Course Report: Analytical and Quantitative Light Microscopy

Marine Biological Laboratory, Woods Hole, Massachusetts, United States

April 26 – May 5, 2023

Shiori Iida
D4 student
Genome Dynamics Laboratory

・Course description

Analytical and Quantitative Light Microscopy course (AQLM) has a long history, having started in 1980 by Dr. Shinya Inoué, a famous Japanese microscopist. This year, the course was led by Dr. Peter Kner, University of Georgia; Dr. Paul Maddox, University of North Carolina at Chapel Hill; Dr. Alexa Mattheyses, University of Alabama, Birmingham; and Dr. Gary Laevsky, Princeton University, held in Speck auditorium and Loeb building at Marine Biological Laboratory (MBL). Twenty-eight participants attended, nearly all from the US or Canada. More than half were Ph.D. candidates, while the rest were postdocs or technical staff. In addition to the course directors, we have lecturers who have developed some fantastic techniques and tools for microscopy, vendors such as Nikon, Evident, Leica, Zeiss, etc., and TAs who helped us with our lab activities. Therefore, the number of people teaching was about twice the number of students.

・My motivation and application process

My current research analyzes chromatin dynamics in live cells using single-molecule imaging/tracking techniques. However, my major is cell biology, and I have limited knowledge and experience in microscopy. I felt that I need to learn more about microscopy to gain a deeper understanding of my experiments. Also, the recommendation from my mentor, Prof. Kazu Maeshima, encouraged me to apply to the course. In my case, I was required to submit an application letter, a CV, and two recommendation letters by February. It was the first time for me to write the application letter in English, but I tried to be straightforward in expressing my motives and interests and explained how I could contribute to the course.

・What I learned

The course was really intense. The typical schedule was that we would start before 9 AM, and the classes and labs would go on until 11 PM. There was usually a lecture on one topic, and then we moved to the lab, where we broke into several groups and did practical things with our group members. We started with basic ray optics, including how to calculate the focal length of lens and magnification, and then learned about the principles of Köhler illumination and condensers. There were also basic lectures on diffraction and resolution; point spread functions; Fourier theory; and detectors. Since this was a “quantitative” microscopy course, we learned about what intensity means, what is the noise, its sources, what we can do to reduce noise, how to get quantitative images, and how to analyze them. The topics then shifted to more practical and applicable ones – we learned about fluorescence, phase contrast and DIC microscopy, FRET biosensors, deconvolution, confocal microscopy, TIRF, single-molecule imaging, lightsheet microscopy, SIM, STED, and PALM/STORM. We also had “lightning talks” on the night of the second day, where students introduced their research topics, and “vendor talks” held on the fourth day. In the free time on the eighth day, there were tours to the library and marine recourse center at MBL. Students also can freely use the microscopes and observe their bringing samples with the help of vendors and

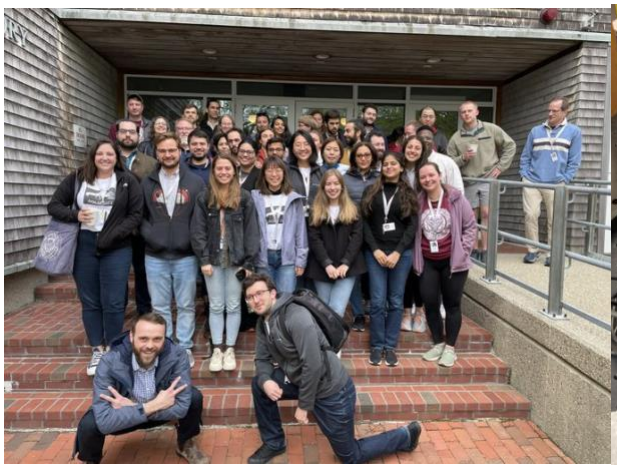
TAs. Last night, we had a lecture from Dr. Daniel Kiehart from Duke University about how cells change their shape during Drosophila development with some impressive videos. After that, we ate lobsters together – it was the first lobster for me and really good – and received a certificate of course completion.

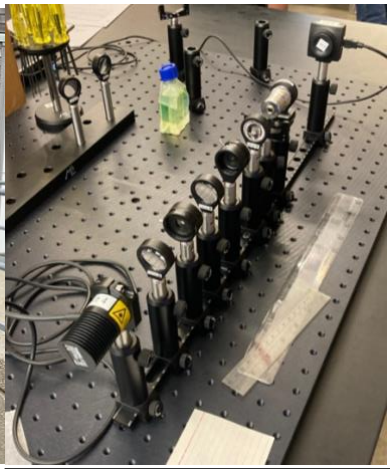
・My feelings and messages to anyone interested in this course

I felt that the course is sophisticated and covers all the essential knowledge. The lab activities are done in groups, which allows students to communicate better with each other. Some students are in the physics field and others are in the biology field, so we can complement each other. I strongly recommend attending this course, not only to learn about microscopy systematically, but to make many friends and future collaborators.

Honestly, it was a hard course for me, especially about English. My English skill is not so bad, as I can communicate one-on-one with native English speakers, and I can understand most of the contents of lectures with the help of the slides. However, in the group work and at the meals, I sometimes could not understand why group members were laughing (they spoke too fast for me…), and it was a heart-breaking situation. Gradually, however, I got used to the speed and recovered from the jet lag. In the latter half of the course, I began to regain my confidence; I just started by imitating how native English speakers speak, tried to communicate more, and finally became friends with many participants. I realized that Japanese people are often said to be shy, not because they are shy, but because they are unable to catch up in conversation and just keep quiet. If you are reading this report and want to participate in an educational course but are hesitant because you are worried about your English skills, I encourage you to give it a try. Maybe everyone will hit the wall, but from the experience, we can learn how to survive without Japanese and you will find that everyone is friendly and helpful, even if they speak different languages.

I sincerely would like to express my gratitude to the Morishima Fund, which supported my attendance at the course.





(Top left) A group photo of AQLM.
(Top right) A microscope that we built at the lab activity.
(Bottom left) Beautiful sea view near MBL.