

“The Life Cycles of Microscopic Imaging in Biology”

Dates: November 13-17, 2017

PIs: Karl Matlin (U. Chicago), Daniel Liu (U. Illinois), Hannah Worliczek (U. Vienna), Kate MacCord (MBL)

Cost: less than \$4,000 (billing not yet complete)

This workshop served two goals. First, to pilot a laboratory embedding experience at the MBL for late-stage graduate/early career historians and philosophers of science. Second, to explore microscopic imaging in the life sciences. These two goals are discussed separately below.

Lab Embedding Experience

The goal of the lab embedding experience was to allow young historians and philosophers of science to actively participate in the daily activities of laboratories at the MBL that use microscopy as a main feature of their research. For this purpose, three McDonnell Scholars, Daniel Liu, Hanna Worliczek, and Michelle LaBonte were selected and placed within the laboratories of Rudolf Oldenbourg, Tomomi Tani, and Jessica Mark Welch. Oldenbourg is a biophysicist who develops microscopes (and specializes in polarized light microscopy), Tani is a biologist who develops microscopical techniques to accommodate biological problems, and Mark Welch is a microbiologist who uses fluorescent microscopy extensively in her research on the structure of microbial communities.

Over the course of a week, the scholars were introduced into these laboratories. Worliczek, who has a previous PhD in microbiology, worked with Mark Welch. Throughout the week, Worliczek spent time with Mark Welch and her research team at the microscope, capturing images, and in lab and project discussions about how to interpret images and “make sense of the data”. Liu and LaBonte were paired and worked in tandem in the labs of both

Oldenbourg and Tani, where they were shown and allowed to use a series of microscopes, and conducted basic experiments on sea urchin fertilization and development.

Throughout the week, each of the McDonnell Scholars and MBL research faculty commented on how enriching the experience was for them. Throughout a discussion panel on the last day of the workshop, each of the participants noted how much they had learned through their interactions. Mark Welch commented several times on how Worliczek's historical and philosophical questions had caused her to pause and think about concepts and procedures that she took for granted. She welcomed Worliczek back to her lab for further collaboration. At different points in the discussion, Liu and LaBonte noted how much they had learned about the practice of developing microscopes and using them within the life sciences by working closely with Oldenbourg, Tani, and members of their labs. Each had worked with labs before this experience, but their week as a McDonnell Scholar allowed them to ask the kinds of historical and philosophical questions that are not often on the agenda of larger scale laboratories.

On three evenings during the week, the McDonnell Scholars, along with Matlin and MacCord, met to discuss readings in the history and philosophy of science that pertained to microscopy and imaging. This journal club allowed the scholars to form a cohort wherein they could discuss their experiences in the lab that day, and use these experiences to reflect on the articles that were read.

In private conversation following the workshop, Oldenbourg discussed how much the presence of Liu and LaBonte, and the kinds of questions that they asked, had made him reflect on his research more carefully. He noted that he has been "thinking differently" and "asking different questions" as a result of the experience.

This pilot study was a successful introduction to integrating historians and philosophers of science into laboratory settings. All participants noted how pleased they were with the experience and welcomed further experiences. While the lab embedding experience was a success, it also raised questions about how to take the experience a step further in order to promote not just discussions between participants, but richer and more sustained collaborations. One suggestion, raised during the Friday session, was for historians and philosophers of science to work with scientists to write review articles which could highlight the strengths of each of the collaborators. Aside from review articles, the scientists noted the difficulty that they would face in making the time to collaborate with historians and philosophers of science. These scientists, all established faculty members, run multiple grants and projects at the same time, and so without a designated project to bring them together, it would be difficult to maintain such collaborations.

Exploring Microscopic Imaging in the Life Sciences

The goal of exploring microscopic imaging in the life sciences ran in tandem with the lab embedding experience. Part of this goal was met by bringing the McDonnell Scholars into demonstrations and discussions with two microscopy experts at the MBL--Louie Kerr (Director of the microscopy facility) and Jim McIlvane (Zeiss representative at the MBL). These demonstrations and discussions went on throughout the week, allowing this group to interact and discuss different aspects of microscopy and imaging. All involved noted that they enjoyed the experience and the opportunity it granted them, and Kerr and McIlvane especially enjoyed the opportunity to think deeply about problems and processes that they faced on a daily basis.

This goal was further met by a mini-conference on the Friday of the workshop. Historians and philosophers, Jutta Schickore and Laura Perini, gave presentations of their research, as did

biologists and microscopists Hari Shroff and Patrick LaRiviere. These presentations were open and advertised throughout the MBL community, and drew an audience of around 40 people. Initial discussions following the talks indicated the difficulty that some of the scientists present had in applying the historical and philosophical lessons of Schikore and Perini to reflect on their own work. However, in a discussion session following a lunch break, Schikore and Perini were asked to respond to the presentations of Shroff and LaRiviere, and especially to highlight how the work that they presented was both pertinent to and could help with further understanding of some of the concepts that Shroff and LaRiviere had discussed. Following this reflection, the discussion and questions from the crowd shifted, and it was clear that the mostly scientific audience began to understand that the problems that Schikore, and especially Perini, discussed were highly relevant to their own work. Following this discussion, in personal communication, one of the attendees, MBL Hibbitt Fellow Duygu Ozpolat, noted how excited she was to hear Perini's talk and how much it had made her reflect on her own work on imaging.

The overall discussion promoted by this mini-conference led to fruitful discussions about specimen standards and values in microscopy and imaging. All participants believed that the mini-conference and the discussions it produced were worthwhile. Given the rich literature on microscopy that exists within history and philosophy of science and the microscopy and imaging work (both in development and in application) that is done at the MBL, this area should be explored more thoroughly in the future, both through continuing to promote lab embedding experiences, as well as through highly-focused working groups that bring together historians and philosophers of science with scientists to collaborate on projects with tangible results.

Participant List (14 people)

<i>Last Name</i>	<i>First Name</i>	<i>Institution</i>	<i>Area of Expertise</i>	<i>Position</i>
LaBonte	Michelle	Harvard	Bio/HPS	grad student
LaRiviere	Patrick	U. Chicago		faculty
Liu	Daniel	U. Illinois	HPS	post doc
MacCord	Kate	MBL	HPS	fellow
Maienschein	Jane	ASU/MBL	HPS	faculty/fellow
Mark-Welch	Jessica	MBL	Microbiology	faculty
Matlin	Karl	U. Chicago	HPS	faculty
Oldenbourg	Rudolf	MBL	Biophysics	faculty
Perini	Laura	Pomona College	HPS	faculty
Schickore	Jutta	Indiana U.	HPS	faculty
Shroff	Hari	NIBIB		faculty
Steinert	Beatrice	Brown U.	Dev. bio/HPS	staff
Worliczek	Hanna	U. Vienna	Microbio/HPS	grad student
Yoshinari	Yoshida	U. Minnesota	HPS	grad student