BDIAP Elective Report 2025

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This summer I was fortunate to spend nine weeks in the Cancer Research UK Cambridge Institute, working in the laboratory of Dr Richard Mair, a neurosurgeon and principal investigator. I am deeply grateful to the BDIAP for their generous support, to Dr Mair and his team for their mentorship, and to the patients whose samples made my work possible.

The Mair Lab is uniquely positioned at the interface of surgery and science. Dr Mair's dual role as neurosurgeon and researcher allows the lab to work directly with primary tumour material collected during operations at Addenbrooke's Hospital. Shadowing Dr Mair in theatre was a formative experience. Meeting patients before surgery, and later handling their blood and tumour tissue in the laboratory, reminded me constantly that behind each sample lies an individual and a family. This reinforced the importance of pursuing translational research that can bring meaningful benefit back to the clinic.

My primary project was to study the methylome of immune cells in patients with brain tumours of different types - glioblastoma, lower-grade gliomas, and metastases. This required processing blood and tumour tissue immediately after surgery to generate single-cell suspensions. I then performed magnetic-activated cell sorting (MACS) to isolate specific immune subsets, including monocytes (CD14+), NK cells (CD56+), B cells (CD19+), and T cells (CD4+ and CD8+). The next stage, which the lab and I continues to pursue, is to carry out nanopore sequencing to profile methylation patterns and better understand how tumour-infiltrating immune cells differ from circulating cells.

A second project involved studying 5-aminolevulinic acid (5-ALA), commonly known as the "pink drink." This prodrug is converted into protoporphyrin IX (PpIX), which accumulates in glioblastoma cells and fluoresces under blue light, guiding neurosurgeons in maximising tumour resection. However, tumour fluorescence varies between patients. I investigated this variability using patient-derived glioblastoma cell lines. I began with literature review, then trialled and optimised protocols to induce and measure fluorescence. I learned to use a laser confocal microscope to visualise PpIX accumulation at the cellular level, an exciting but technically demanding process.

I encountered multiple challenges, from protocols that repeatedly failed to equipment that malfunctioned. At times I felt frustrated and disheartened, particularly when progress seemed slow. These setbacks taught me that experimental science is rarely straightforward, and that persistence, problem-solving, and the courage to ask for help are essential skills. I realised that failures were often the richest learning opportunities - they forced me to understand the methods more deeply and to seek advice from colleagues, which strengthened my technical knowledge and built supportive relationships.

Alongside practical work, I attended lab meetings which exposed me to the broader neuro-oncology research community. These sessions allowed me to share ideas, learn from peers, and appreciate the value of collaboration across scientific and clinical disciplines. Meeting like-minded scientists and clinician-researchers further confirmed my aspiration to follow this path myself.

This project has been transformative. It has strengthened my commitment to becoming a clinician-scientist in neurosurgery, bridging the gap between the operating theatre and the laboratory. Most of all, it has given me a realistic understanding of both the challenges and the rewards of translational research.

I am sincerely grateful to the BDIAP for making this experience possible.