

Visit to the Electron Microscopy Core Facility at the University of Missouri

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UM Host: Prof. Tommi White

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- i. What was the objective of your visit?**

 - to expand our user base at the EMU, UWC by learning other sample preparation techniques, especially for biological specimens
 - learn new techniques such as EFTEM, EELS and HRSTEM on the HRTEM
 - learn how to interpret HRTEM, EELS, EFTEM and HRSTEM data
 - learn how to solve some pitfalls encountered during the operation of the advanced techniques, especially using the software

- ii. If your objective was fulfilled, to what do you attribute your success? If not, what was the reason?**

Not all the objectives were fulfilled because the individual that routinely used the advanced techniques on the HRTEM, left for work opportunities elsewhere, before my arrival. I therefore spent most of the time learning about sample preparation techniques for biological specimens. In addition, I sat in on routine maintenance visits from the FEI technician. During these times, I learned about additional alignments one can do if faced with certain problems on the microscope. This newly acquired knowledge was applied soon after the technician left. I managed to solve the problems we experienced with the microscope by myself. This experience left me feeling more confident about my approach in solving problems encountered on the microscope.

I also sat in on some of the analysis performed by independent users and assisted them when they needed assistance on the SEM and HRTEM.

In addition, I assisted some materials science students with their analysis using STEM on the HRTEM.

My host, Prof. Tommi White, and I also spent some time during my visit, on the HRTEM sharing our knowledge and experience on some of the advanced techniques as well as software related problems.

- iii. If you could change any aspect of your visit, what would it have been?**

Even though my visit didn't turn out exactly the way I thought it would, I still had a very positive experience overall. I therefore, would not change any aspect of it.

- iv. How could the planning and preparation for your visit have been improved by UWC?**

I think UWC could get more involved in terms of VISA requirements. I had the unfortunate experience of being turned away from a connecting flight from Heathrow through Canada. This caused a delay in my arrival time at St. Louis and hence I missed the last available shuttle from the airport to my hotel in Columbia by 2 hours. I had to wait at the airport for 8 hours until the next available shuttle arrived.

- v. **What is your overall assessment of the value of the UM / UWC Exchange Program?**
The UM/UWC Exchange Program is invaluable. The collaboration between the universities is quite unique, and both universities could only benefit from it.
- vi. **If you could change any aspect of the exchange program, what would it be?**
At this stage I would not change anything. The program seems to be running smoothly.
- vii. **Did you encounter any notable problems during your visit?**
My bank blocked my card twice while abroad, even though I informed them beforehand that I will be using my card there. This was quite frustrating because UWC transferred the money for my meals into my bank account. While stranded at the airport, I couldn't buy any food and had to wait until I was at the hotel to phone my bank.
I also found that the money allocated for food, was not enough. Food is quite expensive in the States.
It took me about 10 days to fully acclimatize to my new time zone.
- viii. **How will your visit contribute to strengthening and improving programs at UWC?**
Sample preparation is the most important part of electron microscopy analysis. Thus far we have been limited by sample thickness, which made access to the higher end techniques problematic. Hence, more time should be spent trying to get the sample preparation laboratory more equipped for the preparation of various samples. The acquisition of an ultramicrotome is essential as a first step, and hence funding will be sought for this.
- ix. **Given the opportunity to participate in the exchange again, would you do so?**
I would certainly participate in the exchange program again.
- x. **What, if anything, about your exchange experience surprised you?**
I was quite surprised by how smoothly things run in their core facility. The clients respected the rules of the electron microscopy core facility and there were mutual respect amongst all staff members.
- xi. **What did you like most about the program?**
The opportunity to network, meet other researchers and share ideas.
- xii. **What other observations would you like to share?**
The electron microscopy core facility at UM deals mainly with biological specimens. Cells and tissue (animal or plant) are the main types of samples they receive on a daily basis. The sample preparation involves a number of steps [primary fixation (gluteraldehyde, paraformaldehyde) and processing (washing, secondary fixation with OsO₄, washing, dehydration with ethanol and acetone, resin embedding), thick sectioning (glass knife), thin sectioning (diamond knife), post-staining], and the utmost care is taken at each step to ensure the cells remain intact and is not altered in any way during the sample preparation. All these steps, especially thin sectioning, are quite delicate procedures

and not easy to perform, and requires quite a bit of skill. A number of skilled people are involved in the sample preparation of biological specimens at the electron microscopy core facility at UM, which makes the whole process run very efficiently.

The electron microscopy core facility at UM is also equipped with electron microscopes (environmental SEM [FEI Quanta 600 Extended Vacuum Scanning Electron Microscope], HRSEM [Hitachi S4700], TEM [JEOL 1400], and HRTEM [FEI Tecnai F30; with cryo-capabilities]) that would allow many different types of specimens to be viewed and analyzed. In addition, their sample preparation equipment allows for many different types of samples to be prepared on a daily basis.

- xiii. **How is the knowledge and experience gained on this exchange program going to influence your future work related endeavors?**

I would like to implement what I observed at UM here in the EMU at UWC.

- xiv. **What specifically will these future endeavors entail?**

Discuss with ICS the possibility of saving all the data on a network drive. This would make it easier for students/researchers to access their results from the analysis anywhere and anytime.

Different login details needs to be created for all the different users. This will prevent inexperienced users from altering the main alignments of the microscope.

Adjust the cost for analysis to ensure that the income from the analysis can be used to purchase sample preparation equipment in future.

Seek funding for an ultramicrotome.

Long-term: to have a fully equipped sample preparation laboratory in the EMU for the preparation of various samples (biological and materials). In addition, more technical staff will be needed to ensure efficient operations within the unit. Sample preparation of biological materials can be quite time consuming and requires quite a bit of skill, especially during sectioning. Hence, more technical staff that would only be involved in sample preparation needs to be employed.

- xv. **Should the exchange program be continued? If so, why?**

This program should be continued as international exposure is essential for growth in one's career.

Abbreviations:

UM	:	University of Missouri
UWC	:	University of the Western Cape
EMU	:	Electron Microscope Unit
TEM	:	Transmission Electron Microscope
HRTEM	:	High Resolution Transmission Electron Microscope
HRSTEM	:	High Resolution Scanning Transmission Electron Microscopy
HRSEM	:	High Resolution Scanning Electron Microscope
EELS	:	Electron Energy Loss Spectroscopy
EFTEM	:	Energy Filtered Transmission Electron Microscopy
ICS	:	Information and Communication Services