



**MAURICE WILKINS CENTRE**  
FOR MOLECULAR BIODISCOVERY

Specialised Training & Facilities accessed by MWC investigators

### **Abby Sharrock, Victoria University of Wellington**

Earlier this year, I was lucky enough to be invited to travel to the Wilmer Eye Institute at Johns Hopkins School of Medicine, Baltimore, USA, to further my research into engineering bacterial enzymes for regenerative medicine studies. Thanks in part to the Maurice Wilkins Centre, I was able to take up this fantastic opportunity.

A major focus of my PhD research is the application of bacterial nitroreductase enzymes in the field of regenerative medicine. The fact that humans cannot replace certain cell types make us susceptible to numerous diseases. To discover drugs that protect us from these conditions, and possible even promote cell replacement, new models of degenerative diseases that can be used for large-scale screening of compounds which may help to prevent/reverse the degenerative state are needed. My engineered enzymes are being used to specifically target and ablate cell types which are typically found to be lost in human degenerative diseases. In these studies, zebrafish larvae are used as a model organism as their organs are in many cases very similar in terms of physiology and genetics to human organs. In addition, zebrafish themselves are highly regenerative and can regrow amputated fins, lesioned brain, retina, heart and other tissues.

During my time at Johns Hopkins I was trained by an expert in the field, attended a seminar given by Jennifer Doudna, a world-renown biochemist best known for leading the discovery of CRISPR-Cas9 gene editing and I gathered a large amount of exciting data in zebrafish, some of which will be included in upcoming publications. As well as providing me with an invaluable experience, my research trip to Johns Hopkins also strengthened the collaboration between my lab in Wellington, New Zealand, and the Mumm Lab in Baltimore, and has since sparked additional collaboration between our labs in related research areas.



The Johns Hopkins Hospital, Baltimore



Myself and PhD student Kelsi Hall outside of our building at the Wilmer Eye Institute, Baltimore



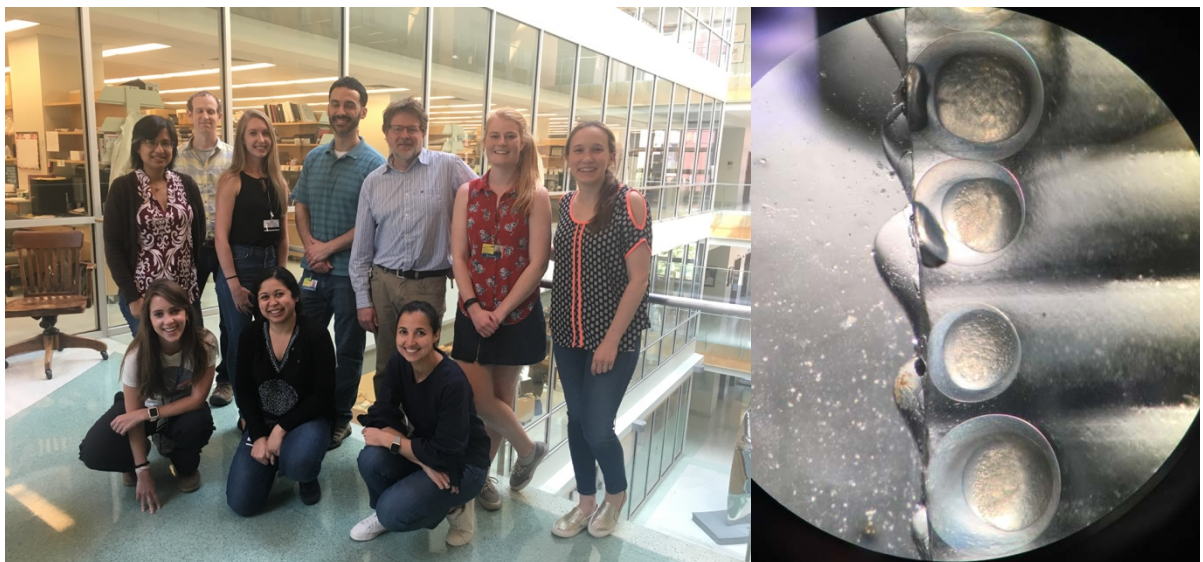
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### **Kelsi Hall, Victoria University of Wellington**

In March of this year I was fortunate enough to travel to the Wilmer Eye Institute at Johns Hopkins University in Baltimore, Maryland to complete two months of research. This trip allowed me to complete work that will contribute towards my PhD and also strengthened our collaboration with Jeff Mumm's lab group at the Wilmer Eye Institute.

My PhD involves the engineering and directed evolution of nitroreductase enzymes from bacterial species for improved activity against a panel of prodrugs. One application of this research is the use of these nitroreductases to target and ablate specific cell types in zebrafish. Our collaborators use these disease models to study the regenerative capabilities of retinal cells in zebrafish, and to search for new drugs that can promote cellular regeneration. This trip gave me the unique opportunity to travel to the Wilmer Eye Institute and test my own evolved nitroreductase variants in this zebrafish model.



***(A) Our research group at the Wilmer Eye Institute. (B) Microscopy image of zebrafish eggs injected with our evolved nitroreductase variants.***

The work I have completed at the Wilmer Eye Institute will enable me to prepare a high-quality PhD thesis, describing how I have personally overseen each step of the work from fundamental enzyme engineering, completed here in Wellington, through to the application in zebrafish at Johns Hopkins University. The work completed will also hopefully lead to several publications with our collaborators at the Wilmer Eye Institute.

I would like to thank the Maurice Wilkins Centre for their assistance which helped me do this trip. This exposure to new techniques and research has been invaluable to my evolution and growth as a researcher.



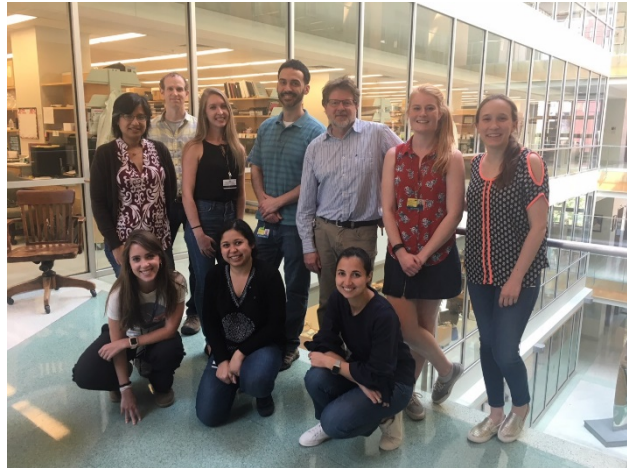


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The Wilmer Eye Institute at Johns Hopkins School of Medicine, Baltimore



Myself and the Mumm Lab Group at the Wilmer Eye Institute, Johns Hopkins School of Medicine, Baltimore



Myself and PhD student Kelsi Hall at the Port of Baltimore