Later at the Institute, he became interested in colloid chemistry, electrochemical preparation of several inorganic compounds such as sodium hydrosulphite and beneficiation of inorganic minerals (e.g. chlorination of phosphatic minerals, chromites and ilmenite; concentration of low-grade manganese ores by froth floatation). Adducts of ferric chloride with phosphorus oxychloride, $2FeCl_3$, $3POCl_3$ and $FeCl_3 \cdot POCl_3$ were characterized by vapour pressure measurements using an all-glass Bourdon gauge. These adducts were identified as intermediates in the chlorination of ferric phosphate in the presence of charcoal.

Rao was deputed by the Institute to undertake a study tour in UK and Europe during 1949–50. Among the places visited by Rao, mention may be made of the University of Cambridge and Imperial College, London where he worked with H. J. Emeleus and G. I. Finch respectively. He gained first-hand experience of instrumental techniques such as electron microscopy and emerging research fronts such as high-pressure reactions involving technical gases, heterogeneous catalysis and polymer chemistry. On his return, Rao intensified research work in physical chemistry mainly in the areas of adsorption and catalysis in which he had an abiding interest even from his early career as a research student. The adsorption of argon, nitrogen, oxygen, hydrogen and carbon monoxide on iron supported on Kieselguhr and iron powders derived from the decomposition of iron pentacarbonyl was investigated. Detailed kinetic and mechanistic studies were carried out to gain an insight into the nature of the adsorbed species. The adsorption of carbon monoxide, hydrogen and a mixture of the two gases on cobalt–silica and iron–silica catalysts with and without an alkali metal promoter was studied to elucidate the mechanism of Fischer–Tropsch synthesis of hydrocarbons from 'synthesis gas'. Preferential adsorption of CO on both catalysts was observed. The formation of a carbene species of the type, M=C(H)(OH) on the surface of the catalyst was postulated to explain the results. A notable accomplishment in the area of high-pressure chemistry was the synthesis of *sym*-di-*n*-alkyl ureas from aliphatic amines and carbon monoxide and that of *n*-propionic acid from CO, dioxane and water at high pressure in moderate yields.

Other research programmes undertaken by Rao's group included direct chlorination of rubber latex by emulsifying it with CCl_4 at room temperature, determination of the spreading properties of natural rubber and its derivatives and light scattering and viscometric measurements on poly (vinyl chloride), poly(methyl methacrylate) and their copolymers to determine their size and shape as well as solvent effects on the properties of these polymers. Twenty students took their Ph D degrees at the Institute under the guidance of Rao. Much of the later work on adsorption and catalysis reported in the Ph D theses (available at the Institute library) was not published in scientific journals, thus precluding a wider dissemination of their importance.

Rao won several distinctions for his work in various aspects of inorganic and physical chemistry. He was elected a Fellow of the Royal Society of Chemistry London (then known as Royal Institute of Chemistry) in 1951 and a Fellow of the Indian Academy of Sciences in 1956.

Even after his retirement, Rao was intellectually very active first as an UGC Emeritus Scientist (1971–73) and later as the Editor of *Current Science* for more than 15 years.

Those who studied under Rao remember him with great affection and high esteem. He was not only an excellent teacher but also a friend and philosopher who would guide the young students in their chosen careers. As a fresh research student of the Department of Inorganic and Physical Chemistry in 1962, I still recall vividly the lucid lectures that Rao gave on 'statistical thermodynamics'. Rao endeared himself to the staff and students alike by his amiable and friendly disposition. What struck everyone was his imperturbable calm even in the face of grave provocations and his deft and tactful handling of ticklish situations in discharging his administrative duties. His organizational abilities were nowhere better evident than in his successful convenorship of the golden jubilee celebrations of the Indian Institute of Science, Bangalore in 1959.

Rao was a well-rounded personality typifying the best traditions of his generation. He was extremely sociable and kind at heart. A connoisseur of good food and tastes, Rao was a generous host and enlivened the conversations with his witty repartees and amusing anecdotes. How can any one, who has come into contact with him, ever forget his stentorian (but never rude) voice?

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Explorer of Himalayan mycoflora

An obituary of K. S. Thind

With the passing away of K. S. Thind, mycology in India has lost one of its stalwarts. Thind's demise on 3 December 1991 at Chandigarh brings to an end a career of forty odd years in the pursuit of mycology. He was elected to the Fellowship of the Indian Academy of Sciences in 1960. He was also a Fellow of the *Indian National Science Academy* (1968) and of the National Academy of Sciences (1958).

Born in the Punjab on 30 October 1917, Thind had his School education in Sultanpur Lodhi and higher education in the Panjab University, taking his BSc Honours (1939) and MSc Honours (1940) degrees from that University. He earned a first class throughout, and a

first class first in the M Sc Honours – the mark of a brilliant student. Deputed by the Government of India for higher study abroad in the wake of Independence, Thind went to the University of Wisconsin at Madison, USA, and obtained a Ph D in plant pathology in 1948.

Returning to India, he successively held the posts of: Regional Potato Development Officer in Himachal Pradesh, 1949; Senior Lecturer in Botany (Mycology and Plant Pathology), Panjab University, 1949–1957; Reader (1957–1962), Professor (1962–1967), Senior Professor (1967–1977) and Head of the Botany Department (1976–1977) in the same University. Re-appointment as Professor (1977–1980) and continuing facilities for work following retirement in 1980 enabled Thind to be in the Department and the University uninterrupted from the time he joined the University till his end. This is remarkable.

Though his Ph D degree was in plant pathology, and he did carry on work on problems in plant pathology, Thind is best known for his contributions to systematic mycology. The general training he received in the Panjab University in the Honours Courses equipped him well for the work he undertook from the early fifties onwards until after his retirement in 1980. Thind's most significant contribution is undoubtedly his pioneering and extensive exploration of the mycoflora of the North-Western Himalayas (1952–1976) and of the Eastern Himalayas (1977–1986). The M Sc Honours Course in mycology attracted many students during these years and most of the work was carried out vigorously by Thind and his many students in an endeavour to map the Himalayan mycoflora. Surveying Thind's contributions as a whole, one sees in it wonderful planning and phasing of the work in terms of manpower and resources available. Besides the Myxomycetes, several groups of the Basidiomycotina and the Ascomycotina were collected and described. These include the Xylariaceae in the Pyrenomycetes, the Pezizales and the Helotiales in the Discomycetes, the Aphyllophorales (Clavarioid, Thelephoroid, Hydnoid and Polyporoid fungi) in the Hymenomycetes, and the class Gasteromycetes as a whole. Taxa were elegantly and accurately illustrated, an important element of the work. The exploration of the Himalayan mycoflora led to an uncovering of a remarkable number of not only new records, but description of a number of new species and some new genera too. Financial support came to Thind from two PL–480 projects (1966–1976) and two projects from the DST (1977–1986).

While the mycological exploration of the Himalayas by Thind and his

students is in itself a major achievement, Thind also consolidated our knowledge of some of the fungal groups by his monographs of some of them. His *Clavariaceae of India* (1961) and *The Myxomycetes of India* (1977) are examples and are authoritative. Thind used the best methods for his anatomical studies of the larger fungi and placed much emphasis on the importance of tissue systems in the fungi. When in doubt, he sent his material abroad to a specialist for confirmation.

The systematic and thorough nature of his work is reflected in the Mycological Herbarium he built in the Panjab University.

Apart from his research, Thind is reputed to be one of the finest teachers of mycology and plant pathology. He was a member of the Executive Committee of the International Mycological Association (IMA) for two terms. He had been President of the Indian Phytopathological Society (1972); President, Section of Biological Sciences, National Academy of Sciences of India (1973); President, Indian Botanical Society (1973); President, Section of Botany, Indian Science Congress (1976) and President, Mycological Society of India (1979). He was Chairman of the Committee for the Development of Asiatic Mycology of the IMA during 1977–83. A recipient of the Panchanan Maheshwari Medal of the Indian Botanical Society, Thind was also awarded the Professor T. S. Sadasivan Lecture Award by the Indian National Science Academy.

Thind participated in national and international meetings and symposia, too numerous to be listed here, and visited institutions and laboratories in many countries. He was a delegate of the UGC to the Second International Mycological Congress at Tampa, Florida, USA, in 1977.

As a friend and a colleague, Thind had remarkable qualities which endeared him to one and all. We have only a few good schools of mycology in the country today and what he built in the Panjab University with great devotion and superb planning is one of them. Thind remained active almost till the end except perhaps for the last few months when a terrible affliction overtook him which he bore patiently and from which there was no possible recovery. His example should inspire the younger generation of biologists and scientists in our country.

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