Professor T R Seshadri – An Acharya par Excellence.

Thiruvenkata Rajendra Seshadri was born on the 3rd of February 1900, in the small town of Kulitaiai on the banks of the river Kaveri near Tiruchirapalli in the then presidency of Madras. He was the third of five brothers and his father was a school teacher. Seshadri had his early education in the temple towns of Srirangam and Tiruchirapalli. He gave credit to his dedicated teachers for instilling in him eternal values such as a sense of duty, obligation to society, love of humanity and thirst for knowledge. He then joined Presidency College, Madras, to do his chemistry honours course. During this time he stayed at Sri Ramakrishna Mission's students home. The spiritual values he learned from the Swamijis there remained with him all through his life. At Presidency College, he was taught by B B Dey and P Narayana Iyer, whom he revered and remembered for the rest of his life. After securing the Master's degree in Chemistry from the University of Madras, he worked with Dey on the synthesis of quinolino-α-pyrones, which earned for him two prizes from the University of Madras. In 1927, the Government of Madras selected him for an overseas scholarship that enabled him to do research under Robert Robinson on new antimalarial drugs and the synthesis of anthocyanins, and obtain a doctorate degree of the University of Manchester. Later, Sir Robert, recalling those years, paid rich tribute to the experimental skills of Seshadri shown in evolving viable synthetic routes to anthocyanins. He spent the summer of 1929 in the laboratories of the Austrian Nobel laureate, Fritz Pregl at Graz, to learn organic microanalysis. He also did part-time work on agricultural analysis under Cameron who was the agricultural analyst for the county of Fife. Seshadri completed his research training in Europe with a study of the alkaloid retrorsine under the guidance of G Barger at the University of Glasgow.

Seshadri returned to India in 1930. After spending a few months at the University of Madras with a research fellowship, he took up an appointment at the Agricultural Research Institute in Coimbatore where he began his studies in plant chemistry. In 1934, he joined Andhra University, Waltair, as Reader and Head of the Department of Chemistry, and became a professor three years later. He and his students worked hard and established an active research school that received international recognition as a prime centre of research on flavonoids and related compounds. In this endeavour he had the full support of two outstanding vice-chancellors, S Radhakrishnan and C R Reddy. During World War II, as the army took over the chemistry building at Waltair, Seshadri moved first to Guntur and then to Madras, but he continued his research work unabated. At the end of the war the laboratories at Waltair were rebuilt, and Seshadri returned there. During these trying times too, he and his students carried on with their research work and publications continued to come out of the school.

In the year 1949, on the invitation of Sir Maurice Gwyer, the then vice chancellor, Seshadri joined the University of Delhi, as Head of the Department of Chemistry. There, he established from scratch, in a very short period of time, a research school in the chemistry of natural products comparable to the very best anywhere in the world. Students from all over the country, and in later years from other parts of the world, came to work under his guidanc. His large research team included postdoctoral scholars from England, France and Germany. He remained active till the

very end. He died on the 27th of September 1975; he had trained 160 PhD students and published more than 1000 papers.

Seshadri had a particular attraction for the variety and range of floral and animal colouration. His early work was on the pigments of cotton flowers and the flowers of different species of hibiscus. Apart from elucidating the structures of new compounds isolated from these sources, he evolved new preparative procedures that have now become routine in the study of flavonoids and other polyphenols. The fascination Seshadri had for biosynthesis led him to suggest the correct biogenetic pathway for the neoflavonoids (4-arylchromans). In India, he was the first to initiate chemical studies on lichens that included some rare Himalayan species.

Some of the major achievements of Seshadri's School are outlined below.

1. Structure Elucidations: Gossytrin and related pigments of cotton and hibiscus flowers, pedicinin, pedicellic acid and related compounds, mangiferin, dalbergin, latifolin, ferreirin and homoferreirin, pongamol, karanjin, auranetin, prudomestin, nepitrin, pedaliin, cupressuflavone, thelephoric acid, virensic acid, tingenone, enhydrin, santalin, alpha terthienyl methanol, etc.

2. Synthesis and synthetic methods: Selective O-methylation and demethylation, C-methylation, C-prenylation, nuclear oxidation, nuclear reduction (removal of a hydroxyl group), total synthesis of gossypetin, quecetagetin, khellin, pterocarpin, rotenoids, cyanomaclurin, pedaletin, damanacanthal and related anthraquinones, etc.

3. Stereochemistry of the catechins.

4. Biogenetic theory: Biogenesis of neo-flavonoids, xanthones and lichen compounds.

A complete list of Seshadri's publications is given in 'Thiruvenkata Rajendra Seshadri 1900-1975 Elected F.R.S.' by Wilson Baker and S Rangaswami in *Biographical Memoirs of Fellows of the Royal Society*, London, Volume 25, 1979, pp.505-533 (see also, S Rangaswami, *Biographical Memoirs*, INSA, New Delhi).

Seshadri's work received wide recognition in India and abroad. He was elected a Fellow of the Royal Society, London, in 1960. In 1963, the Government of India conferred on him the Padma Bhushan. In 1965, the Department of Chemistry of the University of Delhi was elevated to the status of a centre for advanced studies in chemistry with Seshadri as the first director. He was a general president of the Indian Science Congress and president of the Indian National Science Academy. He was on the editorial boards of the international journals, *Tetrahedron* and *Phytochemistry*. However, the one thing that he cherished most was the affection of his students. He helped them in every way including giving financial assistance in times of need. To remain with his students, he declined the post of the Chairman of the University Grants Commission. His students reciprocated by bringing out commemorative volumes on his 60th, 65th, 70th and 75th birthdays. There are also endowments to perpetuate his memory. Even after retirement in 1965, Seshadri continued to teach and guide research students and was always available to them. He would sit through every student seminar and critically evaluate the presentation. His research school at Delhi consisted of half a dozen laboratories in three different buildings in which more than 25 students used to work at a time. He had the time and stamina to visit each one of them, at least four times a day, and to spend several minutes with each and every student.

In conclusion, we may recall what Sir Robert Robinson had to say on Seshadri's 60th birthday. "Even if Professor Seshadri were known to me only as an author of original memoirs in chemical journals I would be gratified to have this opportunity to add my tribute to his fertility of ideas, his technical skill in execution and his qualities of energetic drive and wise planning. His original researches have indeed given him worldwide recognition and he is unsurpassed in the experimental survey of the groups of natural products on which he has concentrated his attention. But, to me he is no mere name in the literature; I have enjoyed the inestimable privilege of following his development from the beginning... We do homage to a most sincere scientist of unassailable integrity, a brilliant and devoted teacher and a most generous friend".

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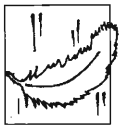
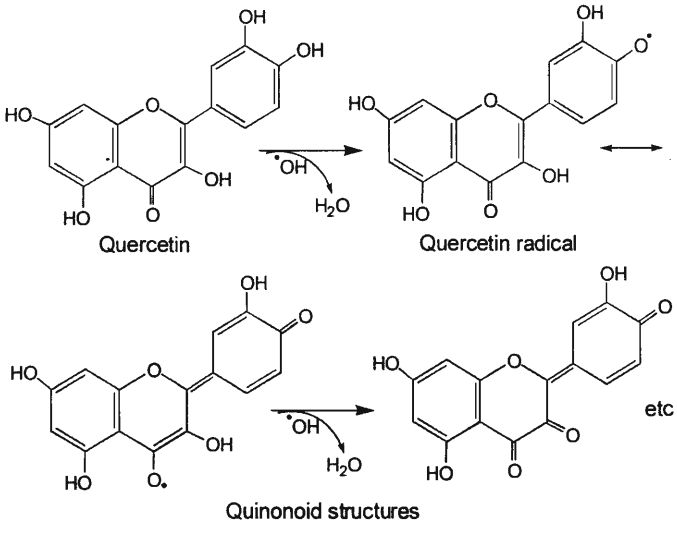


Flavonoids Fight Diseases

Flavonoids are a major class of polyhydroxyphenolic compounds that are largely responsible for the colours of flowers, fruits, and vegetables. An important function of flavonoids in foods we eat is to act as antioxidants by preventing the damage that may be caused by the reactive free radicals (an inorganic or organic species containing an unpaired electron) such as superoxide ($O_2^{\cdot -}$), hydroxy ($^{\cdot}OH$), hydroperoxy (HO-O$^{\cdot}$) and other radicals produced in mitochondria. If free radical reactions are not checked in the body, they would ultimately damage DNA or other important biomolecules, and are believed to be responsible for causing some cancers, Alzheimer's disease, aging, coronary heart diseases and cataract.



For example, quercetin, a widely distributed flavonoid in plants, acts as a free radical inhibitor by allowing a hydrogen of a -OH group in it to be removed, as shown in the given scheme.

The $^{\cdot}OH$ radical may as well abstract hydrogen of any other phenolic -OH group in quercetin. The quercetin radical is far more stable, therefore far less reactive than the $^{\cdot}OH$ radical, and it thus nullifies the damaging effect of the latter. The high stability of quercetin radical is due to the delocalization of the unpaired electron all over the molecule, and so is not easily available for covalent bond formation. Many more resonance structures than those shown in the scheme can be written for quercetin radical.

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