

Laudation for Professor Tomoko Nakanishi: 2016 Hevesy Medal Awardee

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Tomoko Nakanishi received her PhD in 1978 from the Department of Chemistry, University of Tokyo, Japan on a thesis entitled “Half-Lives of Long-Lived Nuclides, ⁹¹Nb and ⁹²Nb”. Dr. Nakanishi was a visiting scientist at the Prof. Melvin Calvin’s Chemical Biodynamics Laboratory of the Lawrence Berkeley Laboratory in USA. She started her career as an Assistant Professor at the Department of Agriculture, University of Tokyo in 1987 and became a full Professor in 2001 at the Graduate School of Agricultural and Life Sciences of the same university.

The number and breadth of Prof. Nakanishi’s scientific and technical achievements and collaborations are remarkable. She is internationally known especially for her elegant and innovative imaging work, using radioactive tracers and neutron beam to follow the absorption and transport manner of water as well as major, minor, and trace elements in plants. Neutron beam analysis revealed the water movement in cut flowers as well as roots imbedded in soil. Without using neutron beam and RI-labeled water, it was previously impossible to analyze water movement. She showed for the first time that water absorbed from the root was circulating in a plant stem using 2 min ¹⁵O labeled water. When the movement of water in the stem was simulated, half of the water already existed in the stem was renewed by freshly absorbed water within 20 min.

Based on the answer Prof. Nakanishi found in water movement, she has been targeting element accumulation and movement in a plant. She performed neutron activation analysis and prompt gamma-ray analysis for a large number of plant samples, showing element specific accumulation pattern and their circadian movement in each tissue during the developmental stage. She was regularly producing ²⁸Mg (half-life: 21 h) and ⁴²K (12.5 h) and applying them for tracer work and imaging, which were not tried before.

Professor Nakanishi has developed a real-time macroscopic and microscopic imaging system able to apply commercially available gamma- and beta-ray emitters. The real-time movement of the elements is now possible by using ¹⁴C, ¹⁸F, ²²Na, ²⁸Mg, ³²P, ³³P, ³⁵S, ⁴²K, ⁴⁵Ca, ⁴⁸V, ⁵⁴Mn, ⁵⁵Fe, ⁵⁹Fe, ⁶⁵Zn, ⁸⁶Rb, ¹⁰⁹Cd, and ¹³⁷Cs. She applied her imaging methods to study the effect of ¹³⁷Cs following 3/11 Fukushima Daiichi nuclear plant accident. She showed that only a small amount of radiocesium is absorbed by rice roots growing in soil, since Cs is firmly adsorbed in soil. She also demonstrated; through a microautoradiography technique that she developed, that ¹³⁷Cs is accumulated at the skin of the rice grain as well as the surrounding part of the meristem.

After the 2011 accident, Prof. Nakanishi was appointed as a leader in the faculty to study the agricultural consequences of radioactive contamination. She has edited a book on this topic, published in 2013 by Springer. The online version has been accessed more than 50,000 times in a year, and a second volume from Springer was published last month. She has published more than 140 papers in refereed journals and given a host of invited talks and Seminars.

Professor Nakanishi is a Commissioner of the Japanese Atomic Energy Commission, President of the Japan

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Fig. 1 From left to right: Dr. Zsolt Revay, Dr. G. de Hevesy, Prof. Tomoko Nakanishi, and Prof. Amares Chatt

Society of Nuclear and Radiochemical Sciences, Vice-President of the Engineering Academy of Japan. She was awarded the Saruhashi Prize in 2000 as the nation's outstanding woman in science. Her contributions to science and to society have been well recognized internationally, notably by France's awarding her the Ordre national du Mérite and she was elected as a Foreign Member of the Royal Swedish Academy of Engineering Sciences.

It is indeed a pleasure to honor Prof. Tomoko M. Nakanishi with the 2016 Hevesy Medal Award for her outstanding contributions on radioisotope imaging in plant physiology and her leadership in the agricultural consequences of the Fukushima Daiichi nuclear accident.

Professor Nakanishi was nominated by Dr. Richard M. Lindstrom (National Institute of Standards and Technology, USA), and co-sponsored by Prof. Darleane C. Hoffman (University of California, USA) and Dr. Peter Bode (Delft University of Technology, The Netherlands).

The Hevesy Medal Award Selection Panel 2016 (HMASP-16) consisted of Prof. Amares Chatt (Dalhousie University, Canada; also Chair of the JRNC Board of the Hevesy Award, and Chair of HMASP-16), Prof. Tibor Braun (JRNC Board of the Hevesy Award), Prof. Zhifang



Fig. 2 Front row, from left to right (year of the award): Prof. Eiliv Steinnes (2001), Prof. Susanta Lahiri (2015), Prof. Tomoko M. Nakanishi (2016), Prof. Amares Chatt (2001), and Prof. Syed M. Qaim (2008). Back row, from left to right (year of the award): Dr. Richard M. Lindstrom (2009), Prof. Frans De Corte (2000), Prof. Jan Kučera (2006), Dr. Peter Bode (2011), and Prof. Enrico Sabbioni (2002). Prof. Zhifang Chai (2005) also attended RANC-2016 but missing from this group photo

Chai (Chinese Academy of Sciences, China), Prof. Sue Clark (Washington State University, USA), Dr. Sam Glover (National Institute for Occupational Safety and Health, USA), Prof. Susanta Lahiri (Saha Institute of Nuclear Physics, India), Prof. Pavel P. Povinec (Comenius University, Slovakia), Dr. Zsolt Révay (Technische Universität München Germany, also JRNC Board of the Hevesy Award), and Prof. László Wojnárovits (Hungarian Academy of Sciences, Hungary, also representing RANC-2016). In accordance with the rules of the award, a secret vote was conducted.

The Hevesy Medal and a scroll were presented to Prof. Nakanishi at the International Conference on Radioanalytical and Nuclear Chemistry (RANC-2016) held in Budapest, Hungary during 2016 April 10–15 (Fig. 1).

Several of the past Hevesy Medal Awardees attended RANC-2016 and were present at the Hevesy Medal Award session (Fig. 2).