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Shinya Inoué

The son of a Japanese diplomat, Shinya Inoué traveled the world by the time he was ten years old. Born in London in 1921, Inoué lived there for three years before moving on to Quemoy Island, China; Portland, Oregon; and Sydney, Australia.

By the time he was ready for his secondary education, Inoué's family had returned to Japan where young Inoué faced not only the challenges of entering the rigorous Japanese educational system, but also the reactions of his fellow students who saw him as "different" —not a quality valued in the Japanese culture, especially at that time.

Inoué recalled that, "we went back to Japan where I was supposed to go into sixth grade, but you have to take an entrance exam into high school and there is very fierce competition. So I was put in fifth grade so I could study Japanese." Notwithstanding the setback, Inoué successfully completed high school, college and university in Japan, earning a degree in zoology in 1944 from Tokyo University.

Inoué was leaning towards pursuing a career in engineering until he had the good fortune to meet and study with the late Katsuma Dan in 1941. Dan, known to his American friends and Inoué as "Katie," had just returned to Japan from the United States and taken his first teaching job when the two met. Immediately im- pressed with Dan's interactive style, Inoué began spending time with Dan and be- came interested in his work on the mitotic spindle. Inoué remembers how Dan "protected and nurtured his family and his students during the war-torn 1940's."

Inoué's early experiences moving around the world are responsible, he feels, for making him a private, inward-focused person. He reflects: "I'm not a group person. I've been sort of an outsider all my life. As a kid we were Japanese brought up in various foreign countries. In Japan I was not a typical Japanese; I was someone who came back from abroad, which made me even more different in the eyes of those around me. Science looks like it is a group effort, and in fact it is, and I've been fortunate to have had a number of excellent students, co-workers, and supportive family and friends. But basically I'm still not much of a big team player, and I'm afraid I don't like to follow what's fashionable. I'd rather concentrate on de- vising new equipment and tools that ex- tend our senses, and then let nature her- self tell what questions to ask. It's ironic, because my earlier work on spindle dynamics has now become very fashionable."

The war disrupted Inoué's life in Japan during the early 1940's, but he, like many science students, received deferments until the final months of the war. "By that time Japan was in chaos. When I was drafted into the army things were so bad that we didn't even have proper uniforms or shoes," recalls Inoué.

Following the war, Inoué returned to the United States and entered Princeton University in 1948 where he earned a Master's degree in Biology in 1950 and a Ph.D. in Biology in 1951 under the tutelage of Kenneth W. Cooper, a protégé of E.B. Wilson and Franz Schrader. After earning his Ph.D., Inoué moved to Seattle where he served as an instructor in the Department of Anatomy at the University of Washington for two years. There he met and married Sylvia September 2000 9 Continued McCandless, a native of the U.S. Midwest. They went first to Japan where for the next year he was Assistant Professor at Tokyo Metropolitan University, followed by five years back in the States at the University of Rochester.

Katsuma Dan and his wife, Jean, also a reknowned cell biologist, had worked at the Marine Biological Laboratory in the 1930s, and introduced Inoué to the place and its people through many tales of their experience there. Inoué visited the MBL in 1949 during his first summer at Princeton, immediately forming a bond that would last for the next half century. For five years in the early 1960's, Inoué served as an Instructor of the famous MBL Physiology Course. In 1979 he also initiated the Short Course on Analytical and Quantitative Light Microscopy.

The 1960's and 1970's also took Inoué to Dartmouth Medical School for seven years, the University of Pennsylvania for 23 years, and finally back to the MBL full- time. Since 1986, Inoué has been a Distinguished Scientist at the MBL. He finds the MBL both exciting and challenging. "At MBL people are always coming and go- ing and there is opportunity for collaboration with people with different expertise and refreshing outlooks. Also, you are not bogged down in various academic nonsense," Inoué reflects frankly. However, he also finds the MBL challenging "because you have to raise essentially every penny yourself."

Always interested in the study of living cells, in 1992 Inoué headed up the new MBL Architectural Dynamics in Living Cells Program. Established in 1992, this program focuses on architec- tural dynamics in living cells – the timely and coordinated assembly and disassem- bly of macromolecular structures

essential for the proper functioning and differentiation of cells, the spatial and temporal organization of these structures, and their physiological and genetic control. The program is also devoted to the development and application of powerful new im- aging and manipulation devices that per- mit such studies directly in living cells and functional cell-free extracts.

Inoué has been a member of the ASCB since 1968, serving on the Society's Council from 1970-73, and receiving the E.B. Wilson Award in 1992. He was elected to the U.S. National Academy of Sciences in 1993.

Inoué is well known for many things, including the microscopes that he has developed and his pioneering video microscopy. Long before video was in use, Inoué developed a time-lapse movie system that caught everyone's at- tention at the MBL. "In order to convey to people what living cells are doing, you need dynamic scenes," Inoué remarked. He explains that in his early years at the MBL, "I had found out that you can visu- alize spindles inside living cells. Up to that point there was a 50-year argument as to whether these spindle fibers really existed or not. But by using a polarizing microscope that I developed I could show those things and then show how they behaved inside living cells and how cold affected division and so on. I showed the cells actually dividing, and the spindle fi- bers, and everyone could see the spindle split the chromosomes and how its molecules become depolymerized in anaphase, or with exposure to cold."

Ever the individualist, Inoué explains that, "I don't particularly care to work in fields where lots of other people are working. I also like to figure out how to make it possible to explore new areas. For that I've been developing different kinds of micro- scopes."

This interest in microscopes led to a col- laboration with Hamamatsu Photonics and Olympus Optical. In 1997, together they de- veloped a microscope that Inoué had envi- sioned for 45 years: a centrifuge polarizing microscope, which allows the observation of cells under a high centrifugal field in polar- ized light. "There have been centrifuge microscopes for years, but you couldn't see in polarized light with them. With this micro- scope you can use polarized light to see how the molecules become lined up. By using po- larized light, which I've done all my life, you can look at structures while they're dynamically chang- ing inside the living cell at the level of fine structures that you can't resolve with the light microscope."

When asked where his work is headed, Inoué reflects, "I like to see what na- ture tells me to explore, rather than what the grant- types like to see. So I'm keeping my eye on the spindle, but we're using the centrifuge polarizing microscope and other microscopes to see what it and the cells can teach us, rather than trying to tell the cells what to tell us. We're finding terribly interesting new things with this new equipment. It's all related to how living cells behave and what's the fine structure underneath. Much of it relates to how cells move and how they develop."

George Langford, who served as Secre- tary of the ASCB from 1993-1999, recalls that, "I was a postdoctoral fellow in Shinya's lab in the early 70's, a time of great excite- ment in the cytoskeleton field. Shinya was far ahead of his time and always has been. He used quantitative microscopy [the polarizing light microscope] to show the dynamics of spindle microtubules in living cells before dynamic instability of microtubules was demonstrated in vitro. His research was so far ahead of the field that he had difficulty getting oth- ers to accept his findings. He went on to develop video microscopy, a technique that revolutionized the study of living cells and molecular motors. He is a brilliant scientist whose contributions to cell biology are leg- endary. He remains an inspiration to me and I continue to rely upon his advice for my own career."

The Inoués are the parents of four sons. Eldest son, Jonathan, has a Masters Degree in Physics and does independent electrical work; son Christopher has a BA in geology and has done hydrology work, most recently moving into fine carpentry; son Stephen, after winning a national motorcycle drag racing event, has traded his cycle service shop for auto service; and Ted, influenced by years of hanging around his father's lab and picking up his passion for microscopy, is President of Universal Imaging Corporation, a leading manufacturer of digital processors for microscopy.

As with many scientists, Inoué's work is his life. Still, when time permits, he enjoys reading non-scientific things and relaxing at home with his wife. In addition to their home in Falmouth near the MBL, the Inoués have a vacation home near the rain forest in Puerto Rico, a place to retreat for a month or two each year.