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Reflecting on the Past and Building the Future of Imaging at MBL: Carrying Forward Shinya Inoué's Legacy

Abhishek Kumar[1,*], Louis Kerr[1], Michael Shribak[1], Rudolf Oldenbourg[1], and Nipam Patel[1*]
[1.] Marine Biological Laboratory, Woods Hole, MA, United States.
* Corresponding author: akumar@mbl.edu; npatel@mbl.edu

Optical imaging has become an integral tool in the biological sciences and live imaging plays a crucial, central role. The field of optical microscopy has seen tremendous growth in the last five decades, fueled by the development of better light sources, detection technology, optical components, and computational capabilities, among other advances. Modern microscopy also benefits from image augmentation approaches and allows biologists to visualize processes and phenomena that remained hitherto unseen.

When Shinya Inoué started his research career in the 1940s, such advanced imaging tools were simply not available. Recognizing the need for advanced imaging in cell biology, Inoué pioneered video microscopy and developed light microscopy techniques, in particular polarized light microscopy, to visualize cell division, cell motility, and their architectural dynamics directly in living cells [1].

Inoué called the Marine Biological Laboratory (MBL) his scientific home for more than four decades, during which he and his colleagues laid a foundation for imaging research and development [2, 3]. Inoué's work defined and intersected with three important aspects of MBL's mission: developing new research tools, enabling biological discoveries, and training the next generation of scientists. These were also the core missions for Inoué's own scientific career. He excelled at all three and set a very high standard for himself and his colleagues.

In the early 1950s, Inoué developed his own polarized light microscope (known as the "Shinya scope") that allowed him and his colleagues to visualize spindle fibers in dividing cells, laying to rest an old controversy about their existence in the living cell. His pioneering work in cell biology with his live-imaging microscopy not only challenged current beliefs in the field, but also launched new research streams that led to many more discoveries over the years [4]. In the 1980s, Inoué, with help from his son Ted Inoué, combined video microscopy with computer-assisted image enhancement and analysis, demonstrating that the combination of optical engineering and computational approaches to image processing would enable biological discoveries. It is hard to imagine modern microscopy without sophisticated image processing and measurement algorithms. On the education front, Inoué along with his colleagues, Ted Salmon, D. Lansing Taylor and Gordon Ellis, started the MBL Analytical and Quantitative Light Microscopy (AQLM) course in 1980, pioneering a collaborative commercial/academic format that has become standard for microscopy courses worldwide, and has trained hundreds of scientists at MBL.

We recognize that imaging is critical for biological research, and we envision that its relevance will only grow in the future with advancements in tool development. To express our commitment and carry forward Shinya Inoué's legacy, the MBL has launched an Imaging Initiative -- an interdisciplinary effort to innovate and lead in instrument development, facilitate training and education, and further biological discoveries. MBL's Imaging Initiative has three core missions (**Figure 1**): a) to develop cutting-edge imaging technologies and fill existing technological gaps in imaging; b) to train and educate students and scientists at all career stages through various programs that have diversity and inclusion among their

outreach goals; and c) to facilitate the evolution of newly developed imaging technologies to enable biological discoveries. We will discuss our efforts to improve existing modalities, such as confocal and light-sheet microscopy for the live imaging of large samples (**Figure 2**); our efforts to make these tools accessible to the scientific community; and our educational initiatives in microscopy.

In summary, it is illuminating to reflect on MBL's past and how a visionary like Shinya Inoué shaped live-cell imaging by blurring the boundaries of scientific disciplines and bringing them together. We are inspired to inherit such foundations and to build upon his legacy for MBL to continue its leadership in scientific collaborations for biological discovery.

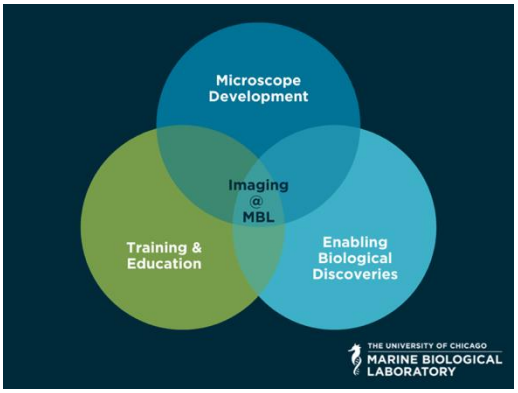

Figure 1. Schematic showing the components of MBL's Imaging Initiative.

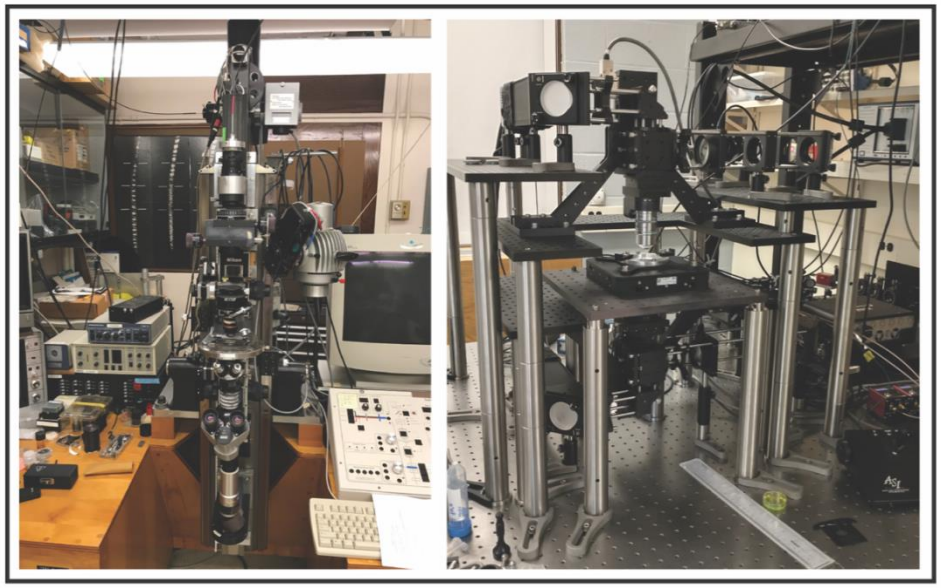

Figure 2. Examples of microscopes developed at MBL. The "Shinya scope" designed and built by Shinya Inoue and now housed in the MBLWHOI Library (left), and a newly developed line-scanning confocal microscope for imaging large and extended samples (right).

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References:

[1] S Inoue in "Collected Works of Shinya Inoue: Microscopes, Living Cells, and Dynamic Molecules" (World Scientific Pub Co Inc, Singapore).
[2] L Cameron, Biological Bulletin **237** (2019), p. 211. DOI: 10.1086/707517
[3] T Tani, M Shribak and R Oldenbourg, Biological Bulletin **231** (2016), p. 85. doi:10.1086/689593
[4] TJ Mitchison, Cell **180** (2020), p. 2. doi.org/10.1016/j.cell.2019.12.022

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