Grids were mounted on beamline sample holders and placed in the endstation (see Figure 1) and scanned through the focussed 12 and 15 keV X-ray beam with 50 nm steps and a 0.015 sec/pt dwell time. These conditions provided a high-resolution image

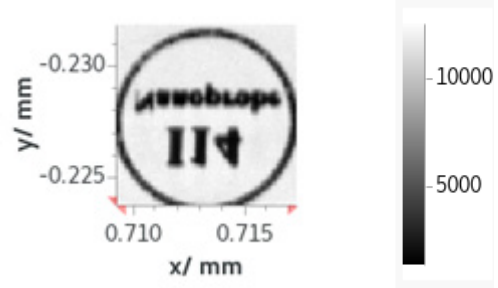

Figure 2. W la map from a 1micron thick W tungsten patterned calibration chart.

of the samples. Data were analysed using PyMCA to extract individual elemental maps.

Results

Data from the archaeological sample tested are not presented here as they will be published elsewhere, however, the samples were successfully able to be FIB milled and analysed to extract meaningful nanoscale elemental composition maps. Instead, the results from some calibration samples are shown in order to demonstrate the application of the technique.

The data from XRF can be viewed as a map of the sample as shown in Figure 2. This clearly shows the outline of the logo where the tungsten is located. Figure 3 shows an example of XRF data plotted in a spectra. From this spectra the fluorescence line for the elements Ti and Cr are visible, from this the composition of the sample can be observed.

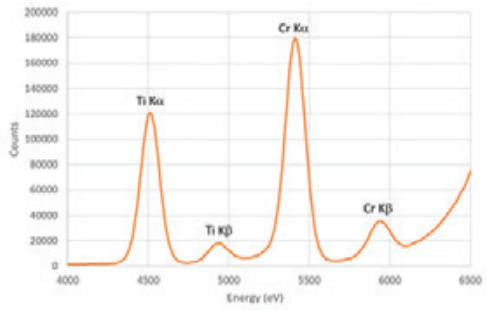

Figure 3. Example nano-XRF spectra from a sample containing Chromium and Titanium with the fluorescence lines labelled.

Conclusions

In conclusion, the nanoprobe XRF mapping has proven to be highly effective in the analysis of the specimens. The technique can provide an insight into the nanoscale elemental composition of the specimens. With these irreplaceable samples, preservation is key and as the technique is virtually non-destructive, it allows minimal damage to occur to the samples which aids in the preservation and further study of them.

The experience at Diamond allowed me the opportunity to visit a dedicated research facility to collect data which provided me with a valuable insight into real life microscopy experiments. I thoroughly enjoyed my time visiting Diamond and every day was filled with the chance to get real life data on state of the art equipment going towards the group's research. I was privileged to work with a great research team on an incredibly interesting piece of research and I am hoping to go on to study a PhD using microscopy techniques, such as electron microscopy, so I can work in further research groups.

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Acknowledgements

Data were collected at Diamond Light Source, Beamline 114 under proposal number MG27407

Endomembrane interactions in microsporidian infection

Student: Mostin Hu
Supervisor: Dr John Lucocq
Project location: School of Medicine, University of St Andrews

Lay summary:

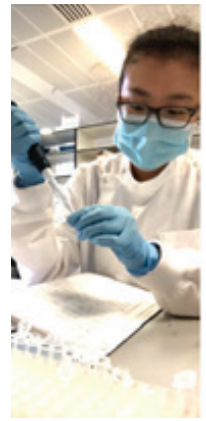
Microsporidia is a group of intracellular eukaryote parasites which require a host cell to survive and reproduce. For most people these organisms do not cause harm, but infection in people with a compromised immune system (for example, due to chemotherapy or HIV-AIDS) can cause serious illness and even death. We previously identified close association of host membranes with microsporidia and speculated that these membranes help wall off and protect the parasite. This project used microscopical techniques and knockdown of host proteins to characterise these membranes and potential mechanisms.

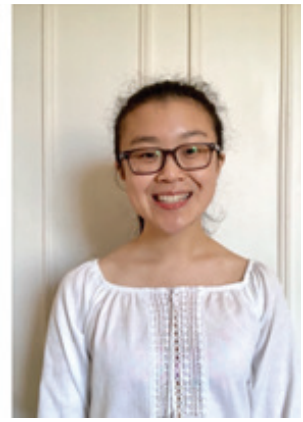
Project Aims:

Previous research in the Lucocq lab demonstrated a host-endomembrane response is triggered by microsporidia-infected cells. This project aimed to investigate which membranes of the are recruited and whether this response is specific for proteins of the organism. By suppression of host cell components, we aimed to elucidate whether this response was protective to the host or beneficial for the parasites.

What I learned:

I am so incredibly thankful to have been given this summer studentship as it allowed me to not only develop key laboratory skills, but it also allowed me to learn and practice the qualitative and quantitative analysis of microscopy images. I was able to refine key research and laboratory techniques such as sterile cell culture, Western blotting, IF staining and how to choose antibodies against the proteins of interest using known data available from other similar species and performing sequence alignment. Working primarily with immunofluorescence microscopy, I learned how to obtain images using systematic





uniform random (SUR) sampling, a method which allows for the non-biased acquisition of images imperative for quantification.

How this project has affected my long-term goals:

This summer studentship has offered me the time and experience to confirm my interest in cell biology research. As a medical student, I found that research is often portrayed to be a separate career path from clinical medicine; however, I have grown to realise that both fields are highly complementary to one another. Crucially, I have been able to appreciate the many transferable skills that can be learned through research which will hopefully make me a better clinician. The skills of inquiry, creative thinking, hypothesis testing, pattern recognition, and critical analysis of data which are practiced daily in research are equally important in clinical practice.

I am very keen to undertake a PhD during my medical training in the field of host-pathogen interactions, an interest I developed through this studentship and hope to use the microscopy techniques I learned this summer in my future research.