

Teaching Histology During Covid-19 Restrictions

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Laboratory settings, particularly when using microscopes, can be quite confining. As a result, it may be difficult to maintain the six feet distance recommended by the Centers for Disease Control (CDC) for preventing/controlling Covid-19 pandemic [1]. In addition, the importance of other safety guidelines such as: hand washing, avoiding touching the eyes, etc., become issues which should be observed strictly during microscopic analyses of samples [1]. These problems may well be amplified in the close confines of the laboratory. Histology classes, like other laboratory situations requires due diligence regarding Covid-19 Safety Protocols and health safety guidelines in general. This can in certain circumstances present a challenge to histology instruction. Fortunately, now there are many excellent histological atlas websites. These digital formats can help with learning the cytology and morphology of the cells. They are sufficiently diverse such that students can see the same cell in many magnifications and in the context of different types of stains. Another important goal is that students gain experience with the microscope. However, sending microscopes home with the students during restrictions imposed by the Covid-19 pandemic is an expensive undertaking. Last year, we mailed out Foldscopes to all class members to make microscopic observation from samples found in the student's home environment. This year we extended that approach to histological studies. The Foldscopes are an inexpensive monocular microscope [2]. They are capable of 120X magnification and thus can be used to observe the cell and histological relationships of cells [2-4]. This year we sent histological slide sets in addition to the Foldscopes. The first objective was to observe and obtain microscopic documentation of a given cell or tissue type with the Foldscope. Then the students were asked to check their observation against online Histological Atlas images. This activity enabled the students to test their observational and creativity skills. All of them were able to identify and document the given cell types but some needed some extra help by way of critique from their peers. The following tissues were observed: epithelial, connective, adipose, cartilage, bone, nervous tissue, muscle, blood, organs of the immune system, organs of the digestive tract, lungs, skin, and retina. Once images were obtained, they were presented in the online discussion groups. The images were critiqued for quality, including: the correct cell types, post image processing and artifacts. Staining and processing artifacts were identified and explained. The optical artifacts discussed were spherical and chromatic aberration. After the critique, students were then allowed to reimage their slides and improve both the image and identify the right cell type where necessary. This was achieved with feedback from the peers, faculty, and referral to online Histological Atlases. Next, the students were shown how to minimize chromatic aberration, and spherical aberration in the images. Size measurements with latex Nano spheres was also part of the learning activities. These size standards give an idea of the magnification capacity of the Foldscope. They were also a comparative way to determine the size of the specimens observed. Ergonomic issues were also considered. Overall, this learning approach was well received by the students involved with majority reporting having enjoyed the activity anecdotally. The activity strongly contributed to student interaction at multiple levels and provided experiential learning during Covid-19 pandemic. This was a much needed and effective online learning format necessitated by the Covid-19 pandemic. In addition to

Histological studies, microscopic observations with critical specimen analysis are essential skills in STEM education [5-7].



Figure 1. Students examine assigned specimen.



Figure 2. Students present their observations to the class in an online meeting for critique and comments.

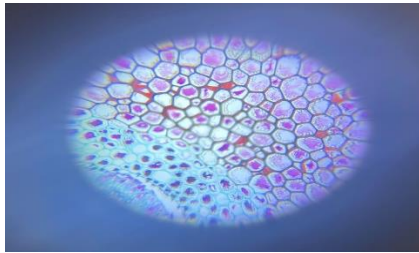


Figure 3. First attempt, Out of focus with Flare

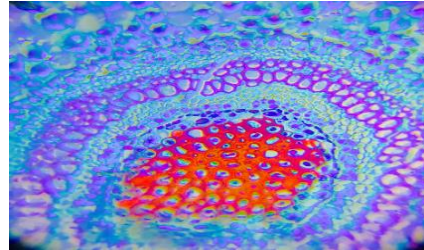


Figure 4. Next Improved focus contrast and color.

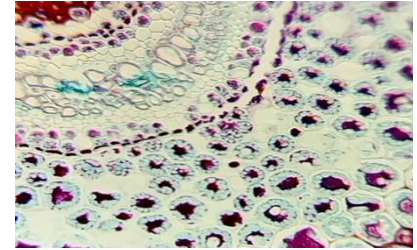


Figure 5. Peers submit their image improvements.



Figure 6. Foldscope images comparisons with form online atlas images.



Figure 7. Methods and image presentation in chart

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