest-edit a special issue of *Molecules* on the topic of **Unsaturated Sugars: Syntheses and Applications**, with manuscripts contributed by distinguished scientists from all over the world working in the area. The issue is dedicated to Professor K.K. Balasubramanian on the occasion of his 65th birth anniversary.



Professor K.K. Balasubramanian

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