



## Sanichiro Mizushima



Tokyo, Japan, 21 Mar. 1899 - 3 Aug. 1983

**Title** Professor of Physical Chemistry, Tokyo, Japan

**Nomination** 11 Aug. 1961

**Commemoration** - It is indeed a privilege to have this opportunity to say a few words in honour of the late Professor Mizushima at this Plenary Session of the Academy. My last encounter with Professor Mizushima was in Tokyo on April 12, 1983, at a party hosted by the Chemical Society of Japan to welcome the members of the Executive Committee of the International Union of Pure and Applied Chemistry, who had come to Japan in connection with the IUPAC international committee meeting. A Bureau member himself, Professor Mizushima was well-known for his active interest and participation in IUPAC. At this particular party, he looked fine, chatting amicably with his fellow chemists and giving a short speech full of wit and humour – despite the fact that his health was already fast deteriorating. I was not to see the good Professor alive again. It was with deep sorrow that I heard of Professor Mizushima's death on August 3rd, 1983, at the age of 84. At the time I was President of the Chemical Society of Japan, a post that Professor Mizushima had held more than two decades earlier, and to the advancement of that Society Professor Mizushima had for long dedicated himself. Professor Mizushima's last published writing was an article entitled "A Gift to Young Scientists from a Senior" which appeared in the *Members' Journal of the Chemical Society of Japan* two months after his death. I am told he wrote these last words on his sickbed even though he needed an oxygen mask to breathe. This article, together with more than ten other prominent essays published in the same journal, had an immense influence on all Japanese chemists. Born in downtown Tokyo on March 21st, 1899, Professor Mizushima graduated from the University of Tokyo's Department of Chemistry in 1923. Even after graduation, Professor Mizushima remained associated with the University of Tokyo, throughout his remarkable scientific career, including the period from 1938 to 1959 when he was Full Professor of Chemistry. After retiring from the University, he became Director of the Yawata Iron and Steel Company Tokyo Research Institute.

Although he had the wide-ranging interests typical of a genius, physical chemistry was always his first academical love. Since a complete description of his many achievements would fill a volume, I will restrict myself to a few highlights. Professor Mizushima's unusual scientific abilities became evident early in his career when he accurately measured the anomalous dispersion of the dielectric constant in several alcohols by using electromagnetic waves in the 3-50 metre part of the spectrum, the first experimental proof of Debye's theory of permanent dipole moment of molecules. Amazingly, the main part of this work was contained in five important papers published within three years after his graduation from the University of Tokyo. Shortly after this proof was published, he was awarded a Japanese Government stipend to work with Professor Peter Debye in Leipzig. Between 1929 and 1931, Professor Mizushima studied in Europe, and it was during this period that he got interested in the use of quantum mechanics to explain chemical phenomena. In fact, Professor Mizushima was himself one of the pioneers who adapted quantum mechanics to the interpretation of the molecular structure, significantly influencing the later development of theoretical chemistry.

Upon returning to Tokyo, Professor Mizushima focussed his attention on the structure of molecules, particularly their internal rotation. Studying dipole moments and the Raman spectra of 1,2-dihalogenoethanes, he discovered a new rotational isomeric form which he named "gauche", in 1934. This discovery was to have a profound impact on structural chemistry. After World War II, Professor Mizushima expanded his research into molecular structure with a variety of elaborate experiments making use of vibrational spectroscopy. His penetrating insight led him to initiate studies of the structures of biomolecules, proteins in particular. His having

had interest in biomolecules during these years encouraged many students, who later contributed much to the development of related fields in Japan.

In 1959, Professor Mizushima brought the curtain down on a 36-year career in the University of Tokyo faculty, the final reception at the University Club being attended by a crowd of his admirers and distinguished guests, including his Imperial Highness Prince Hitachi, gathering to honour this outstanding scientist.

As might be expected of one who has had such a profound impact on the advancement of science worldwide, Professor Mizushima's brilliant achievements brought him a shower of prestigious awards. In Japan he was awarded the Imperial Academy Prize, Japan's highest accolade for scientific achievement, in 1938, while still in his thirties.

He has also been designated a Person of Cultural Merit and awarded the Order of Culture and First Class Order of the Sacred Treasure, among other decorations. A member of the Japan Academy since 1963, he also belonged to a number of foreign Academies, besides this Pontifical Academy of Sciences, including the National Academy of Sciences, USA, the American Academy of Arts and Sciences, and Indian Academy of Sciences, and was an Honorary Councillor of the Supreme Science Council of Spain and an Honorary Member of the Spanish Royal Society of Physics and Chemistry.

In the closing years of his life, Professor Mizushima was fascinated with the interaction between traditional Japanese culture and Japan's rapid technological development following the Meiji Restoration of 1868. Clearly a departure from molecular chemistry, this is indicative of his range of interests and scholarship. In the introduction to his definitive paper on this subject, published in the Proceedings of the American Philosophical Society, he explained that he had been prompted to write the treatise by a discussion with President Chagas, during the morning session of the Pontifical Academy of Sciences on October 22nd of 1976, and that the title "Cultural and Social Background of the Rapid Modernization of Japan" had been suggested by President Chagas.

In September 1984, an international seminar was held in Shimoda and in Tokyo, Japan, to commemorate the fiftieth anniversary of the publication of Professor Mizushima's first paper on rotational isomerism in molecules. Unfortunately, Professor Mizushima passed away just one year earlier and his absence was sorely felt by the many participants who knew him. Professor Mizushima was truly irreplaceable. Although he has passed away, his greatness endures, and I am proud to have known him.

Kenichi Fukui