

Seeing eye disease clearly with robotics

The need

Nearly half a million Australians live with a form of vision impairment or blindness. By far, most of these cases – 80% or more – are treatable with prescription eyewear or surgery. However, within the remaining cases lurk several debilitating forms of eye disease, many rooted in genetic abnormalities that lead to blindness. With no interventions or cures, Australians with hereditary eye conditions that result in blindness face significantly a decreased quality of life, mobility and ability to contribute to the community.

The projects

Two researchers at the Centre for Eye Research Australia (CERA) are hot on the trail of innovative therapies for treating vision loss and even curing blindness thanks to recent advances – and investments – in stem cell and gene-editing technologies.

Associate Professor Alice Pébay, also of the University of Melbourne, and Associate Professor Alex Hewitt, also with the University of Tasmania, are reprogramming patients' skin cells into induced pluripotent stem cells, then growing them into cells affected in various eye diseases. These cells can be used to study eye diseases by modelling how certain diseases occur, and then using these cells to identify and to test novel interventions to treat vision impairment and blindness.

Ground-breaking robotic cell culture technologies at CERA's Automated Stem Cell Facility allow the research teams to grow and sustain millions of cells collected from a large number of donors. The robotic system enables maintenance and expansion of the cells, allowing the researchers to work on a greater number of conditions to obtain a more accurate image of how disease develops and the potential for drug-based therapies for blindness. For example, they have been able to develop a deeper insight into three different diseases that affect the retina, that until now have been poorly understood. In a 2017 paper, the Pébay and Hewitt labs demonstrated use of the gene-editing platform known as CRISPR to successfully edit genetic errors that cause inherited eye disease. They have also worked with collaborators to explore a type of mitochondrial disease that affects the optic nerve.

The impact

Pébay's and Hewitt's investigations are game-changers for eye health. Beyond the potential for creating new cell-based and pharmaceutical treatments for vision impairment, their work may also be paving the way for greater public understanding of developments in the field. The science of altering genetic codes to change health and other outcomes is not without controversy, but a recent global survey conducted by the team suggested two-thirds of people support genetic interventions for debilitating or potentially lethal diseases. That level of public support, combined with significant public- and private-sector investment, puts Pébay's and Hewitt's research on track for success – one that will have lasting benefits for thousands of Australians.

At a glance

Induced pluripotent stem cells combined with state-of-the-art robotics offers new insights into eye disease.



Associate Professor Alice Pébay



Associate Professor Alex Hewitt

