RAMANLAL CHHAGANLAL SHAH

(1899–1969)

Elected Fellow 1941

Early Life and Education

Ramanlal Chhaganlal Shah was born on October 7, 1899 at a small place called Pardi, nestling among mango groves, a few miles from Bulsar in South Gujarat. He was the elder of the two sons. His father was in railway service and worked as a station master. Transfers were inevitable and young Shah studied in the schools at Baroda and Navsari. The matriculation examination was then conducted by the University of Bombay for the whole of the then Bombay state. Shah who had at times to study under municipal lamp posts, stood fourteenth in the matriculation examination and was first amongst the students who appeared from the then Baroda state. He then joined the Gujarat College at Ahmedabad. He later went to Bombay and studied at the Wilson College and took the BA degree of the Bombay University in 1920 with first class honours in Physics and Chemistry. Shah was appointed a Fellow at the Wilson College and he took the BSc degree of the same University in 1921. He was influenced by Professor K C Pandya to choose chemistry as his subject for further study. A post-graduate research scholarship took him to the Indian Institute of Science at Bangalore which was then the Mecca of all brilliant research students in science. He worked there in the Department of General and Organic Chemistry under Professor J J Sudborough. Shah was awarded the MSc degree by the Bombay University for his thesis which also won for him the Moos Gold Medal of the University. He was admitted to the Associate membership of the Indian Institute of Science in the same year.

Professional Career

Shah joined the educational service of the Bombay Government in 1925 and was posted at the then Royal Institute of Science in Bombay where he worked till 1929. It was at about this time that he married Kusumben the daughter of a business man. The Mangaldas Nathubhoy Foreign Scholarship of the University of Bombay enabled him to work with the distinguished chemist, Professor Robert Robinson, at the University College of London. Professor Robinson soon left for Oxford, and Shah had to join the Dyson Perrins Laboratory at Oxford to complete his work. On his return to India after getting his doctorate of the University of London in 1931, he was appointed Head of the Department of Chemistry in the Ismail Yusuf College which was newly started by the Government of Bombay. Although this college was only upto the intermediate stage, Dr Shah never lost touch with research and he continued to take research students at the Royal Institute of Science.

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This was made possible due by the generosity of Dr T S Wheeler, who was then the Professor of Organic Chemistry and Principal of the Royal Institute of Science, and who held Dr Shah in high esteem. With the departure of Dr Wheeler in 1939 Dr Shah was transferred to the Royal Institute of Science as Professor of Organic Chemistry. There he remained for 12 years and built up a flourishing school of research in organic chemistry. MSc was then a research degree and over 50 students took their MSc degree and over 25 students took their PhD degree under his guidance.

In 1950, Dr Shah was invited by the Council of Scientific and Industrial Research to join the newly started National Chemical Laboratory (NCL) at Poona as an Assistant Director and Head of the Organic Division. He became the Deputy Director of NCL in 1959. He retired in 1961 but continued to take a good deal of interest in industrial development and acted as an adviser to a number of pharmaceutical and chemical industries.

Shah As a Teacher

Dr Shah was an excellent teacher. His exposition was lucid and the teaching material up-to-date. He used to show many experiments in the class which enhanced the interest in his lectures. There were two very serious accidents during these lecture demonstrations. On one occasion while demonstrating the properties of hydrogen, he lighted the hydrogen at the end of a tube, the flame struck back, there was an explosion and the glass hydrogen generator was smashed to pieces. Fortunately no one was injured. On another occasion, he was demonstrating the coloured flames using different salts, the mixture flared up and burnt his hand. The burns took more than two months to heal. Unknown to him an over enthusiastic laboratory assistant had mixed magnesium powder with the salts to make the demonstration more spectacular. Undeterred by these accidents he continued his lecture demonstrations. His lecture table was full of models, charts and lecture demonstration equipment. He enjoyed till the end of his teaching career lecturing to undergraduate classes making abstract ideas and principles so easy to understand. He never wrote any text book despite lucrative offers. It can be said of him without any hesitation that—

> "The beauty of his better self lives on
> In minds he touched with fire, in many an eye
> He trained to Truth's exact severity;
> He was a Teacher,
> Whose living ward still stimulates the air."

Dr Shah's research work was extensive and varied. He worked in the field of pure as well as applied chemistry. He published over 150 research papers and was granted 13 patents In his generosity he allowed his students to publish some papers under their own names and to continue work independently in the fields in which

he had initiated the work. He took delight in getting pure crystalline material from pastry, tarry, intractable material and each one of his research students had to keep a dozen dry test tubes and an equal number of glass rods, a pocket lens and a number of solvents ready when he took his round in the laboratory. He was very generous towards his research students and never nagged them for results. When he found that a student was sincere worker he gave him ample scope for developing his own talents and had a word of appreciation when an interesting result was obtained. Nevertheless, he was very critical of students who were lazy and careless in their work and such students very often left in the first year of their research.

Research Contributions

In pure chemistry his work is both in the field of natural products and on the synthetic side. In the field of natural products he studied the chemistry of oroxylin, a constituent of the root bark of *Oroxylum indicum* Went; wogonin, a constituent of the roots of *Scutellaria baicalensis*; calycopterin, a constituent of the leaves of *Calycopteria floribunda*; cardanol, the main constituent of the cashew nut shell liquid and pristimerin, isolated from the root bark of *Pristimera indica*. The chemical examination of the indigenous medicinal plants *Swertia decussata* and *chirata* was carried out and the structures of swertinin and decussatin established. Geijerin, a naturally occurring coumarin derivative and dihydrorobinetin were synthesised. New syntheses of neaturally occurring hydroxyxanthones, lichexanthone and gentisein, were also developed. Much of Professor Shah's work on natural products was done at a time when the present day techniques of cromatography, microanalysis and spectral analysis were either not developed or were not available in India. Prior to the second world war the compounds were sent to Germany for microanalysis, a facility which stopped when the war broke out. During the war some compounds were analysed at Oxford and others at Lahore where Professor J N Roy had started a microanalysis unit. The establishment of the structures of natural products could only be done through degradation and synthesis. Almost all the fine chemicals including solvents had to be imported from UK or Europe and as they came by ship they took several months. The research grants and fellowships were very meagre and many research students had to do their research work on a part-time basis along with some other job.

On the synthetic side, his work lay in the synthesis of various imidochlorides and study of their reactions; γ-substitution in the resorcinol nucleus and studies on the fixation of double bonds in the aromatic nucleus; studies in the synthesis of various oxygen heterocycles such as coumarins, chromones and flavones and nitrogen heterocycles such as quinolines; studies on the pattern of substitution in various oxygen heterocycles; and synthesis of C-alkyl-resorcinols. He developed the use of anhydrous aluminium chloride dissolved in dry ether in the Gattermann reaction on some resorcinol derivatives and obtained γ-substitution in the resorcinol derivatives. When he used anhydrous aluminium chloride dissolved in dry nitrobenzene as a condensing agent in the Prechmann condensation of ketonic esters with some resorcinol derivatives such as methyl resorcylate and resacetophenone he obtained

5-hydroxy coumarin derivatives which are otherwise difficult to obtain. It was because of these interesting results that his friends called this reagent 'Dr Shah's magic wand'. Later, at the NCL, he developed the use of a mixture of anhydrous zinc chloride and phosphorus oxychloride as a condensing agent. This reagent has been found to be remarkably effective for the synthesis of a variety of organic compounds such as hydroxy xanthones, arylalkylketones, deoxybenzoins, chalkones, 4-hydroxycoumarins and 2,4-dihydroxy quinolines. New applications of lithium aluminium hydride and boron trifluoride were also worked out.

Dr Shah was keenly interested in industrial problems. In the thirties he worked as the Secretary of the Chemicals Sub-committee of the National Planning Committee set up under the inspiration and guidance of Shri Jawaharlal Nehru. In the early forties, he investigated the manufacture of saccharine and chloramine-T. His process for the manufacture of chloramine-T was taken up by the Government of India during the second world war for the manufacture of antigas ointment and a reward was given to him. His services were lent by the Government of Bombay to the Government of India during the second world war. He served as the Development Officer (Antigas) during 1942-43 and in that capacity established the manufacture of chlorosulphonic acid at Mysore Chemicals and Fertilizers Ltd., for the Government of India. He served as the Deputy Director of Chemicals in 1943-44 in the Supply Department of Government of India.

Professor Shah developed a new synthesis of 4-hydroxycoumarin, the key intermediate for the manufacture of blood anticoagulants such as dicoumarol and warfarin. The latter is also used extensively as a rodenticide and its manufacture was undertaken by a firm under the guidance of Professor Shah. Among the other work initiated by him personally may be mentioned the preparation of thymophthalein which was considered at one time a potent colouring matter for ghee obtained by hydrogenation of oils to prevent adulteration of pure ghee with hydrogenated oils; industrial utilisation of sugar cane wax and development of a cheap oxidizing agent for oxidation of nicotine sulphate to nicotinic acid. A number of other problems were tackled under his general supervision at the National Chemical Laboratory.

Awards and Honours

Honours came to him in abundance but he never went after them. He was elected Fellow of the National Institute of Sciences of India (now INSA) in 1941. He was a Fellow of the Indian Academy of Sciences. He presided over the chemistry section of the Indian Science Congress in 1951 and over the Science Section of the Gujarati Sahitya Parishad in 1949. He was the recipient of Acharya Prafulla Chandra Ray Medal of the Indian Chemical Society and of Dr K G Nail Gold Medal of the MS University of Baroda, awarded for research work in the field of applied chemistry. He was the President of the Indian Chemical Society for two years and a member of the Pharmaceutical Enquiry Committee of the Government of India (1952-54). He was deputed by the Council of Scientific and Industrial Research to visit England and the continent in 1954 to see various university an

industrial research laboratories to study newer developments in organic chemistry. He was elected chairman for some of the meetings of the International Union of Pure and Applied Chemistry held at Zurich in 1955.

Shah As a Person

Professor Shah was quiet by nature and of a rather retiring disposition. As an administrator he was very kind and sympathetic and showed great consideration towards those who worked with him. When he entrusted some work to a person, he had full responsibility for the same. He never raised his voice in anger or made any disparaging remarks. He never made a fetish of trivial incidents of lapses on the part of those who worked with him. It was always a pleasure to work with him. In research work he was very exacting and wanted precise information on the experiment done. He could at once find out through a few questions whether the research worker was truthfully reporting the results or bluffing.

Dr Shah commanded great respect. His relations with his former students were cordial. In their company he relaxed and talked freely about many things amongst which were educational matters and need for more young men starting small scale chemical industries. His latent sense of humour came out on such occasions. His advice to his students, though sometimes cryptic, were very useful. To a student who got his first appointment as a demonstrator he said "keep out of politics as I have done". To another who used to talk incessantly his advice on taking up an appointment was "talk only when you must".

He was very keen on the maintenance of high standards in our universities and wanted good, dedicated teachers to be appointed. He used to say that "If you select a bad research worker the damage will be limited. At the most he will not work but if you select a bad teacher you harm generations of students." He was known to objectively evaluate even his own students and did not hesitate in recommending an outsider for appointment if he was found superior in qualifications and performance.

Since his retirement he stayed in Bombay and he was quite happy and relaxed. His two sons and a daughter are happily settled. Mrs Shah, whose kindness and grace all those who have known her admire, looked after him with tenderness and great care and we all hoped he would live for many more years to come. It is very sad that the end came so suddenly and without any premonition.

To a large number of students, friends and admirers of Professor R C Shah the news of his sudden death after a heart attack on September 3, 1969 came as a great shock. They were planning to celebrate his 70th birthday on October 7, 1969 in a big way. In his death the country lost a good citizen whose patriotism took the concrete shape of application of the results of his work for the production of chemicals the country needed. The world of science lost a sound organic chemist whose research was not motivated by the prospects of material gain or intellectual snobbery or desire for social prestige but by the sheer love of it. We who had the privilege

of knowing him and working with him over years mourn the loss of a genuine well wisher and a warm hearted personality.

SURESH SETHNA

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