追悼号：升島努教授の思い出

In Memory of Professor Tsutomu Masujima —Scientist, Inventor and Friend

Alexander A. MAKAROV

Director of Research, Life Science Mass Spectrometry, Thermo Fisher Scientific, Hanna-Kunath-Str. 11, 28199 Bremen, GERMANY

One of the greatest attractions of science for me is the possibility of meeting extraordinary people who think and act in a way that makes them stand out from the crowd and rise above the mundanities of everyday life. Such meetings do not happen every day or even at every conference—but I immediately sensed my good fortune when I first met Professor Tsutomu Masujima in May 2009.

It was my first trip to Japan, and my colleague at the time, Dr. Michiko Kanai, carefully arranged my schedule so that we could attend each others' presentations at a User Meeting and then meet to talk in person (Photo 1). Prof. Masujima's talk on 'single live cell metabolomics' became one of those highlights that actually make the whole trip worthwhile. Indeed, this new application pushed mass spectrometry to its very limits, especially on sensitivity and specificity. In the previous months, Michiko had helped Tsutomu to get an LTQ Orbitrap XL, the best Orbitrap instrument at the time, so that his group could use its sensitivity, high resolution and accurate mass to considerably advance their work relative to what was achievable using prior-generation instruments. However, it was clear that the single-cell analysis application created an urgent need for ever greater mass spectrometer performance, and this posed a great challenge to instrumentation developers like myself. So, I saw this as an opportunity for a collaboration that would challenge our mass spectrometers to the extreme and consequently benefit all other types of analysis as well.

We started talking, and within a few minutes all formalities were gone as Tsutomu painted for me a picture of the future world where each cell, plant or human, would recover its individuality and uniqueness in front of our eyes. And he was really passionate to bring this future closer in spite of all difficulties with the help of what he called the "Video Mass Spectroscope"! So I simply could not stand away and promised to take part in this journey.

Fortunately, it was just a few weeks before a new atmosphere-to-vacuum S-lens interface was released by our company, boosting sensitivity in the new LTQ Orbitrap Velos instrument by up to an order of magnitude. It was not a trivial

Photo 1. Meeting at a conference with Prof. T. Masujima.

task to retrofit a similar interface on Tsutomu's machine, so I asked for the help of my colleagues Jean-Jacques Dunyach and Eloy Wouters from our San Jose factory. And then Hajime Mizuno, at that time a post-graduate student and nowadays one of the leaders in single-cell metabolomics, came to Bremen in autumn 2009 to learn how to run the S-lens under manual control. The subsequent upgrade of Tsutomu's instrument was accompanied by testing of different transfer tubes to enable an additional 2–3 fold gain in sensitivity.

As we met the following year at the Conference of American Society for Mass Spectrometry (ASMS) in Salt Lake City in May 2010, I was amazed to see the Tsutomu's entire group coming to present an impressive line-up of twenty posters and orals, representing one for each group member! Prof. Masujima was very proud, not only of the scientific quality of all these presentations but also of the opportunity to provide each student with the unique experience of attending so large and intense conference in such an unusual location. He also mentioned to me that he had lived in this city during his post-doc times, and therefore the trip had a special significance to him.

Photo 2. At the opening of the live-cell mass spectrometry laboratory in RIKEN, Osaka in 2011.

From left to right: Prof. Tsutomu Masujima and Thermo Fisher Scientific colleagues: Dr. Alain Guiller, Dr. Alexander Makarov, Dr. Murray Wigmore.

Tsutomu's short visit to Bremen in November 2010 fostered our continuing collaboration, but even more importantly his visit allowed me to discover new aspects of his character. Following Tsutomu's inspirational talk to the scientists in our factory, my wife Anna organized a social outing, with the three of us going to see a local figure-skating show. Seeing figure-skating for the first time, Tsutomu promised that he would also show us something unique when we came to Japan next time—and indeed he had kept his promise many times over as you could see later.

He also told us that his interests were not limited to mass spectrometry alone—and this was when we learned for the first time about his love for his city of Hiroshima, which had suffered such a terrible and unjust fate in WWII. This love led him to look for new ways to help the long-term future of the city—for example, by designing a low cost retractable dome for the new baseball stadium, or by developing a car that could later be manufactured by the local company Mazda. It turned out that he invested his free time and own money in building a low-cost electric car that would be intrinsically safe both for pedestrians and drivers. So during that trip to Europe, he had also been visiting companies making electric motors and suspensions to be used in this car. The car design belonged to a small company called Humanix that he had started years earlier, which was the same company producing nanospray needles for live cell mass spectrometry. These different fields fitted together well in his mind because they were just different aspects of a physicists' way to improve the world ...

During our next meeting at ASMS Conference in Denver in 2011, Tsutomu told me about the emerging single cell mass

Photo 3. In Prof. Masujima's lab.

spectrometry program in RIKEN, Osaka. A month later during my short visit to Osaka, I was glad to witness a suite of our company's latest instruments running neatly installed in the new laboratory, complete with a robotic device for single-cell sampling (Photos 2, 3). I remember Tsutomu being quite upset by bugs that stopped him from demonstrating this device in action—but this did not reduce his joy from seeing his technology being adopted by other labs.

All these encounters culminated in September 2012, when my family came to Japan for a tourist trip and to celebrate my Thomson Medal award at the International Mass Spectrometry Conference. Tsutomu wanted to show us not only the Japan of impregnable castles and ancient temples, but also the Japan that he loved and valued. So with our local colleague Dr. Takashi Sawashima (Photo 4) we took off together to the west coast of Japan, to Shimane prefecture where Tsutomu had grown up. We were the only foreign tourists there, so Takashi and Tsutomu took special care to carefully explain to us details of the astonishing variety of places and sights that we experienced: from the ultra-modern SPring-8 synchrotron (Photo 5) and SACLA free-electron laser to the ancient Izumo-taisha shrine, from the Adachi garden and art center to museums of sand and brushes, from hot springs to Ōnaruto Bridge whirlpools. Tsutomu had carefully planned our route, and then passionately presented to us each of the different sights like a magician showing tricks to astonished children. While traveling, we learned about his relatives still living in

Photo 4. On tour with Tsutomu Masujima and Takashi Sawashima.

Photo 6. Tsutomu presents “Nagashi Soumen” installation in the lab.

Photo 5. Discussing experiments at SPring-8 synchrotron.

the region, and also about his youth in a remote village on the coast of Sea of Japan and then leaving it for university.

As we arrived in Hiroshima, Tsutomu took us to his lab, which proudly carried the name “World Cellomics Center.” He has already planned for his approaching retirement and knew that soon he would spend most of his time at RIKEN institute in Osaka—but the lab was still full of students and instruments. Following a demonstration of live-cell mass spectrometry in action, he brought us to another room where everything was ready for celebration.

Given his creative and inventive nature, he was not satisfied giving an ordinary lunch. Instead, he designed a “nagashi soumen” installation (Photo 6) that reflected his childhood

Photo 7. Tsutomu shows a painting inspired by a view from a plane.

Photo 8. Tsutomu joking about his earlier experiments in painting.

Photo 9. Examining chassis of the future safest car in the world iSAVE-SC1.

memory of a village celebration when the whole community gathered along a waterway made of open bamboo half-pipes, to catch noodles that were dispatched into the water flow from the top. As a sign of the times, in this case bamboo half-pipes were replaced by plastic ones from a local do-it-yourself store—but the fun was really genuine! In conclusion, he also demonstrated another of his hobbies—the art of painting (Photos 7, 8).

Then he drove us to a remote derelict factory where he had been developing his three-wheel car that was later revealed to the world as iSAVE-SC1 (<http://inhabitat.com/humanix-isave-sc1-electric-vehicle-is-a-pillow-cushion-on-wheels/>, <http://www.trendhunter.com/trends/humanix-isave-sc1>). At that time it did not have all its outside cushions yet (Photo 9) but we were already able to test it by driving into a concrete block. Tsutomu was radiating optimism about this car—even though it was clear from looking around how difficult it was to come to that stage of development on such a low budget.

These were the real highlights of our journey—even though it continued with crossing the Inner sea and touring Shikoku and Awaji islands. Similarly, our friendship with Tsutomu continued for all these years at a new level of mutual understanding and respect, with regular warm encounters at conferences (Photo 10) and through common acquaintances.

Photo 10. Prof. Masujima at our last face-to-face meeting in Baltimore at the ASMS Conf. in 2014.

Throughout these years he continued to work on all his endeavors. For example, he had ambitious plans about reaching to a wider audience with live-cell mass spectrometry with more journal and book publications, as he felt that his work was not widely recognized and cited in the American and European scientific circles. He also travelled to Laos and Vietnam with plans to establish a supply chain for his car.

Over the course of time, I noticed that Tsutomu avoided any discussions of his health or even his age, always deflecting such conversations with a joke. I noticed that he consistently omitted his year of birth in any biography sketches at conferences or journals. He clearly did not want this to become a distraction from his passion; therefore, it was even sadder to later hear him admitting that he had to undergo bone marrow transplantation. And then in February of this year I got the really upsetting news that he urgently needed to go back to hospital...

So my planned visit in March of this year never took place—but in writing this essay, I still feel his presence, with his smile and optimism warming and illuminating our souls, inspiring us to continue his research and realize his dreams!