Report on the study trip of the PhD program Cutting Edge Microscopy on May 23 – 24, 2022.

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During our study trip to Strasbourg with the PhD program *Cutting Edge Microscopy* (CEM) we had the chance to visit the facilities of the IGBMC (Institute de génétique et biologie moléculaire et cellulaire). Here, over the time of two days we visited several different microscopes covering a wide variety of imaging approaches, from electron microscopy to fluorescent microscopy. We also had the opportunity to see these microscopes working over some workshops where we could directly interact with the experts in the facility about the details of the techniques and their applications.

One of the three workshops we had during our visit was with a confocal and a multiphoton microscope (Leica DMI6000). As we were about to find out, there was way more about the setup than we expected. The multiphoton microscope included a 355 nm laser, which they used for inducing DNA damage in very specific regions of their cultured cells or organoids. To effectively achieve that, a temperature control and a CO_2 chamber were also installed around the microscope to preserve the cultures alive. With this setup they can for example study the recruitment of fluorescently labelled DNA repair proteins from the cytosol to the nucleus, followed by their dissipation back into the cytosol. The imaging can be performed at high enough speeds to get a detailed insight into the dynamics, even though it is a confocal microscope.

A second workshop we took part in was focused on spinning disc microscopy. Here we compared the imaging in a setup with and without the spinning disc of pinholes, where we could clearly appreciate the increase in resolution that the spinning disc brings. Also, it was very impressive to observe how much faster the acquisition was when compared to a confocal microscope. We also learnt the added value of this approach for live imaging, where high resolution images can be taken at high speed, allowing for the acquisition of fast events in living cells.

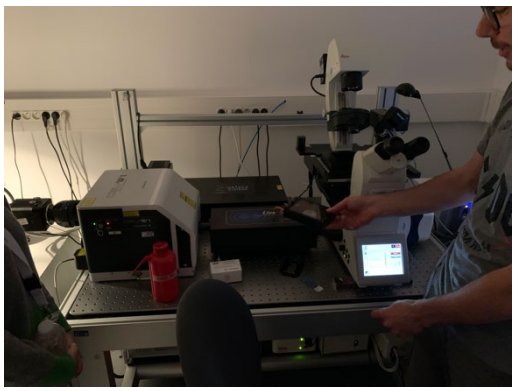

Figure 1. Spinning disc microscope

Figure 2. TECNAI Transmission Electron microscope

The third workshop dealt with the many electron and cryo-electron microscopes they have in the IGBMC. During this visit, we could see the equipment used deep-freezing the samples, as well as for mounting them in the grids used for cryo-EM. It was very impressive to see them doing it live, since it is a very tricky procedure as the membranes and grids are extremely fragile. Later, we visited the cryo-EM and the TITAN microscope and all the logistics behind these big microscopes e.g., the vibration insultation. As a sample of an image and how to reconstruct and process the acquisitions they showed us the resolved structure of an aquaporin.

Figure 3. Vitrobot plunge freezer

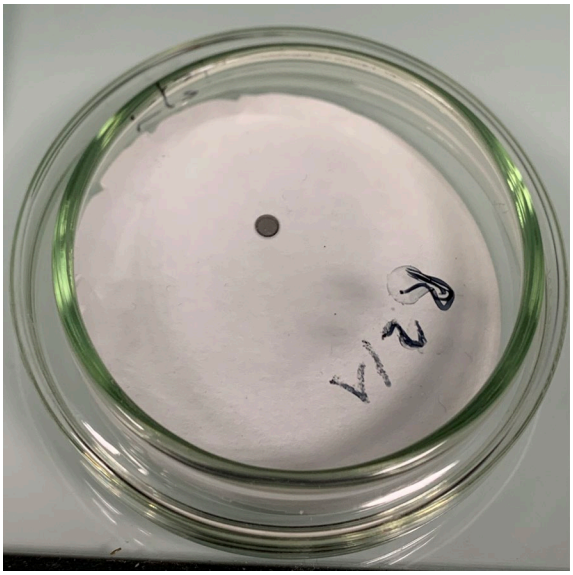

Figure 4. TEM sample grid

Finally, we could also discuss with them the type of image analysis they routinely perform and the software they use. It was really interesting to learn about different software possibilities and different segmentation algorithms, including CellPose that give nowadays very nice results. We had some insights on how machine learning is applied to scientific image analysis and processing.

In brief, we all really enjoyed the visit to the facility. It was very fruitful to see other microscopy facilities and the sort of applications they work on. Above all, we really benefited from the discussions and the possibility to directly ask questions to the imaging experts from the IGBMC, who were very kind and patients answering to all our curiosities and inquiries.