

BDIAP Elective Report 2025

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I am incredibly grateful to the BDIAP for their generous support, which enabled me to undertake an elective placement in the Hess Lab this summer. The Hess Lab is a large and dynamic group specialising in Immunometabolism, with two main research arms in Basel and Cambridge, and a wealth of international collaborators. The lab spans a broad range of projects at the cutting edge of immunology, and it was a privilege to be welcomed into such a stimulating environment.

During my time in the lab, I was first trained in a number of core experimental techniques, including staining, flow cytometry, and Western blotting, while also extending my microscopy skills through the use of the Zeiss 980 Airyscan system. This initial training provided me with a strong technical foundation before moving on to my individual project. My work focussed in an important problem in the field of cancer immunotherapy. Hypomagnesemia is prevalent in cancer patients and correlates with poor prognosis because it undermines anti-cancer T cell efficiency by inhibiting the LFA-1 integrin (critical for immune synapses formation). The aim was to explore whether magnesium-independent variants behave differently from wild-type T cells in hypomagnesemia, and to explore future clinical applications of these findings. The Hess Lab has since developed a CAR T cell line carrying a mutant form of LFA-1 which I used to investigate ways to overcome the limitations caused by hypomagnesemia. My project aimed at characterising this variant, exploring how it altered T cell functions, particularly whether it strengthened immune synapse formation.

To do this, I also worked with blood cells from donors, isolating T cells using peripheral blood mononuclear cell separation techniques before culturing and transducing them with lentivirus. From here, I worked with cells expressing both CAR and the variant LFA-1 to investigate how immune synapses were formed. This involved the optimisation of a new protocol using live confocal fluorescence microscopy in co-cultures of Raji cancer cells and CAR T cells. I stained cell surfaces to analyse cell-cell contacts and employed a calcium-sensitive dye to assess the kinetics of calcium flux during immune synapse formation, as a surrogate of cell signalling strength.

Alongside this project, I also contributed to several other experiments within the lab, including verifying expression of His-tagged proteins by flow cytometry for subsequent protein purification; as well as different Western blotting assessment.

I particularly enjoyed this project as it built directly on my prior laboratory-based research experience, while also pushing me to develop a more advanced and confident approach to experimental work. My time in the Hess Lab gave me the opportunity to refine techniques such as cell culture and microscopy to a much higher level of proficiency, which was both challenging and rewarding. I also valued being part of the critical discussions that drive the scientific process, from experimental design to interpreting data and rethinking approaches when the results were unexpected. I believe this experience was strongly reinforced during the lab retreat, which I was fortunate to attend. It was inspiring listening to the vast array of projects across the lab, whilst having the opportunity to take part in the rigorous discussions

underpinning them. I was also lucky enough to briefly present my own work and answer questions, which whilst initially daunting, proved to be an invaluable experience in developing both my scientific communication and critical thinking skills.

I would once again like to express my sincere thanks to the BDIAP for their support. My elective in the Hess Lab has been an outstanding experience, and pivotal in shaping my development as a future clinician–scientist. The techniques I learned, the experiments I ran, and the discussions I took part in have given me both technical skills and intellectual perspectives that I will carry forward in my medical training and beyond. I thoroughly enjoyed my time in the lab and look forward to building upon the skills and inspiration I have gained from this placement.