

Biography of Mitsuo Tasumi—Questions by the Guest Editors and Answers by Mitsuo Tasumi

Q1: How did you spend your boyhood?

A1: I was born on January 23, 1937, in Nishinomiya, a city located between Osaka and Kobe. My childhood that I remember was already under the shadow of the Pacific War, which broke out on December 8, 1941. (Incidentally, Americans remember that the attack on Pearl Harbor took place on December 7, but the date was December 8 for the Japanese, because the International Date Line exists in the western part of the Pacific Ocean between Japan and the Hawaiian Islands.) After four months from the outbreak of the Pacific War, at the age of five, I entered a kindergarten run by Kwansei Gakuin, a Christian school originally established in Kobe by a missionary from the American Methodist Church. During the War, Christianity was under some pressure but was not completely suppressed by the Japanese Government. In the kindergarten I used to take lunch after saying grace. At Christmas, the children there including myself presented a drama after the story of the birth of Jesus. On the other hand, we were taught some stories from *Kojiki* (the legendary stories of old Japan) as well, which is the oldest and basic document of Shintoism. My family religion was Buddhism. Although religious education in my childhood was such a mixture, I do not think that I had a sense of incongruity about it. This kind of tolerant attitude to various religions and thoughts is common to many Japanese people. I guess that such tolerance has its origin in the history of Japan, which had to learn almost everything from overseas; Japan learned a lot mainly from China before the beginning of the 17th century and from the West after the middle of the 19th century.

In April 1943, I entered an elementary school. Education there was strongly influenced by militarism, but life was still normal until the middle of 1944. During the later half of 1944, it was increasingly clear that the front line of the War was moving toward us. Probably in October or November of that year, I first saw an American aircraft flying so high that I could not recognize its shape, but its vapor trail was beautiful in a blue sky. Toward the end of 1944, air raids by B29 bombers began on the Osaka/Kobe area. In 1945, attacks from the air became so frequent that air-raid alarms were sounded several times a day. There were night attacks as well. As soon as the alarm was sounded, school was over and children went home. The air raids were scary, but it was not bad for me to be released from school. By the end of May 1945, the central parts of Osaka and Kobe were almost flattened. The southern part of Nishinomiya facing the Osaka Bay (industrial area) was also destroyed, but its northern residential area where my family was living was mostly untouched. I clearly remember that two B29 bombers were shot down by antiaircraft artillery. This was a very shocking experience for me, and since then I imagined many times with dread what happened to the crew in the falling aircraft and wondered where they crashed. (I guess that people who actually saw the events of September 11, 2001, had a similar experience on a much more dreadful scale.) On August 6, 1945, the first atomic bomb was dropped on Hiroshima. I vaguely remember a news story telling about a “new-type bomb”. The War ended on August 15, 1945, with Japan’s unconditional surrender. The subsequent two years or so were a period of confusion with serious food shortages and inflation.

However, many people, including myself, recall that strangely there was no gloomy atmosphere, although Japan was under occupation by the Allied Forces.

Q2: How did you become interested in science (chemistry in particular)?

A2: In April 1949, I entered a private junior high school. This was (still is) located near the eastern end of the city of Kobe, but it escaped air raids. Its chemical laboratory was well equipped. In either the first or the second year, a chemistry teacher showed us how hydrogen gas could be produced by using a Kipp’s gas generator. I was fascinated by the setup of this apparatus. I remember also an experiment on light scattering by a colloidal solution, which is related to the Raman scattering. In addition to a full-time teacher, a young part-time teacher by the name of Kazuo Nakamoto, who I guess was a graduate student of Osaka University at that time, taught us chemistry. One day I visited his laboratory at Osaka University. He was purifying mercury by distillation, and he told me that the distillation must be carried out with great care, because gaseous mercury is very poisonous. Such chemical experiments handling dangerous substances interested me like magic. After some years, Nakamoto went to the United States, and he has been staying there since then. I believe that many vibrational spectroscopists are familiar with his book *Infrared and Raman Spectra of Inorganic and Coordination Compounds*.

In September 1951, my family moved to Tokyo. In the next spring, I entered a senior high school, which is the oldest of this kind in Japan and located close to the National Diet and the Prime Minister’s Official Residence. This school produced a great number of leaders in every field of the Japanese society during the past 120 years. When I was a student of this school, the school had a special atmosphere created by a circle of intellectually ambitious young people in the capital city. This fresh environment immensely stimulated a boy who was brought up in the Osaka/Kobe area far from the capital. My interest in chemistry continued to grow at this school. I belonged to the Science Club and did various chemical experiments by myself. Among numerous scholars who graduated from this school, I found the name of San-Ichiro Mizushima. It may be said that Mizushima, then a professor at the Department of Chemistry of the University of Tokyo, was the first Japanese physical chemist with an international reputation for his scientific achievements. My desire to study chemistry at university was augmented by this finding.

Q3: Why did you decide to specialize in vibrational spectroscopy?

A3: In April 1955, I was a freshman at the University of Tokyo. After studying various subjects for two years, I specialized in chemistry. I attended Prof. Mizushima’s lecture on structural chemistry. In October 1958, I began undergraduate research in the Mizushima laboratory. For a half year, I did some experimental work on the temperature dependence of the infrared spectrum of monochloroacetone. My original intention was to continue to study under Prof. Mizushima as a graduate student. However, he retired at the end of March 1959, and Takehiko Shimanouchi, who was an associate professor until then, was promoted to full professorship to succeed to the chair

held by Mizushima. Although I did not know Shimanouchi personally well until then, I decided to belong to his group as a graduate student. Shimanouchi was a physical chemist and a vibrational spectroscopist well-known for his work on the Urey–Bradley–Shimanouchi force field. On starting his own laboratory, he told the members of his laboratory that he would like to put more emphasis on spectroscopic aspects than structural studies. Thus, I started to do research in vibrational spectroscopy.

Q4: What experiences in your twenties were significant for your career?

A4: I learned many practical matters for doing research, but the most important experience was that I felt genuine pleasure in doing scientific research. In September 1962, I first participated in an international conference held in Tokyo. That was the Symposium on Molecular Structure and Spectroscopy organized by Prof. Mizushima. This Symposium was the first large-scale international conference in chemistry ever held in Japan. From overseas, famous scholars such as B. Crawford, D. M. Dennison, Th. Förster, D. R. Herschbach, G. Herzberg, R. N. Jones, J. Jortner, M.-L. Josien, M. Karplus, J. Lecomte, H. C. Longuet-Higgins, R. C. Lord, P.-O. Löwdin, R. Mecke, F. A. Miller, R. S. Mulliken, H. H. Nielsen, G. Porter, G. B. B. M. Sutherland, H. W. Thompson, E. B. Wilson, and others came to this Symposium. I knew these names in the literature but had never seen them in person. It was most exciting for me to see them closely and attend their lectures. In this Symposium, I met Sam Krimm and Gus Zerbi whom I was to work with a few years later. Much later I found that Andy Albrecht was also there. Professor Shimanouchi organized a post-Symposium tour to Kyoto, Nara, Kobe (Mt. Rokko), and Shima peninsula (pearl cultivation). This was a most enjoyable and memorable tour. Gus Zerbi has an 8-mm film on which he photographed many scenes of this tour. In a bus carrying us from Nara to Mt. Rokko, I sat next to Prof. E. Bright Wilson and talked with him. It was unbelievable for me to talk to the great professor who coauthored the two well-known textbooks *Introduction to Quantum Mechanics* and *Molecular Vibrations*. In the Symposium I gave a talk on the dispersion curves of a polymethylene chain. Prof. R. Mecke was in the audience and asked me a question. Having given a talk in English for the first time gave me the confidence to behave as a researcher in the international community of science.

I got my Ph.D. degree in March 1964. In August 1965, I went to Sam Krimm's laboratory at the University of Michigan and stayed there for a year. Then, I moved to Gus Zerbi's laboratory at the Politecnico di Milano and stayed there for a year. Staying at these two universities, one in the United States and the other in Italy, was a most precious experience not only for understanding the importance of doing scientific research in different environments but also for realizing the cultural similarities and differences among the United States, Italy (Europe), and Japan. Since I experienced too many things in that period, I cannot easily sum them up.

Q5: What did you do in your thirties?

A5: In September 1967, I came back to the University of Tokyo from Italy at the age of thirty. In the next spring, campus disputes occurred at this University, following the patterns that were already prevailing on many American and European university campuses. I could not concentrate on research in most of 1968 and 1969, but it was fortunate that, right in the middle of that difficult time, the Shimanouchi group received funding to construct a laser Raman spectrometer from the Toray Science Foundation. From late 1969, I began various studies by using this spectrometer. I was particularly interested in resonance

Raman spectroscopy, which was attracting much attention of spectroscopists all over the world. In early 1971, Tatsuo Miyazawa invited me to join the group he was going to organize at the Department of Biophysics and Biochemistry. He was a former student of Prof. Mizushima and was well-known for his studies on the amide I and II bands of polypeptides and the vibrational analysis of synthetic helical polymers. At that time, he was a professor at the Institute of Protein Research of Osaka University, and he was going to run another group at the University of Tokyo. Since I respected him deeply, I gladly decided to join his new group as an associate professor. After moving to the new laboratory in August 1971, I continued resonance Raman studies. On the other hand, I wanted to start NMR studies of biomolecules, because high-field NMR seemed to be a very promising method for studying the structures of biomolecules in solution. At first, I tried to utilize lanthanide-induced shifts for this purpose. In parallel, I made great efforts for a few years to introduce an FT-NMR spectrometer with a superconducting magnet. Finally, in early 1976, the Miyazawa group could get a government fund to buy a Bruker 270 MHz spectrometer. Thus, the first high-field FT-NMR spectrometer ever installed in Japanese research institutions was in operation in November 1976. Personally, I am very proud that I was instrumental in opening a new era of biological NMR studies in Japan.

Q6: What was your principal aim in research after you became a full professor?

A6: In early 1977, Prof. Kozo Kuchitsu, then Chairman of the Department of Chemistry and another physical chemist I respected highly, officially told me that the Department of Chemistry would like to have me back there and let me succeed to the chair held by Prof. Shimanouchi, who was going to retire at the end of March. With great pleasure I accepted his offer.

After coming back to the Department of Chemistry as a full professor in April 1977, I decided to restart vibrational spectroscopic research, leaving biological NMR to the Miyazawa group at the Department of Biophysics and Biochemistry. (It did not seem wise to have two competing groups in the same School of Science.) My first aim was to catch up with the progress that had taken place in molecular science during the preceding several years with the rapid development in lasers. This aim was not fully attained until I could get a government fund in a substantial amount in 1983. With this fund, my group could start time-resolved Raman studies in the nanosecond range. This line of research has kept going well until now. Another aim was to innovate the method of spectral analysis using rapidly increasing computer capabilities. Efforts toward this aim have been made vigorously and continuously, so far producing a number of satisfactory results.

Another concern of myself has been, what is the contribution characteristic of my group to science? In the world, there are a great number of research groups even in the field of vibrational spectroscopy only. Why should I do something that other people can also do? Competing with other groups actively may be a way of contribution, but this is not enough for me. I have been trying to find out a way of research genuinely Japanese, although I am not sure if something Japanese really exists in scientific research which should seek invariable truth. It seems that this is a question that I will keep asking myself. To avoid misunderstanding, I would like to add that what I have in my mind is quite different from ethnocentrism.

Q7: What was most impressive in performing research in vibrational spectroscopy?

A7: From many experiences that impressed me, I will pick

up the following three cases. (1) Around 1961, I calculated the dispersion curves of a polymethylene chain and found an unexpected feature for a branch mainly consisting of the CC stretch and CCC deformation (ν_4). On the basis of this knowledge, I could satisfactorily assign irregular band progressions observed in the 1150–950 cm^{-1} region of the infrared spectra of *n*-alkanes. I was very proud of this result. Before I published this result, Prof. Shimanouchi received a letter from Bob Snyder, who was also engaged in the vibrational analysis of *n*-alkanes. I was most surprised at seeing this letter, in which Bob depicted by hand a very similar dispersion curve for ν_4 . (2) Around 1982, one of my graduate students was carrying out normal coordinate calculations for *all-trans*-retinal. Since this is a large molecule not easy to treat, I thought that nobody dared to do such formidable calculations which took a long time and labor at that time. One day in 1982, I found a paper in *J. Am. Chem. Soc.* by Rich Mathies' group on exactly the same subject. This was unbelievable for me. (3) In 1988, I published a paper on normal coordinate calculations for *trans,trans*-octatetraene based on ab initio MO calculations in *J. Chem. Phys.* Shortly after the paper was published, I received a letter from a well-known researcher in this field telling that he had submitted a manuscript on exactly the same subject to *J. Phys. Chem.* A lesson that can be learned from these three cases is that there is always someone somewhere in the world who is doing the same thing as you are doing.

Q8a: Which one of your many publications do you like best?

A8a: It is impossible to pick up only one paper, but I am fond of a series of papers on polymethylene chains which I published in my youth, and also a series of papers on polyacetylene and other conducting polymers including their model molecules. My favorite subject seems to be chain molecules in general.

Q8b: Apart from your research, what are you most proud of?

A8b: Many former students of mine at the Department of Chemistry of the University of Tokyo are very active in the field of physical and biophysical chemistry. In addition, quite a few former students at the Department of Biophysics and

Biochemistry are now leading post-genomics (or proteomics) studies in Japan. I am really proud that I could help them develop their own abilities and look forward to their achievements in the future.

Q9: What are you most interested in at present?

A9: With further developments in computer capabilities and theoretical treatments of molecular potential functions and molecular interactions, I think it will be possible in future to simulate accurately vibrational spectra of molecules in various environments in not only the ground electronic state but also excited electronic states. If such spectral simulation becomes feasible, it will be possible to extract more useful information from intensity-related quantities (infrared absorption and Raman scattering intensities, Raman depolarization ratios, infrared linear dichroism, vibrational circular dichroism, etc.) and band shapes as well as from frequency data. It will be possible to determine anharmonicities and to simulate overtone and combination bands as well as results observed in two-dimensional spectroscopy. It will also be interesting to simulate the infrared and Raman bands of very large and complex molecules such as proteins. If all these simulations can be performed, vibrational spectroscopy will become the most powerful source of information in molecular science. Then, we can read "letters from molecules" to the fullest extent.

Q10: How do you feel about this Festschrift?

A10: It is indeed the most wonderful present for my 65th birthday. I am most grateful to Prof. Mostafa El-Sayed, Editor-in-Chief, for allowing the publication of this Festschrift in *J. Phys. Chem. A*, a journal published by the American Chemical Society. As I said earlier, my country was at war with the United States in my childhood. I feel that peace and friendship are the best things on Earth. My thanks also go to Prof. Paul Wine, Associate Editor in charge of this Festschrift, and the three Guest Editors, George Atkinson, Yukio Furukawa, and Hiromi Okamoto, and of course to many friends and former students of mine for contributing their valuable papers to this Festschrift. Finally, I highly appreciate great help rendered by my former students, Hajime Torii, Akira Sakamoto, and So Hirata, and a long-time friend, Shigeko (Moko) Suzuki, in preparing these answers and the list of publications, etc.