Functional interrogation of loci associated with the regulation of haematopoiesis

Dr Kirsten Fairfax

Alex Gadomski Fellowship 2019 ongoing

Dr Kirsten Fairfax is the recipient of the Alex Gadomski Fellowship, and undertakes her work at the Menzies Institute for Medical Research, University of Tasmania, Hobart. Her main area of interest is to try to understand if there are new drug targets that can be found for Bone Marrow Failure Syndromes (BMFS). She is achieving this by studying how the genetic code of each individual changes the way their blood cells develop and is using an exciting new technology called single cell RNA sequencing where the genes in every single cell are individually studied. So far, she has examined over one million cells from blood samples and collected bone marrow samples from 72 individuals to map the developing blood stem cells.

Dr Fairfax expands, “The blood forming stem cells, known as haematopoietic stem cells, that reside in the bone marrow are truly extraordinary. The stem cells are capable of generating in a healthy adult approximately 600 billion cells per day! These cells are composed of red blood cells, which carry oxygen around the body, platelets which are important for clotting the blood, and white blood cells which fight infection. Bone Marrow Failure Syndrome occurs when the bone marrow stem cells are no longer able to generate the cells of the blood that we need to lead a healthy life. By studying how the genetic code of each person impacts on blood cell development, we will find ways to alleviate the defects in patients with BMFS and additionally, will uncover novel

genetic mutations that are causative of Bone Marrow Failure."

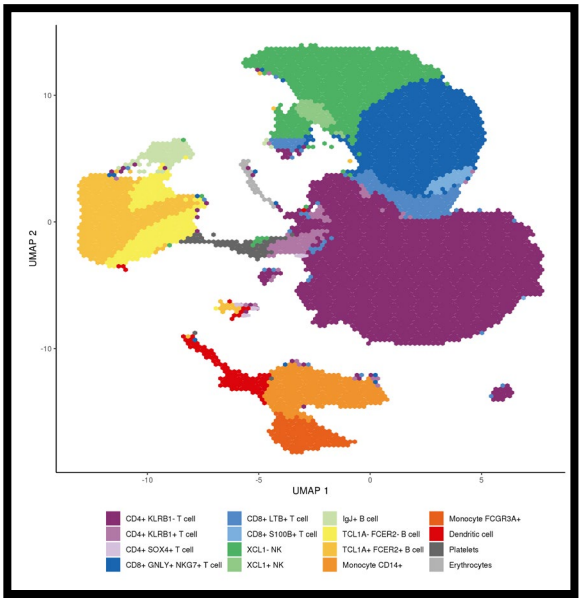
Dr Fairfax and her team are using gene technology to use the information generated from analysing specific sections of the genetic code to change the way stem cells behave when they are grown in a laboratory dish. This is the first step in demonstrating what each bit of the genetic code is doing. Whilst the research is currently at an early stage, she is delighted that the bone marrow sample collection is complete and has received confirmation that the genetic material is very high quality. Her team is collaborating with scientists at The Garvan Institute in Sydney, who are generating all the single cell data, and demonstrates a productive association between leading scientists from around Australia to work on a common problem. Additions to the team will be recruited to ensure the information generated will be translated into possible new therapies for patients as quickly as possible.

Dr Fairfax is very excited about the possibilities of gene therapies as cures for BMFS and was instrumental in initiating the Gene and Cellular Therapies Subcommittee of the CRE Executive. "I think gene therapy could really change the face of therapies for BMFS. As they are such a rare group of diseases, and because there are multiple causative genes, it is very difficult to convince biotechnology or pharmaceutical companies to be involved. This means that we need our academic institutes to step into the void and generate the clinical grade therapeutics that are needed to establish the safety profiles for these therapeutics. However, this is quite different to the typical model of science research, and as such it is quite difficult to get funding for. We are currently trying to secure funding to conduct safety testing on some gene therapy products for use in BMFS."

Dr Fairfax's background in immune cell development was a perfect fit for the Alex Gadomski Fellowship. "I was approached to consider being involved in the work going on in Tasmania. I like a good challenge and am very passionate about using scientific research to develop new therapeutics, so I think I was a great addition to the project team and was thrilled to become involved. There is an amazing family here in Tasmania, the Gadomski's, who work together with Maddie Riewoldt's Vision to fundraise for research into BMFS. The Gadomski's work tirelessly, not only to fundraise, but also to promote awareness of the need for research into BMFS, so that scientists can deliver new therapeutics for sufferers of these rare diseases. They do this in memory of their beautiful son and brother Alex, in the hope that other families do not tragically lose a child or sibling as they lost Alex."

Dr Kirsten Fairfax in the laboratory at the Menzies Institute of Medical

Dr Fairfax grew up in Launceston, Tasmania, and kept herself out of trouble as a youngster by exhausting her energy running in the hills and rowing on the Tamar River. Leaving Tasmania at the end of school, she headed to Melbourne on a National Undergraduate Scholarship to study science, majoring in genetics and biochemistry, and then furthered her education with an Honors and PhD at the Walter and Eliza Hall Institute through the University of Melbourne. During this time, she held a Dora Lush Fellowship. Subsequently, she held a NHMRC CJ Martin Fellowship to complete post-doctoral studies in Cambridge and at Monash University. A further appointment at The Walter and Eliza Hall Institute ensued before returning to Tasmania in 2019. She is delighted to call the The Menzies Institute for Medical Research and Hobart her home, and remarks, "Hobart is a not only a fantastic place to do my research but a most fabulous and picturesque location to go running and hiking in the hills!"



A total of 1,300,902 peripheral blood mononuclear cells have been analysed from 981 individuals. Clustering of cell types differentiated CD4 and CD8 T lymphocytic, B lymphocytic and monocytic cell clusters. Each colour represents a cell type from multiple individuals; T cells are in purple and blue, NK cells in green, monocytes are orange and dendritic cells are red.