RAM CHARAN MEHROTRA
(1922-2004)
Elected Fellow 1964

FAMILY BACKGROUND AND EDUCATION

RAM CHARAN MEHROTRA was born on 16th February 1922 at Kanpur where his father, the late Shri RB Mehrotra ran a modest shop dealing with clothing accessories. Though the family did not have a strong academic background, Ram Charan Mehrotra developed a keen interest in studies; besides, he devoted a number of hours daily working at his father's shop. Ram Charan lost both his parents early in life; his mother died when he was just seven years old, and his father ten years thereafter. From the age of seventeen onwards, Ram Charan supported his studies on merit scholarships and part-time work, mainly tuition assignments.

Ram Charan was a student of the Municipal School, Kanpur; it was at this school that he was influenced strongly by his Arithmetic teacher who instilled in the bright pupil a strong love for Mathematics. Ram Charan joined the Christ Church School, Kanpur in the fifth standard. This school had an outstanding Chemistry teacher as well as good facilities for laboratory work. Ram Charan Mehrotra stood first in the final Intermediate Examination in the entire state, obtaining record marks in all the subjects.

The young Ram Charan joined the University of Allahabad as a B.Sc. First year student in 1939. During the four years that he spent as a student at the University of Allahabad, Ram Charan received continuous encouragement from Dr. Amarnath Jha, who had taken over as Vice-Chancellor of the University in 1938. In addition to the Merit Scholarship, Dr. Jha awarded him two more scholarships in order to lighten his burden of excessive tuition work. In the undergraduate degree program, Ram Charan’s main interest continued to be Mathematics which he studied together with Physics and Chemistry. In the M.Sc. programme, Ram Charan chose Chemistry as it offered better prospects, besides enabling him to make use of his proficiency in Mathematics in the discipline of Physical Chemistry.

In 1942, the upheaval of the “Quit India” movement took place. Ram Charan who was then in the final year of the M.Sc. class could not remain unaffected. On August 12, 1942 he was in the forefront of the students’ procession and was arrested by the police. For the next four months, he almost gave up his studies, and worked for the independence movement collecting funds and distributing literature. Ram Charan returned to his studies in January 1943 just a few months before the M.Sc. final examination. Despite his involvement with the Quit India movement as a M.Sc.
final year student (1942-43 academic session), he obtained the first rank in the University examination.

After obtaining his M.Sc. degree in Chemistry, Ram Charan took up an assignment at the newly established Vigyan Kala Bhawan, Daurala (Meerut), founded with the noble objective of training young people for industrial entrepreneurship by teaching of science and technology through the Hindi medium. He worked in this institution for ten months in 1943-44, and authored his first book on Physical Chemistry in Hindi. Later, Ram Charan continued to produce technical and popular literature on scientific subjects in Hindi. Also, in 1964 he accepted the challenge of popularizing the CSIR publication ‘Vigyan Pragati’, and the magazine reached a circulation of nearly one hundred thousand copies per month from the lowly figure of a few hundred copies, that had been its circulation since its beginning in 1957.

Ram Charan Mehrotra was appointed a lecturer in July 1944 in the Allahabad University and taught Inorganic Chemistry at the University until 1954.

In 1944, Ram Charan got married to Suman, who has been the virtuous and strong life companion of a very busy academician—an academician who managed also to carry out the complex and manifold duties of a Vice-Chancellor at the Universities of Rajasthan, Delhi and Allahabad. Suman Mehrotra is a scholar of Hindi, and devotion to the national language, and work for its cause comes naturally to both of them. Ram Charan and Suman have three children, two daughters and a son. Rashmi Patil is a Professor in Environmental Science and Engineering at IIT, Mumbai; Piyush Mehrotra is a computational physicist in the USA, and the youngest of the three—Shalini Khanna joined the State Bank of India after obtaining her M.A. in Economics from the University of Delhi.

**PROFESSIONAL CAREER**

At the University of Allahabad, RC Mehrotra found the task of teaching Inorganic and Analytical Chemistry challenging, stimulating and satisfying. With his growing interest in Inorganic and Analytical Chemistry, he became keen to carry out research work in these areas. His enthusiasm for teaching and sincerity towards providing answers to the searching questions of bright students belonging to various levels provided him with contemporary research problems, such as flame test for tin and adsorption indicators, a field in which he initially established his international reputation. In classroom discussions on phthalein dye chemistry and adsorption indicators, a student asked him whether dyes derived from other dibasic acids could also be employed as adsorption indicators. He had no answers and neither was there any previous work that was available along these lines. This set him on to an extensive and pioneering program of the mechanistic study of dyes and indicators, leading to the publication of a sizeable number of papers. He obtained the D. Phil.
degree of the University of Allahabad in 1948, under the supervision of Professor NR Dhar. In 1950, Dr. RC Mehrotra proceeded to England to take up the assignment of a British Council Fellow and part-time teacher at Birbeck College, University of London. His extraordinary research output in the short span of two years earned him the Ph.D. degree of London University in 1952. Despite offers to continue his work at London, he chose to return to Allahabad in 1952.

In 1954, Dr. RC Mehrotra left Allahabad and joined Lucknow University as a Reader staying there for four years before moving on to Gorakhpur University in 1956 as its first Professor and Head of the Department of Chemistry. He began his endeavors at Gorakhpur with great zeal, introduced a new and updated syllabus, and laid the foundations of a vibrant research programme. Subsequently in 1962, the Vice-Chancellor of the University of Rajasthan, Dr. Mohan Singh Mehta persuaded him to take over as Professor and Head of its newly established Department of Chemistry. Professor RC Mehrotra moved to the picturesque city of Jaipur in 1962; ever since, this became home for him.

From 1962 to 1973, he headed the Department of Chemistry, to which he formally returned from his assignment in Delhi in December 1979 as a U.G.C. National Fellow. During his stint as the Vice-chancellor of the University of Delhi from 1974 to 1979, he continued to supervise the work of his research group at Jaipur. Even as Vice-Chancellor of the University of Delhi, Professor RC Mehrotra took postgraduate classes and nurtured a research program in the Department of Chemistry at Delhi University.

It is largely because of the initiatives and dedicated efforts of Professor RC Mehrotra that the Department of Chemistry, University of Rajasthan has become a strong school and obtained the first U.G.C. supported Special Assistance programme in 1971 in the area of Inorganic Chemistry. It was also awarded the University Leadership Programme besides a very large number of projects from other national bodies. Professor Mehrotra guided the research work of scores of doctoral students and together the group has published a very large number of original research papers in the most prestigious national and international journals. As early as 1964, the University of London conferred on him its D.Sc. degree for his published work in the field of Inorganic Chemistry. In the later half of the seventies, Professor RC Mehrotra along with his collaborators authored two important books on “Metal Alkoxides” and “Metal α-Diketonates and Allied Derivatives”. These two books were published by Academic Press and have been acclaimed by reviews that appeared in several International Journals of Chemistry.
IMPORTANT RESEARCH CONTRIBUTIONS

Analytical Chemistry
- Professor Mehrotra's work on flame test of tin and gold as well as that on the precipitation of hydrated copper-oxide (both accomplished as a response to searching questions of undergraduate students) are often cited as outstanding contributions with novel ideas and glowing examples of relationship between teaching and research.
- In the field of Adsorption Indicators, Mehrotra's contributions (again kindled by the curiosity of a postgraduate M.Sc. student) on novel types of indicators and especially the mechanism of their action are highly recognized and quoted in several reviews and treatises.
- Mehrotra's work on applications of redox reagents like alkaline bromine, ceric, chromous and vanadous salts have been cited in dozens of text books.

Complexation Reactions with Polymetaphosphates and Other Reagents
- The complexation reactions of sodium polymetaphosphate (Calgon) has not only explained its water-softening activity, but the work has been extended to similar complexation of a large number of other cations (e.g. Li, Mg, Ba, Zn, Cu, Pb and Fe).
- In addition to the above, complexation studies of number of systems with reagents like thiocyanate, N-alkylsalicylideneimines, and 2-alkylamino-cyclopentene-1-carboxylic acids have illuminated novel features of their coordination.

Metal (including organometal) Homo- and Heterometal Alkoxides
- Synthesis of and sophisticated physico-chemical investigations on the simple and complex alkoxy derivatives of almost all the transition and main group metals (including organometal species) have revealed highly exciting and novel features, thus adding a comprehensive new chapter in these directions, which has been regarded as a major component of the existing overall knowledge in the field. The discovery of simple properties like “the ageing phenomenon” of aluminium alkoxides has had a phenomenal effect on developments in the field.
- Synthesis and remarkable stability of hetero- (initially bi-and later tri- and tetrametal alkoxides) have added a new dimension to the hetero-metal inorganic systems in general. It is a matter of unique recognition that Mehrotra was invited to present these exciting results in successive Main Lectures at Sao Paulo (1977), Toulouse (1980), Athens (1986), and Laussanne (1992) sessions of the ICCC. Inspite of the extraordinary stability of these novel heterometal
alkoxides (e.g., unchanged volatility), their identity was regarded with considerable skepticism, but fortunately quite a number of these have now been fully characterized by actual X-ray crystal structure determinations in the research schools of F A Cotton (USA) and more recently of Mehrotra confirming the numerous plausible structures suggested originally by Mehrotra on the basis of their chemical reactivity and spectroscopic properties.

Metal β-diketoaminates β-ketoaminates and Schiff Base Complexes
- The highly noteworthy accomplishments of Mehrotra in these areas can be illustrated for brevity by one example only, i.e. establishment of the monomeric nature of titanium dichloride diacetylacetonate.

Metal Carboxylates
- Out of a large amount of work throwing light on the nature of bonding in these derivatives, Mehrotra’s singular success in the initial stage (1953) has been the synthesis of aluminium tricarboxylates, a class of compounds whose existence was seriously doubted in numerous publications (1930-53) by McBain, Alexander and Gray, the last two of whom had even tried to explain their non-existence in 1949.

Metal Thiolates, Thio-β-diketonates, Dithiophosphates, etc.
- Although work on M-S-C derivatives was a natural follow-up of extensive researches on M-O-C compounds for their comparative features, it has advanced much further and has yielded valuable insights in unpredicted directions. For example, in addition to the expected variation in the nature of bonding with soft and hard metals, the nature of bonding in dialkyl (later extended to alkylene) dithio derivative showed an intriguing change from the usual bi- to mono-dentate nature in tri-alkyl tin derivatives. Mehrotra’s plenary lecture on “Organo-germanium, -tin and-lead chemistry of sulphur ligands” (Padova, 1986) is an excellent survey in this area.

Precursors for Ceramic Materials
- Mehrotra has emphasized the salient advantages of using metal and heterometal alkoxides as precursors for ceramics by the sol-gel process. Synthesis and characterization of a number of heterometal alkoxides (special lectures at the IV and V International Workshops on Ceramics, Kyoto, 1987 and Rio, 1989 and at the Better Ceramics through Chemistry Symposium, Reno, 1988) have confirmed the conjecture on the formation of new species in multicomponent alkoxide precursors. Interestingly, this has opened up the possibility of ‘molecular design’ (IAC, Kyoto, 1990 and Paris 1993) of ceramic...
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materials. Extensive researches by Hirano (Kyoto) and Mackenzie (Los Angeles) have already confirmed a higher ultrahomogeneity of the final ceramic product by the use of pre-synthesized heterometal alkoxides.

- Professor Mehrotra has published about 800 research papers in international journals and has trained scores of doctoral students, more than 100 of whom have already been awarded doctorate degrees. The importance of Professor Mehrotra’s research can be assessed by the extensive references of his findings in numerous treatises and books; to quote only one example: his work has been mentioned almost regularly (1949, 1950, 1951, 1952, 1953, 1954, 1957, 1958, 1961, 1962, 1963, 1964, 1966, 1968, 1972, 1974, 1976, and the following years) in the Annual Report of the Progress of Chemistry published by the Chemical Society, London, now called the Royal Society of Chemistry.

International Recognition

- Professor Mehrotra was invited to present a paper on Adsorption Indicators at the Gasellschaft Deutscher Chemiker, Cologne, 1951. He also attended the International Congress on Analytical Chemistry at Oxford in 1952. Professor Mehrotra was invited to present his work in the above fields at the IUPAC meetings held at Paris (1957); Munich (1959), Montreal (1961) and Munich (1973); the International Conference on Inorganic Polymers at Nottingham, 1961; Gordon Research Conference in U.S.A. in 1961 and 1988; and several University and Industrial Research Laboratories in U.K., U.S.A., Europe, Japan, Korea, Malaysia, Hong Kong, Singapore and Africa in 1961, 1964, 1965, 1967, 1969, 1973, 1974, 1975, 1976, 1977.

- In 1964, Professor Mehrotra was invited to give one of the MAIN LECTURES on “HEAVY METAL SOAPS” at the VI International Conference on Lubricants held at Jena.

- In 1965, he gave a MAIN PLENARY LECTURE at the First International Organosilicon Conference held at Prague. He has presided over a number of paper reading sessions and plenary lectures etc. at various international conferences in France, Germany, U.S.A, Austria and Czechoslovakia.

- In 1967, 1969, 1973, 1985 and 1991, he was invited to present an account of his researches at the Rare Earth Research Conference held at various centers in U.S.A.; in 1972, he was invited to the 7th Conference on Rare Earths held at Moscow.

- In 1967, he was invited to present a paper at the International Symposium on Decomposition of Organometallic Compounds held at Dayton, U.S.A.

- In 1967, Professor Mehrotra was invited under the Canadian Commonwealth Fellowship Plan to spend three months in Canadian Institutions. Based at the
University of W. Ontario as Visiting Professor, he participated in a number of discussions and gave lectures at more than a dozen institutions.

- In 1969, Professor Mehrotra was invited by the National Science Foundation to study the U.S. pattern of education and research. He delivered seminars and lectures at a large number of Universities and other research institutions.

- In 1971, 1973, 1985 and 1990, he was invited to contribute papers at the Vth and VIth International Conferences on Organometallic Chemistry held at Moscow (USSR) and Amherst (USA), Vienna (AUSTRIA) and Detroit (USA) respectively.

- In April 1976, Professor Mehrotra attended the Centennial Celebrations of the American Chemical Society in his capacity as the President of the Indian Chemical Society.

- In October 1976, he led the Indian Delegation to USSR for a Conference on the Role of State in Economic and Technological Development.

- In November 1976, Professor Mehrotra represented the country at the XVI Biennial Conference of UNESCO at Nairobi.

- In July 1977, Professor Mehrotra was invited to give one of the main SPECIAL LECTURES at the XVII International Conference on Coordination Chemistry at Sao Paulo, Brazil.

- In August 1977, Professor Mehrotra was elected as a member of the Inorganic Chemistry Division of the International Union of Pure and Applied Chemistry (IUPAC) and later as a member of Inorganic Nomenclature Commission.

- In August 1977, Professor Mehrotra was invited to chair a plenary lecture session on: Chemical Education: Interdependence of Developing and Developed Countries at the University of Ljubljiana, Yugoslavia.

In September 1978, Professor Mehrotra was invited to present papers and chair plenary sessions at the XIX International Conference on Coordination Chemistry at Prague and at the IV International Conference on Solute-Solvent Interaction at Vienna.

- Professor Mehrotra was nominated as the Chairman of the Organizing Committee for the XX International Conference on Coordination Chemistry to be held in India during December 1979.

- The invitations for special plenary lectures grew in number as well as prestige as illustrated by the following few examples:

  - International Conference on Teaching of Chemistry (Madrid, 1975; Kuala Lumpur, 1981 and Maryland, 1981); Plenary Lecture at VI International Conference on Organic Chemistry Ge, Sn and Pb (Padova, 86); Special Lecture at
IV International Workshop on Glass Ceramics (Kyoto, 87); Convener, Symposium on Metal α-Diketonates (Nanjing, 87); First FACS Lecture (Seoul, 87); I and II Indo-Soviet Symposium on Organometallic Chemistry at Jaipur, 1988 (Convener) and at Irkutsk, 1989 (Leader of Indian Delegation); Plenary Lecture at V Int Conf on glasses and ceramics (Rio, 1989) followed by 4 lectures on Chemistry of Precursors for the Sol-Gel Process at the Winter School (Sao Carlos, 89); Special Lecture at International Conference on Silicon and Tin (Kuala Lumpur, 89); Special Lecture at 1st International Conference on Advanced Ceramics (Kyoto, 1990); Dhar and Chaterjee Memorial Lectures (January and February, 1991); Special Lecture at III International Symposium on Aerogels [Wurzburg, 1991]; XXXIX International Conference on Coordination Chemistry (Lausanne, 1992); VII International Workshop on Glasses and Ceramics from Gels and ‘European Sol-Gel Summer School’ at Paris and Chateau de Bierville (1993); International Symposium on Sol-Gel Processing at Chicago (1993); International Symposium on Glass Science at Athens (1993) and 2nd ANAiC International Conference on Material Science of Main Group Elements at Kuala Lumpur (1993), ICCC, Kyoto (1994), Inorganic Ring systems, Loughborough (1997), and Nanocomposites from gels, Sheffield (1997).

- As a recognition of his pre-eminence in the field, Professor Mehrotra has been invited to be a member of the International Advisory Committee of a number of series of Conferences, e.g., International Conference on Organosilicon Chemistry; International Conference on Organometallic Chemistry and International Conference on Organic Chemistry of Germanium, Tin and Lead.

National Recognition

- In 1960, Professor Mehrotra was invited to attend a conference on Teaching of Physics and Chemistry in S. E. Asia countries at Delhi as a UNESCO delegate.
- In 1961, Professor Mehrotra was nominated as a member of the Chemistry Review Committee of the U.G.C.
- In 1971-72, Professor Mehrotra was invited by the U.G.C. to lecture at a number of Universities under the national Lecturership Programme.
- Since 1974, he has been many times the convener of the Chemistry Panel of the U.G.C. and in 1975 he was renominated as the Chairman of the Chemical Research Committee of the CSIR. He has also been a member of the Society and Governing Body of the CSIR.

AWARDS AND HONOURS

Professor Mehrotra is a Fellow of all the three Academies of Science in the country. In 1946, he was elected a Fellow of the National Academy of Science, Allahabad.
(India). In 1964, he was elected a Fellow of the Indian National Science Academy and in 1974, he was offered the Fellowship of the Indian Academy of Science, Bangalore. Professor Mehrotra has served in the Council of the National Academy of Sciences, Allahabad, and was the Vice-President of the Academy. Professor Mehrotra was also the Vice-President of Indian National Science Academy.

Amongst the many awards and honours which were bestowed on Professor Mehrotra as a recognition of his academic work, the following may be mentioned:

- E.G. Hill Memorial Prize of Allahabad University in 1949 for the best research work in the Faculty of Science.
- Sir S.S. Bhatnagar Award for 1965.
- The FICCI (Federation of Indian Chambers of Commerce and Industry) Award for his outstanding achievements in research in Science and Technology in 1975.
- Professor T.R. Seshadri 70th Birthday Commemoration Medal (1976) for his research work in the field of Chemistry.
- Honorary D.Sc. (Honoris Causa) by the University of Meerut, Meerut in 1976 and S.M. University, Kanpur (1997).
- Elected President of the Chemistry Section of the Indian Science Congress in 1967.
- Elected President of the Indian Chemical Society for 1976-77.
- Elected President of the Indian Science Congress Association 1978-79.
- The highest award (Rs. 21,000/-) in recognition for Hindi Science writing by the P. M. (1985) on behalf of the U. P. Hindi Academy.
- Platinum Jubilee Distinguished Service Award (1980); G.P. Chatterjee Award (1991) and Asutosh Mukherjee Award (1993) of Indian Science Congress Association.
- Atma Ram Award for popularization of Science in Hindi by the Central Hindi Institute (1988) and by Vigyan Parishad (1994).
- Vidya Vachaspati (Honoris Causa), All India Hindi Sahitya Sammelan (1992).
PK Bose Award of the Indian Chemical Society (1997).
PC Ray Award, ISCA (1998).
Senior Scientist, INSA, (2001)
Honorary Fellow, Vijnan Parishad (2001)

Popularization of Science and Editorial Activities
Apart from his teaching and research interests, Professor Mehrotra took a keen interest in the popularization of science. As the Editor of Vigyan (1947-50) and as the Chairman of the Indian Language Unit of the CSIR (1964-68), he has contributed richly in these directions. In fact, the increase in the print order of the monthly journal Vigyan Pragati (CSIR) from about 500 to more than 1 lac under his supervision has been one of his covetable achievements. He is the Chairman of a Committee for popular books on science under the project—"Reading to Learn" of the NCERT since 1985, about ~2 dozen books by prominent scientists including three authored by him have also been published under this project.

He has been the Honorary Editor of the Journal of the Indian Chemical Society and a member of the Editorial Board of the Indian Journal of Chemistry and the Proceedings of the Indian National Science Academy (A Section). He is also one of the Editors of the Indian Journal of Chemical Education. In view of his outstanding contributions in the field of Group IV Chemistry, he was invited to serve on the International Editorial Board of the Journal "Reviews on Silicon, Germanium, Tin and Lead Compounds", which has been since renamed as "Main Group Metal Chemistry". Since 1973, he was the Editor of the first Review Journal of Chemistry in Hindi (RASAYAN SAMEEKCHHA) published by the Rajasthan Hindi Granth Academy. More recently he was invited to accept the membership of editorial boards of the ‘CHEMTRACTS’ and ‘JOURNAL OF SOL-GEL SCIENCE AND TECHNOLOGY’.

Liaison between Research and Industry
Professor Mehrotra was keen on an active liaison between academic and applied research and has tried continuously to contribute in this direction through the CSIR, with which he has been attached in the following capacities:
- Member of the Board of Scientific and Industrial Research 1963-68.
- Convenor of the group on "Inorganic Chemicals, Fertilisers, Cement, etc." at the Get-Together of Research and Industry organized by the CSIR in 1965.
- Member of the Executive Council of the Central Electrochemical Research Institute, Karaikudi, the Central Salt and Marine Research Institute, Bhavanagar; the National Chemical Laboratories, Poona; and the Regional Research Laboratory, Hyderabad.

- Member of the Governing Body of the CSIR from 1975 to 1979.

Also, his contributions in this area have earned him the following recognition:

- Invited for Clarence Karcher Memorial Lecture, University of Oklahoma (USA) in 1982.

- Invited to deliver the First Foundation Lecture of the Federation of Asian Chemical Societies at Seoul (Korea) in 1987.


- Honorary consultant to the R/D divisions of a number of industrial units in India and abroad.

Authorship

Professor Mehrotra has had a prolific record of research publications that include the following: several text-books (including one on Organometallic Chemistry, 1991); about 700 research papers and about 50 review articles in International Journals and five treatises (Metal Alkoxides, 1978; β-Diketonates, 1978; Carboxylates, 1983; Organometallic Chemistry, 1991 and Sulphur Ligands Derivatives of Metals, 1993). He was invited to contribute to many other treatises; e.g., Recent Advances in Inorganic and Radiochemistry (Academic Press, 1983); Comprehensive Inorganic Chemistry eds. Wilkinson, et, al. (Elsevier, 1989; Recent Advances and Future Potential of Sol-Gel Process Springer Verlag, 1991); and special issues of prestigious Journals, e.g. Van der Kirk issue of the Recueil (1988), Eaborn issue of the Journal of Organometallic Chemistry (1998) and Bradley issue of Polyhedron (1997). He was invited to contribute a 225 page chapter for the prestigious series Progress in Inorganic chemistry, Vol. 46, 1997.

CONCLUDING REMARKS

The high respect in which Professor Mehrotra’s scholarship is held in international circles is exemplified further by the following tribute not only to him, but also to his students in the Editorial comments of a Special Issue of the prestigious Journal of Organometallic Chemistry brought out to felicitate him on his 60th birthday:

“We seize this opportunity to add our own tribute to Professor Mehrotra, who has given so much to organometallic chemistry, not only through his own high...
productive research, but also through the numerous fine graduates from his group who have gone to contribute so effectively in the work of leading organometallic centers in many countries. Saluting him on his sixtieth birthday, we wish him many more years of health, happiness and scientific success."

Professor Mehrotra has been rated as one of the foremost Inorganic Chemists in India. Professor R.C. Mehrotra continued to serve the cause of Chemistry with distinction well into his retirement, until the age of 82 years. In April, 2004 his wife Suman Mehrotra suffered from cancer, and had to go to Mumbai for medical treatment. Professor RC Mehrotra was extremely anxious about Suman, and despite his own indifferent health insisted on going to Mumbai to be with her. In Mumbai, he was suddenly taken ill, and after a brief illness breathed his last on 11 July, 2004.

The world of Chemistry in India and higher education in India lost a leader; however, his monumental researches in Organometallic Chemistry will continue to inspire several generations in the years to come.

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